

# Macroeconomic Theory

## Editors

Prof.Dr. Selami SEZGİN  
Prof.Dr. Erkan ÖZATA

## Authors

Prof.Dr. Selami SEZGİN  
Prof.Dr. Erkan ÖZATA

CHAPTER 1

CHAPTER 2, 3

Prof.Dr. Jülide Yıldırım ÖCAL

CHAPTER 4, 6, 7

Prof.Dr. Dürdane Şirin SARAÇOĞLU

CHAPTER 5

Lecturer.Dr. Ayşenur AYDINBAKAR

CHAPTER 8

Assoc.Prof.Dr. Barış ALPASLAN

**T.C. ANADOLU UNIVERSITY PUBLICATION NO: 4303**  
**OPEN EDUCATION FACULTY PUBLICATION NO: 3068**

Copyright © 2020 by Anadolu University  
All rights reserved.

This publication is designed and produced based on “**Distance Teaching**” techniques. No part of this book may be reproduced or stored in a retrieval system, or transmitted in any form or by any means of mechanical, electronic, photocopy, magnetic tape, or otherwise, without the written permission of Anadolu University.

**Instructional Designer**  
Lecturer.Dr. Orkun Şen

**Graphic and Cover Design**  
Prof.Dr. Halit Turgay Ünalın

**Proof Reading**  
Lecturer Merve Dombaycı  
Research Assistant Tuncay Karalık

**Assessment Editor**  
Yaşar Özden İnceler

**Graphic Designers**  
Ayşegül Dıbek  
Gülşah Karabulut

**Typesetting and Composition**  
Yasin Narin  
Zülfıye Çevır  
Süreyya Çelik  
Diğdem Aydın  
Arzu Ercanlar  
Nihal Sürücü  
Gızem Dalmış  
Yasin Özkır

**MACROECONOMIC THEORY**

ISBN  
978-975-06-4355-2

First Edition

Printed in Türkiye

at Anadolu University Printing House, Eskişehir

November 2022

..... copies

**TOPLAM SAYFA SAYISI: 268**

# Contents

## CHAPTER 1 Basics of Macroeconomics

|                                                                   |    |
|-------------------------------------------------------------------|----|
| Introduction .....                                                | 3  |
| A Brief History of Macroeconomics and Macroeconomic Thought ..... | 4  |
| The Measurement and Structure of the National Economy .....       | 7  |
| National Income Accounts .....                                    | 7  |
| GDP .....                                                         | 7  |
| Currently Produced .....                                          | 7  |
| Final Goods and Services .....                                    | 8  |
| Calculated at Market Prices .....                                 | 8  |
| The Measurement of Production, Income and Expenditure .....       | 10 |
| The Production Approach .....                                     | 10 |
| The Income Approach .....                                         | 10 |
| The Expenditure Approach .....                                    | 10 |
| GDP Versus GNP .....                                              | 12 |
| Nominal and Real GDP .....                                        | 12 |
| GDP Level Versus Growth Rate .....                                | 16 |
| GDP Per Capita .....                                              | 17 |
| Fundamental Concepts of Macroeconomics ...                        | 18 |
| The Unemployment Rate .....                                       | 18 |
| Trends in the Unemployment Rate ....                              | 21 |
| Why is the Unemployment Rate Important For Economists? .....      | 22 |
| The Inflation Rate .....                                          | 22 |
| The Gdp Deflator .....                                            | 22 |
| The Consumer Price Index .....                                    | 24 |
| Negative Effects of Inflation .....                               | 25 |
| The Producer Price Index .....                                    | 27 |
| Relationships Between Macroeconomic Variables .....               | 28 |
| Relationship Between Actual and Potential GDP .....               | 28 |
| Relationship Between GDP Growth and Unemployment Rate .....       | 28 |
| Relationship Between Inflation and Unemployment .....             | 29 |
| The History of the Modern Phillips Curve .....                    | 30 |

## CHAPTER 2 The Goods and Services Market

|                                                   |    |
|---------------------------------------------------|----|
| Introduction .....                                | 39 |
| The Aggregate Demand and its Components .....     | 40 |
| Consumption Function .....                        | 40 |
| Duality of Consumption and Household Saving ..... | 44 |
| Investment Function .....                         | 45 |
| Investment Demand .....                           | 46 |
| Marginal Efficiency of Capital .....              | 49 |
| Government Spending .....                         | 50 |
| The Determination of Equilibrium Output...        | 53 |
| Saving – Investment Equality .....                | 57 |
| Paradox of Thrift .....                           | 58 |
| Derivation of the IS Curve .....                  | 59 |
| Algebraic Expression of the IS Relationship ..... | 61 |
| Shifts in the IS Curve .....                      | 63 |

## CHAPTER 3 Money Market



|                                          |    |
|------------------------------------------|----|
| Introduction .....                       | 77 |
| Financial Markets .....                  | 77 |
| What is Money? .....                     | 77 |
| What are Bonds? .....                    | 77 |
| The Demand For Money .....               | 78 |
| Demand for Real Balances .....           | 78 |
| Supply of Money .....                    | 81 |
| Equilibrium in the Money Market .....    | 82 |
| The Instruments of Monetary Policy ..... | 84 |
| The Mechanism of Monetary                |    |
| Expansion .....                          | 85 |
| Who Determines the Money Supply? ...     | 86 |
| Derivation of the LM Curve .....         | 87 |
| Algebraic Expression of the LM           |    |
| Relationship .....                       | 88 |
| The Slope of the LM Curve .....          | 89 |
| Shifts in the LM Curve .....             | 89 |

## CHAPTER 4 Equilibrium in the Goods And Money Markets



|                                           |     |
|-------------------------------------------|-----|
| Introduction .....                        | 101 |
| Simultaneous (General) Equilibrium        |     |
| in the Goods and Money Markets .....      | 101 |
| Changes in the General Equilibrium in the |     |
| Goods and Money Markets .....             | 103 |
| Goods Market Effects .....                | 104 |
| Money Market Effects .....                | 110 |
| The LM Relation and the Interest          |     |
| Rate Rule .....                           | 114 |
| Monetary and Fiscal Policy Mixes .....    | 115 |
| Special Cases .....                       | 117 |
| The Liquidity Trap .....                  | 117 |
| The Quantity Theory of Money .....        | 119 |



## CHAPTER 5 The Labor Market



|                                                              |     |
|--------------------------------------------------------------|-----|
| Introduction .....                                           | 133 |
| Basic Concepts of the Labor Market .....                     | 133 |
| Movements in Employment and Unemployment .....               | 134 |
| Labor Market Equilibrium .....                               | 136 |
| Labor Demand .....                                           | 137 |
| Labor Supply .....                                           | 138 |
| Equilibrium in the Labor Market .....                        | 139 |
| Existence of Unemployment .....                              | 140 |
| Frictional Unemployment and Job Search .....                 | 140 |
| Structural Unemployment and Wage Rigidity .....              | 141 |
| Collective Bargaining and Union .....                        | 141 |
| Efficiency Wage Theory .....                                 | 143 |
| Minimum Wage Laws .....                                      | 143 |
| Cyclical Unemployment and Natural Rate of Unemployment ..... | 143 |
| Unemployment and Inflation .....                             | 143 |
| The Phillips Curve and Natural Rate of Unemployment .....    | 144 |
| Okun's Law .....                                             | 147 |

## CHAPTER 6 The AD-AS Model



|                                                                        |     |
|------------------------------------------------------------------------|-----|
| Introduction .....                                                     | 157 |
| Aggregate Demand .....                                                 | 157 |
| Shifts in the AD Curve .....                                           | 159 |
| Aggregate Supply .....                                                 | 161 |
| Keynesian Aggregate Supply-SRAS ....                                   | 161 |
| Classical Aggregate Supply-LRAS .....                                  | 162 |
| Upward Sloping AS Curve .....                                          | 163 |
| Equilibrium in the AD-AS in the Short-Run and in the Medium-Run .....  | 169 |
| Short-Run Equilibrium in the AD-AS Model .....                         | 169 |
| From Short-Run to Medium-Run Equilibrium .....                         | 171 |
| Demand-Side Shocks in the AD-AS Model:                                 |     |
| Monetary and Fiscal Policy Effects .....                               | 172 |
| Monetary Policy Effects .....                                          | 172 |
| Fiscal Policy Effects .....                                            | 174 |
| Supply-Side Shocks and Changes in Equilibrium in the AD-AS Model ..... | 176 |

## CHAPTER 7 Openness in Goods and Financial Markets, and Policy in the Open Economy



|                                           |     |
|-------------------------------------------|-----|
| Introduction .....                        | 191 |
| Openness in Goods Markets .....           | 191 |
| Nominal and Real Exchange Rates .....     | 193 |
| Determinants of Exports and Imports ...   | 195 |
| Openness in Financial Markets .....       | 199 |
| Equilibrium in Financial Markets .....    | 199 |
| The Balance of Payments .....             | 202 |
| General Equilibrium in an Open Economy .. | 205 |
| Equilibrium in Goods Market in an         |     |
| Open Economy .....                        | 205 |
| Equilibrium in the Money Market in        |     |
| an Open Economy .....                     | 208 |
| Equilibrium in the Balance of             |     |
| Payments or External Balance in           |     |
| an Open Economy .....                     | 209 |
| Shifts in the BP Curve .....              | 210 |
| General Equilibrium in IS/LM/BP           |     |
| Model .....                               | 212 |
| Adjustments in Equilibrium and Policy in  |     |
| an Open Economy .....                     | 212 |
| Adjustments in Equilibrium in             |     |
| Open Economy Under Fixed                  |     |
| Exchange Rates .....                      | 212 |
| Adjustments in Equilibrium in an          |     |
| Open Economy Under Flexible               |     |
| Exchange Rates .....                      | 218 |

## CHAPTER 8 Economic Growth



|                                           |     |
|-------------------------------------------|-----|
| Introduction .....                        | 237 |
| Definition and Measurement of             |     |
| Economic Growth .....                     | 237 |
| Neoclassical Exogenous Growth Models .... | 239 |
| Basic Solow Model .....                   | 240 |
| Human Capital-Augmented Solow             |     |
| Model (Mankiw-Romer-Weil Model) ...       | 248 |
| New Growth Theory: Endogenous             |     |
| Growth Models .....                       | 250 |
| Brief Overview of Endogenous              |     |
| Growth Models .....                       | 250 |
| AK Model .....                            | 251 |

## Preface

Dear students,

Today, it is a common tradition to examine economic theory in two major sections as macroeconomics and microeconomics. Although there are different sections under these two headings, the first and basic division is macro and micro economics. Within these sections, the area of interest of macroeconomics is the functioning of the economy as a whole. Macroeconomics is the subfield of economics that analyses and draws conclusions about aggregate quantities such as total consumption, total output, total savings, total investment, national income, and employment. In contrast to microeconomics, it analyses the economy as a whole using macro-equilibrium analysis.

It is enough to just read the newspapers or listen to the television news to understand the importance of macroeconomics. The words output, unemployment, and inflation appear daily in newspapers and on the evening news. The press announces macroeconomic developments every day. Macroeconomic developments are closely related to our daily lives. Business managers have to consider how fast consumer incomes will increase in order to predict demand for their products. Those who earn a living on a fixed income try to find solutions to maintain their purchasing power in the face of the increase in prices. The unemployed look forward to the recovery of the economy in order to get a job. The status of the economy has an impact on all of them.

Economic theory, and especially macroeconomics, is subject to change over time. While the changes in the nature and structure of the problems make this change problematic, the answers sought for the solution of new problems also make an additional contribution to the change. Therefore, these facts have been the main starting point when writing a macroeconomics book. In this way, the topics were discussed in the light of new developments in the macroeconomics literature, and the economic thought at the root of the developments was tried to be emphasized.

Students studying economics must rely on a wide range of skills. It is the responsibility of teachers and textbook writers to aid students in the development of these skills. This book aims to make macroeconomics understandable, useful, and enjoyable. Those of us who opted to specialize in macroeconomics did so because we are passionate about the subject. More importantly, we think that studying macroeconomics can reveal a lot about the world and that, if the lessons are implemented correctly, they can improve it. I hope that this book shows not only the wisdom of our profession but also its energy and motivation.

Many people have contributed to the preparation of this book. It would be a great pleasure for us to thank all the contributors, especially the authors, for their help and valuable contributions. We hope that our students will find the book interesting, inspiring and worth reading.

Editors

Prof.Dr. Erkan ÖZATA

Prof.Dr. Selami SEZGİN

# Chapter 1 Basics of Macroeconomics

After completing this chapter, you will be able to;

## Learning Outcomes

- 1 Explain the primary causes of the evolution of macroeconomics
- 2 Understand the importance of Measurement and Explain the Structure of the National Economy
- 3 Explain how the national income is measured by using production, income and expenditure approaches
- 4 Explain the Fundamental Concepts of Macroeconomics like Unemployment and Inflation and explain why they are important for all of us
- 5 Explain the relationships that exist among key macroeconomic variables and among the different sectors of the economy

## Chapter Outline

Introduction  
A Brief History of Macroeconomics and Macroeconomic Thought  
The Measurement and Structure of the National Economy  
The Measurement of Production, Income and Expenditure  
Fundamental Concepts of Macroeconomics  
Relationships Between Macroeconomic Variables

## Key Terms

GDP  
Production Approach  
Income Approach  
Expenditure Approach  
Nominal and Real GDP  
Growth Rate  
Unemployment Rate  
Inflation Rate  
GDP Gap  
Okun's Law  
Phillips Curve



## INTRODUCTION

We can consider economic events on two separate levels, one in terms of the whole economy and the other in terms of the smallest units that generate it. We call the first of these the macro level or approach, and the second, the micro level or approach. The smallest unit of the economy is the individual or family in terms of consumption and the firm in terms of production. Accordingly, national income is a macro concept and for example, Mehmet's income is a micro concept. For the same reason, the market demand for bread is a macro and Mehmet's demand for bread is a micro concept.

Today, it is a common tradition to examine economic theory in two major sections as macroeconomics and microeconomics. Although there are different sections under these two headings, the first and basic division is macro and micro economics. Within these sections, the area of interest of macroeconomics is the functioning of the economy as a whole. Microeconomics, on the other hand, examines the behaviour of the units that make up this whole. Macro and micro approaches, that is, the levels at which the subject is dealt with, should be clearly distinguished from each other in the analysis of the problems. If this is not done, serious mistakes can be made. For in many cases, the macro (social) quantity or behaviour is not simply the sum of the micro (individual) quantity or behaviour. For example, although workers' wages are only a cost item for a single firm, they constitute an important part of the total demand in terms of the national economy. For a single individual, although saving is a way of getting rich, if everyone behaves in the same way, the country will become poor because a part of the production cannot be sold. This is called the paradox of thrift or paradox of saving. According to the paradox, a rise in autonomous saving leads to a decline in aggregate demand and, consequently, a decline in gross production, which reduces the total saving. A similar example can be given for agriculture. For a single farmer, producing a lot of a product can be considered good. However, if many farmers start producing the same product with high efficiency at the same time, the price of the product falls and the total income of each farmer decreases. All these examples show us that macroeconomic results may

differ from individual results of individuals and firms. Therefore, it is necessary to be very careful in making use of the behaviour of a single person while making analyses at the social level. What is beneficial for the individual may not always be beneficial for the society.

The Greek word *mikros* means small and *macros* means big. These words, which are adapted to many fields, are used to express different fields in accordance with their original meanings in micro and macro economics. Macroeconomics is the subfield of economics that analyzes and draws conclusions about aggregate quantities such as total consumption, total output, total savings, total investment, national income, and employment. In contrast to microeconomics, it analyzes the economy as a whole using macro-equilibrium analysis. The primary subjects of macroeconomics are income distribution, total output and consumption, inflation and unemployment.

- What will the national income be in 10 years?
- Can unemployment rates be reduced by providing employment opportunities?
- Under the influence of which factors will total expenditures and total savings be determined?
- What are the reasons that lead the economy to collapse and how should economic policies be used to get rid of them?
- How can public deficits and foreign trade deficits be prevented?

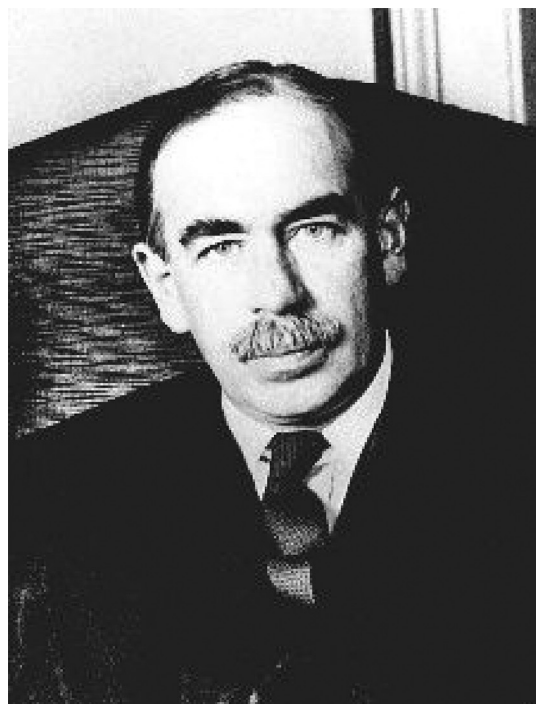
Macroeconomics, which studies the economy as a whole, tries to answer those kinds of questions. It is enough to just read the newspapers or listen to the television news to understand the importance of macroeconomics. The words output, unemployment, and inflation appear daily in newspapers and on the evening news. The press announces macroeconomic developments every day. "Central Bank keeps interest rates stable" "House sales in Türkiye jumped by 20.6 percent in March" "Ukraine war and inflation threaten global economy" "China's March exports grow despite virus; imports flat" are some headlines from recent newspapers. Macroeconomic developments are closely related to our daily lives. Business managers have to consider how fast consumer

incomes will increase in order to predict demand for their products. Those who earn a living on a fixed income try to find solutions to maintain their purchasing power in the face of the increase in prices. The unemployed look forward to the recovery of the economy in order to get a job. The status of the economy has an impact on all of them. Macroeconomic concerns are also prominent in political discourse. Governments try to increase their chances of being in power again by holding elections during periods when economic indicators improve. Opposition parties on the other hand criticize the government by using reasons such as the increase in public deficits, the inability to reduce the inflation rate and the increase in unemployment rates. Macroeconomic issues are also decisive for international relations. The effectiveness of countries in world politics is proportional to their economic power, perhaps more than their military power. Today, the development of relations between countries is achieved by increasing trade and investments between countries rather than political and military cooperation.

### A BRIEF HISTORY OF MACROECONOMICS AND MACROECONOMIC THOUGHT

John Maynard Keynes' book *General Theory of Employment, Interest, and Money* in 1936 marked the beginning of modern macroeconomics. Keynes provided a justification for the ongoing high unemployment rate in his book. He based his reasoning on a wage and price adjustment assumption that differed significantly from the classical assumption. As opposed to the classical assumption that wages and prices adapt quickly to equalize quantities demanded and supplied in each market, Keynes thought that wages and prices adjust slowly. Quantities demanded and supplied may not match for extended periods of time due to slow wage and price adjustments. According to Keynesian theory, unemployment might continue because wages and prices do not adapt to balance the number of individuals who want to work with the number of people that enterprises want to hire. Keynes thought that the best way to deal with high unemployment was for the government to purchase more goods and services, which would raise the demand for

output. Keynes maintained that this approach would reduce unemployment because firms would need to hire more people to fulfil the increased demand for their products. Keynes also believed that newly recruited individuals would have more money available for spending, which would add to the demand for goods and services and boost employment even further. In general, Keynesians, unlike classical economists, are suspicious of the invisible hand and hence more ready to advocate for the involvement of government in improving macroeconomic performance.



Picture 1.1 John Maynard Keynes.

Source: <https://lemonacademy.co.uk/john-maynard-keynes>

One of the reasons for the *General Theory's* initial popularity was its timing. In addition to being an economic disaster, the Great Depression represented an intellectual failure for economists. Few economists could provide a clear explanation for the Depression's intensity or duration. The economic steps that the governments had taken were based more on feelings and emotions than on economic theory. A justification for government action was offered by *The General Theory*, which also offered an intellectual framework for understanding the events.





The Great Depression was a severe worldwide economic depression between 1929 and 1939 that began after a major fall in stock prices in the United States.

The General Theory underlined the effective demand, which is currently referred to as aggregate demand. Keynes maintained that effective demand determines output in the short run. Even if the production gets back to its normal level in the long run, the process is at best slow. One of the most well-known sayings attributed to Keynes is “In the long run, we are all dead”. Many of the fundamental ideas of contemporary macroeconomics were presented by Keynes:

- The connection that exists between income and consumption, in addition to

the multiplier that describes the process through which demand fluctuations may be amplified and result in larger swings in production.

- The demand for money, which Keynes referred to as “liquidity preference,” demonstrates how monetary policy may impact interest rates and overall demand.
- How individuals’ expectations influence their consumption as well as their investment decisions, as well as how shifts in expectations are a primary driver of changes in both demand and production.

Government spending boosts the economy by more than what is spent. This is called the **Keynesian multiplier**.

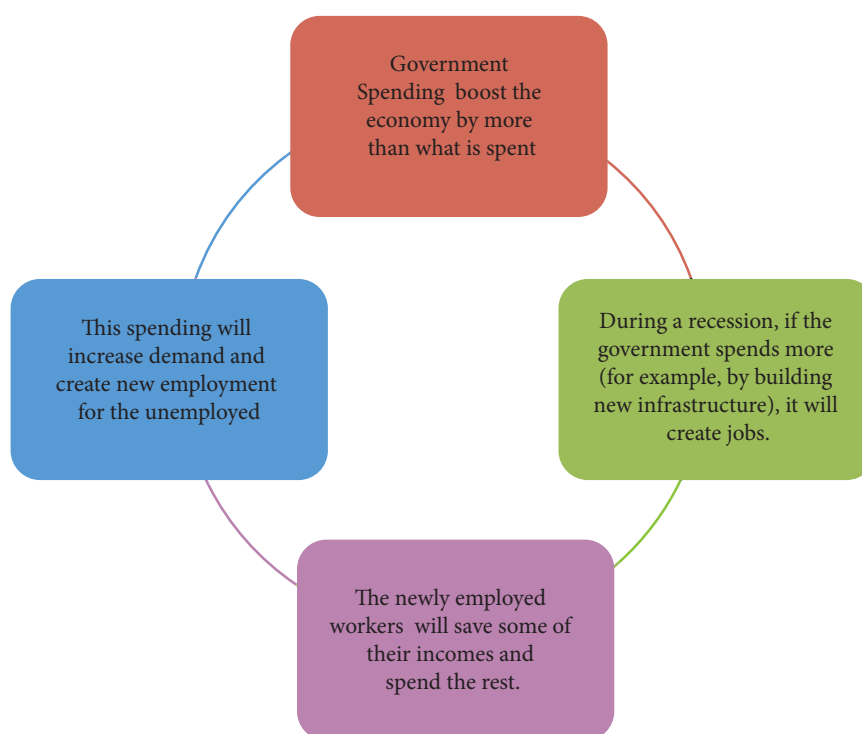


Figure 1.1 The Keynesian Multiplier

According to Keynes, waiting for the economy to get better on its own was irresponsible. It was necessary to have an active fiscal policy in order to get the economy back to full employment. After the General Theory was published, the first task was to codify Keynes’ ideas mathematically. Several formalizations of Keynes’s concepts were provided. The most significant was the IS-LM model developed by John Hicks and Alvin Hansen in the 1930s and 1940s. The IS-LM framework together with monetary and fiscal policies are presented in the 4<sup>th</sup> chapter of this book.

From World War II until about 1970, macroeconomic theory and policy were mostly based on Keynes's ideas. The decades beginning in the early 1940s and continuing into the early 1970s are often referred to as the golden era of macroeconomics. At the height of Keynes's power, many economists thought that the government could use macroeconomic policies to boost economic growth without causing inflation or a recession. The theories of investment, consumption, money demand, and portfolio choice, as well as the growth theory and macroeconometric models, were some of the most significant changes during this period.

During the 1960s, the main debate was between Keynesians and monetarists. Keynesians said that changes in macroeconomic theory gave people more control over the economy. The monetarists, who were headed by Milton Friedman, had less faith in the ability of governments to make a positive contribution to economic stability. The efficacy of monetary policy against fiscal policy was a hot topic throughout the 1960s. Instead of monetary policy, Keynes highlighted fiscal policy as the key to combating recessions. Friedman, on the other hand, indicated that monetary policy was important and those changes in money actually explained most of the changes in output. After Friedman's challenging task, there was a lot of discussion and investigation on the effects of fiscal and monetary policy on economic activity. Finally, an agreement was achieved. Clearly, both monetary and fiscal policies had an impact on the economy. And, if policymakers were concerned with both the level and the composition of output, the ideal policy would usually be a combination of the two.

**attention**

Keynes had emphasized that fiscal policy is useful for fighting recessions. Friedman supports that movements in money explain most of the fluctuations in output, and monetary policy is powerful.

In the 1970s, there was a crisis in macroeconomics. There were two causes behind this: One was the emergence of stagflation, which surprised most economists. Stagflation, sometimes

known as stagnation plus inflation, was a problem in the United States throughout the 1970s as a result of both high unemployment and high inflation. This event diminished economists' and policymakers' faith in the classic Keynesian method. The other was a theoretical attack led by Robert Lucas. Lucas criticizes the fact that existing macroeconomic models did not explicitly include expectations, even though they knew that expectations affect behaviour. So macroeconomic models without rational expectations could not be used to design policy. The name for this criticism of macroeconomic models is **Lucas critique**.

**Lucas critique:** Although existing macroeconomic models recognized that expectations affect behaviour; they did not incorporate expectations explicitly.

Integrating rational expectations into macroeconomics dominated the 1970s and 1980s. When compared to where they were twenty years ago, macroeconomists have a considerably better understanding of the complexity of policy, as well as the role that expectations play in influencing the consequences of both shocks and policy. From the late 1980s up to the financial crisis of 2009, three groups were responsible for the majority of the research highlights in the field of macroeconomics: the new classicals, the new Keynesians, and the new growth theorists. New classical economists investigated the extent to which fluctuations may be seen as changes in the natural level of production, as opposed to changes that cause output to deviate from its natural level. New Keynesian economists investigated the role of market imperfections in fluctuations using a more formal approach. New growth theorists investigated the causes of technological progress. On the eve of the crisis, a new synthesis seemed to be taking shape as these lines began to converge.

The financial crisis of 2009 shows that macroeconomists didn't understand how important the financial system is to the economy as a whole. Even though many of the factors needed to analyze the crisis had already been known before it began, major macroeconomic models did not take these aspects into account since they were



not considered fundamental to macroeconomic theory. Much study is currently being conducted on macroeconomic and financial linkages.

## THE MEASUREMENT AND STRUCTURE OF THE NATIONAL ECONOMY

Measurement is essential to scientific research. In order to make new discoveries, compare competing theories, and predict future events or trends, it is important to measure things correctly. For a serious understanding of the economy, it is not only possible to measure the economy carefully, but it is also necessary to do so. Researchers' efforts have led to the evolution of economics from a science where scholars depended on casual observations and broad generalizations to a field where statistics and statistical analysis are essential tools.

Some of the conceptual and practical challenges related to macroeconomic measurement are discussed here. National income accounts are frequently used for monitoring economic activity. Understanding the national income accounts provide us with valuable information about the economy. In addition, the national income accounts are logical and consistent with the structure of the economy. They therefore serve as a crucial starting point for understanding how the macro economy functions.

### National Income Accounts

In the nineteenth century or during the Great Depression, economists had no way of measuring overall economic activity. They had to piece together data like iron ore shipments as well as department store sales to figure out how the economy was doing. Therefore, national income and product accounts were required. Short term economic indicators organized in a consistent set of quarterly national accounts are regarded as a very valuable tool in the short term economic analysis. Thus, most of the industrialized countries have published their quarterly national accounts since the 1950s. However, Türkiye started to publish its quarterly national accounts in 1990. The national income accounts, like any accounting system, establish concepts before constructing measurements.

The final and most important measure of macroeconomics is the total production, or, technically, Gross Domestic Product (GDP). Because GDP determines income and income determines consumption. Consumption is the most important factor that determines the welfare level of a society. GDP is effective not only on the level of welfare, but also on many other macroeconomic variables such as foreign trade and unemployment. As a result of the decrease in Aggregate output, unemployment problem arises as some factors of production are not used. To put it most accurately, GDP is a cause and effect of other macro variables. That's why GDP is the most important macro measure.

### GDP

The gross domestic product, or **GDP** for short, is the measure of aggregate output in national income accounts. Gross domestic product (GDP) is a measure of all currently produced final goods and services evaluated at market prices. If  $P_i$  represents the price of a good and  $Q_i$  the output of the same good, and an economy has  $N$  goods and services, the nominal GDP of that country for a given period is calculated as follows:

$$Y = \sum_{i=1}^N P_i \cdot Q_i$$

In short, the sum of the current values of  $N$  goods and services in a certain period gives us the nominal GDP. As long as the condition that the goods and services are produced within the borders of the country is met, it does not matter who produced them.

There are a few points in this definition that need to be clarified.

**GDP:** It is the Value of the Final Goods and Services Produced in the Economy during a Given Period.

### Currently Produced

GDP only counts goods and services that are currently produced. It is a flow measure of production over a certain time period—for

example, a quarter or a year—and contains only goods and services generated during that period. Market transactions such as the trade of previously manufactured houses, and automobiles are excluded from GDP. Stock and bond trades are the examples of market transactions that are not included in GDP since they do not involve the actual production of goods and services.

## Final Goods and Services

Only final goods and services are included in GDP. Items that are used to manufacture other goods rather than being sold to end purchasers—what is referred to as intermediate goods—are not included individually in the Gross Domestic Product (GDP). Due to their contribution to the value of the finished commodities they are used in, these items are accounted for in GDP. Counting them separately creates a double counting problem. For the manufacture of automobiles, for instance, we do not want to consider the value of the steel used in the process as a distinct entity and then count it again when the vehicle is sold.

## Calculated at Market Prices

GDP is the worth of goods and services as measured by market prices. This excludes non-market items like homemaker services and garden production, as well as unreported output from criminal activities like drug sales and gambling. Additionally, since GDP is a measure of the value of production in terms of market prices, it is vulnerable to fluctuations in the average price level. The same physical production will result in a different GDP level when market prices fluctuate.

**Table 1.1** Türkiye Gross Domestic Product (GDP) at current prices by expenditure approach (value, percentage change), 1998-2021.

| Years | Value (Thousand ₺) | Percentage Change (%) |  | Years | Value (Thousand ₺) | Percentage Change (%) |
|-------|--------------------|-----------------------|--|-------|--------------------|-----------------------|
| 1998  | 71 944 700         | -                     |  | 2010  | 1 167 664 479      | 16,0                  |
| 1999  | 107 374 258        | 49,2                  |  | 2011  | 1 404 927 615      | 20,3                  |
| 2000  | 171 494 210        | 59,7                  |  | 2012  | 1 581 479 251      | 12,6                  |
| 2001  | 247 266 207        | 44,2                  |  | 2013  | 1 823 427 315      | 15,3                  |
| 2002  | 362 109 648        | 46,4                  |  | 2014  | 2 054 897 828      | 12,7                  |
| 2003  | 472 171 775        | 30,4                  |  | 2015  | 2 350 941 343      | 14,4                  |
| 2004  | 582 852 799        | 23,4                  |  | 2016  | 2 626 559 710      | 11,7                  |
| 2005  | 680 275 847        | 16,7                  |  | 2017  | 3 133 704 267      | 19,3                  |
| 2006  | 795 757 109        | 17,0                  |  | 2018  | 3 758 773 727      | 19,9                  |
| 2007  | 887 714 414        | 11,6                  |  | 2019  | 4 317 786 909      | 14,9                  |
| 2008  | 1 002 756 496      | 13,0                  |  | 2020  | 5 046 883 307      | 16,9                  |
| 2009  | 1 006 372 482      | 0,4                   |  | 2021  | 7 209 040 465      | 42,8                  |

**Source:** TurkStat Annual National Account Statistics

The general level of prices determines the GDP value as well as production. For this reason, economists do not evaluate current GDP figures as they do not provide reliable information on economic activity.



**attention**

The rapid increase in Türkiye's GDP values may be caused by an increase in prices as well as an increase in production.



## In Practice

### What GDP is not

#### Nonmarket Productive Activities are not Included

Nonmarket output is not taken into account since goods and services are valued at market values in GDP. (for instance, homemaker services).

#### The Underground Economy is Left Out

The underground economy, which includes illegal business and legal business that isn't reported to avoid paying taxes, is also not counted in GDP. Gambling and selling drugs are two examples of the first group.

#### GDP is not a Welfare Measure

The Gross Domestic Product (GDP) is not a measure of well-being or even material well-being; it is a measure of output of goods and services. In addition, the GDP fails to deduct some welfare costs of manufacturing. For instance, if the generation of electricity produces acid rain, which in turn causes water contamination and the death of trees, we include the production of electricity in the GDP, but do not reduce the economic loss caused by pollution.

#### GDP does not Measure Happiness

GDP would not be expected to measure happiness if it is not a measure of welfare. In the past few years, though, a lot of people have been interested in whether or not GDP and happiness are linked. Surveys reveal that there isn't much of a link between GDP and happiness, which is measured by "life satisfaction."

#### GDP does not Measure How Income is Distributed

Total production (income) or income per capita doesn't say anything about how the money made is distributed.

**Source:** Froyen R. T., Macroeconomics, Pearson, 2013, p.37.



### your turn 1

Determine whether each economic action given below is included in the calculation of GDP.

1. Toyota will increase its inventory of (unsold) cars if it manufactures a car in 2022 but doesn't sell it in 2022.
2. Government's old-age payments to the elderly.
3. Leaving ₺1000 to your spouse who looks after the children at home.
4. The government gives salaries to civil servants.
5. Your purchase of a new phone.
6. Your purchase of a second hand phone.

## THE MEASUREMENT OF PRODUCTION, INCOME AND EXPENDITURE

Economic activity as a whole may be quantified in three distinct but equal ways. The national income accounts are based on the idea that the amount of economic activity in a given period of time can be measured in the following ways:

1. The quantity of output generated, excluding the one that is consumed in intermediate phases of production (the production approach);
2. The earnings obtained by the output producers (the income approach);
3. The sum of the spending made by output's final consumers (the expenditure approach).

Production, income, and expenditure approaches all give the same answer. Given that the three methods are equivalent, over any given time frame,

total production = total income = total expenditure

This is called the fundamental *identity* of national income accounting.

An **identity** is an equation that is true by definition.

### The Production Approach

Totalling the value of all goods and services produced over a certain time period, such as a year, may be the simplest method. Because the output of one business, like flour, might be used as an input in another, like bread, by just adding “*value added*,” which is the overall value of production minus the cost of “inputs” such as raw materials and pieces that are valued elsewhere, while double counting is avoided. The production or value added method is obtained by subtracting the intermediate input costs from the current sales for each sector. Thus, the contribution of each sector -or production stage- to the production of the final good is revealed, and the sum gives the added value. The production approach calculates economic activity by adding the value contributed by each producer.

**Value Added:** The value added by a firm is defined as the value of its production minus the value of the intermediate goods used in production.

### The Income Approach

The income approach consists of the sum of the incomes of households, firms and government, which are defined as economic actors. The total income from production is used to figure out the income measure of GDP.

Basically, it's the sum of:

- wages and salaries of employees;
- income from self-employment;
- trading profits of companies;
- trading surpluses of government corporations and enterprises; and
- income from rents.

The GDP by income approach is calculated by adding the earnings and salaries, operational surplus of all producing units, and net tax revenues of the government in an economy. It is the sum of all payments made to production factors by all industrial units engaged in all sorts of economic activity.

### The Expenditure Approach

The expenditure approach measures GDP as the total amount spent on the final goods and services made in a country over a certain time period. While calculating the GDP with the expenditure approach, it is taken into account how much of the domestically produced goods are purchased by which economic actors. If the buyers of these goods are households (=consumers), it is called consumption expenditure (C); if the buyers are firms, it is called investment expenditure (I); if the buyers are governments, it is called Government expenditure (G); and if the buyers are foreign countries, it is called net exports (NX).

In symbols,

$$\begin{aligned} Y = \text{GDP} &= \text{total production (or output)} \\ &= \text{total income} \\ &= \text{total expenditure;} \end{aligned}$$

C = consumption;

I = investment;

G = government purchases of goods and services;

NX = net exports of goods and services.

By using these symbols, we reach one of the basic relationships in macroeconomics:

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

This is called the *income–expenditure identity*, because it states that income, Y, equals total expenditure, C + I + G + NX.

**Consumption (C):** Consumption means spending by domestic households on final goods and services and it is the largest component of expenditure. In Türkiye, the share of consumption in GDP was 56,4% in 2020. Consumption expenditures can be made on consumer durables as well as non-durable goods and services.

**Investment (I):** Three subcomponents comprise the investment component of GDP. The greatest of them is the fixed investment in businesses. Fixed investment in a business consists of the acquisition of newly manufactured plants and equipment. Residential construction investment is the second subcomponent of investment. Inventory investment is the last subcomponent of investment and it refers to the change in firm inventories. The

investment in the income-expenditure identity is the gross investment. Net investment is the entire amount of money spent by a corporation on capital assets less the cost of depreciation.



attention

When macroeconomists speak about investment, they mean the acquisition of new physical capital as opposed to financial investments like stock or bond purchases. In macroeconomic terms, investment is simply the acquisition of new physical capital.

**Government Purchases of Goods and Services (G):** The third largest component of GDP is the government purchases of goods and services, or Government Expenditure, which includes any expenditure by the government on a presently produced commodity or service.

**Net Exports (NX):** Net exports are exports minus imports. Exports are the goods and services made in a country that are sold to people outside of that country. Imports are the goods and services made outside of a country that its residents buy. If exports exceed imports, net exports are positive; otherwise, net exports are negative.

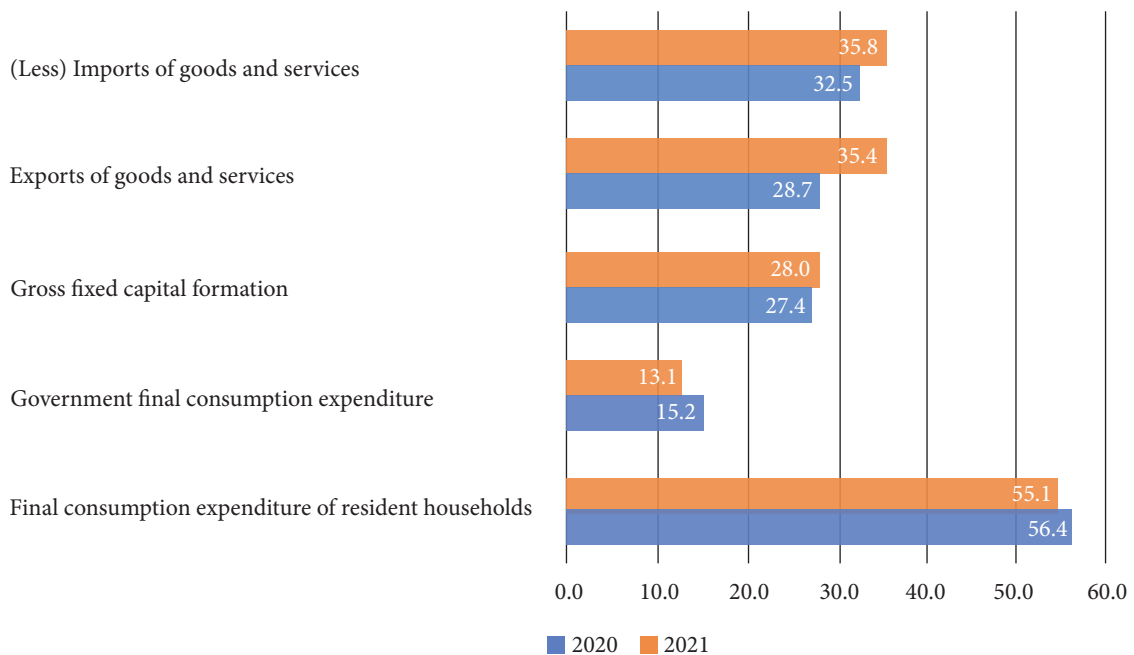


Figure 1.2 The shares of main components of GDP by expenditure approach, 2020, 2021.

Source: CBTR

The share of final consumption expenditure of resident households in GDP was 55.1% in 2021. So, consumption has the largest share among the other components of GDP. The share of government final consumption expenditures in GDP was 13.1% while the share of gross fixed capital formation was 28% in 2021. In main components of GDP by expenditure approach, exports of goods and services has 35.4% share, imports of goods and services has 35.8% share.

## GDP Versus GNP

The distinction between **GNP** and GDP is in how capital and labor created output outside their native (domestic) countries are treated. While gross domestic product (GDP) refers to the value of production that takes place inside a country, gross national product (GNP) refers to the market value of new final products and services that have been created by the domestic elements of production during the present time. When Turkish capital and labor are utilised in other countries, it results in the production of output and revenue for Türkiye. This output and revenue are considered part of Türkiye's gross national product (GNP), but they are not considered part of Türkiye's gross domestic product (GDP) since they do not reflect production that takes place inside Türkiye. Thus, the value of a plant constructed in Russia by a Turkish construction company is included in Turkish GNP, but not in Turkish GDP. Similarly, when foreign capital or labor is employed in Türkiye, the output and revenue generated are included in Turkish GDP (since the production occurs within Türkiye), but not in Turkish GNP (they are instead included in the other country's GNP). As you know, there are a lot of Turkish citizens working in Germany. While the goods and services produced by Turkish workers working in Germany are not included in Türkiye's GDP, the factor incomes transferred by these Turkish workers to Türkiye are included in the GNP.

The term “net factor payments from abroad” (NFP) refers to the difference between the revenue paid to domestic producers by the rest of the world and the home economy's payments to foreign producers. Using this concept, we express the relationship between GDP and GNP as

$$\text{GNP} = \text{GDP} + \text{NFP}$$

The difference between GNP and GDP is especially essential for nations with a large number of people working abroad, such as Türkiye. Because revenue generated by Turkish employees overseas is included in Türkiye's GNP but not its GDP, as Türkiye's GNP is larger than its GDP.

**Gross national product (GNP)** is the market value of production generated by the factors of production owned by the residents of a particular nation.

## Nominal and Real GDP

So far, we've discussed **nominal GDP**, which is a measure of goods and services produced today and valued at current market values. GDP is a great measure for measuring how well the economy as a whole is operating. Although quantifying economic activity in nominal terms has its own advantages, there is a challenge when attempting to compare the values of an economic indicator at two different times. If the current market value of the goods and services included in GDP changes over time, it is impossible to tell if the change is due to changes in the amount of goods and services produced, changes in their prices, or a combination of both. For example, a considerable rise in the current market value of GDP may suggest that a country's production of goods and services has grown greatly, or it may signal that the country has experienced inflation, which increases the cost of the products and services. Thus, we would like to distinguish the rise in the value of GDP caused by general price escalation from the increase in the value of GDP caused by quantity increases.

Real variables are often used to describe economic variables that are calculated by using prices from a base year. **Real GDP** uses the prices of a base year to measure the amount of a country's final output. Real GDP is the most effective indicator for tracing changes across time since it captures all economic activity at constant prices. After correcting for inflation, it displays changes in economic production. We are able to draw meaningful comparisons across years by maintaining prices constant and utilizing prices from a single base year.



**Nominal GDP** is a measure of currently produced goods and services valued at current market prices.

**Real GDP** is the total value of final goods and services calculated by using market prices from a base year.



### your turn 3

If the total value of real output in 2021 is ₺150.000 and the total value of real output in 2020 is ₺120.000, what is the growth rate of real GDP?



### your turn 2

Explain if it is possible for nominal GDP to increase and real GDP to decrease in the same period.

Now that you understand the difference between nominal and real GDP, we can discuss the growth rate of real GDP, also known as real GDP growth. For example, the calculation for 2021 real GDP growth is provided by

Real GDP growth in 2021 =  $\frac{(\text{Real GDP in 2021}) - (\text{Real GDP in 2020})}{(\text{Real GDP in 2020})}$

If the economy just produced one final product, such as a certain kind of automobile, calculating real GDP would be straightforward: We would use the price of the automobile in a particular year to multiply the number of automobiles manufactured in each year. Consider the case of an economy that only manufactures automobiles and in order to make it simple, suppose that the same model is produced each year. Consider the following scenario: The quantity and price of automobiles in three consecutive years are provided by table 1.2.

Nominal GDP, which is equal to the quantity of automobiles times their price, goes up from ₺20.000.000 in 2020 to ₺33.600.000 in 2021—a 68% increase—and from ₺33.600.000 in 2021 to ₺51.000.000 in 2022—a 52% increase.



### attention

When a headline of the newspaper announces, “Turkish Growth Slows to 3%,” the readers should understand that real growth is being discussed.

Table 1.2 Calculating Nominal and Real GDP

| Year | Quantity of Automobiles | Price of Automobiles | Nominal GDP | Real GDP (with 2021 prices) |
|------|-------------------------|----------------------|-------------|-----------------------------|
| 2020 | 100                     | ₺200.000             | ₺20.000.000 | ₺24.000.000                 |
| 2021 | 140                     | ₺240.000             | ₺33.600.000 | ₺33.600.000                 |
| 2022 | 170                     | ₺300.000             | ₺51.000.000 | ₺40.800.000                 |

To construct real GDP, we need to multiply the quantity of automobiles in each year by the market prices from a base year. Suppose that we use 2021 as the base year. This approach gives us real GDP in 2021 prices.

Using this approach, real GDP in 2020 (with 2021 prices) equals 100 automobiles \* ₺240.000 per car = ₺24.000.000. Real GDP in 2021 (with 2021 prices) equals 140 automobiles \* ₺240.000 per car = ₺33.600.000, the same as nominal GDP in 2021. Real GDP in 2022 (with 2021 prices) is equal to 170 \* ₺240.000 = ₺40.800.000. So, real GDP increases from ₺24.000.000 in 2020 to ₺33.600.000 in 2021—a 40% increase—and from ₺33.600.000 in 2021 to ₺40.800.000 in 2022—a 21% increase.



Our results would have been different if we calculate real GDP using the prices of a different base year. For example, if we use the prices of 2020, then the level of real GDP in each year would be different but its rate of change from year to year would be the same.



#### your turn 4

Change the base year to 2020, calculate real GDP with 2020 prices and find the growth rate of real GDP from 2020 to 2021 and from 2021 to 2022. Compare the results with the 2021 base year case.

The issue with creating real GDP in practice is that there are definitely several final goods. As previously stated, real GDP must be defined as a weighted average of the output of all final goods, which leads us to consider what the appropriate weights should be. The measure of real GDP in the Turkish national income accounts uses weights that reflect relative prices and change over time. This metric is known as the GDP at chain-linked volume index, and it is calculated by correcting the inflation impact so that output changes may be tracked more precisely. As the chain-linked volume index has no price impact, it reflects the actual changes in GDP over a particular time. The pricing structure must represent the current condition in order to prevent the consequences of price changes and measure only the actual change. When chain-linked volume indices are calculated

using the previous year's prices instead of a fixed year's pricing in two successive year computations, the method of reducing price fluctuations becomes more suitable.

The chain linked volume index may be calculated using one of the three fundamental chaining techniques. These techniques include chaining with the average of the previous year (annual overlap), chaining with the last quarter of the previous year (quarter overlap), and chaining with the same quarter of the previous year (over the year). In Türkiye, the annual overlap method is used for the calculation of the GDP. When this procedure is utilised, the outcomes are more consistent.

Table 1.3. shows the Real GDP of Türkiye in chain linked Volume by expenditure approach between 2003 and 2021. According to this table, the real GDP growth rate from 2020 to 2021 is approximately %11.



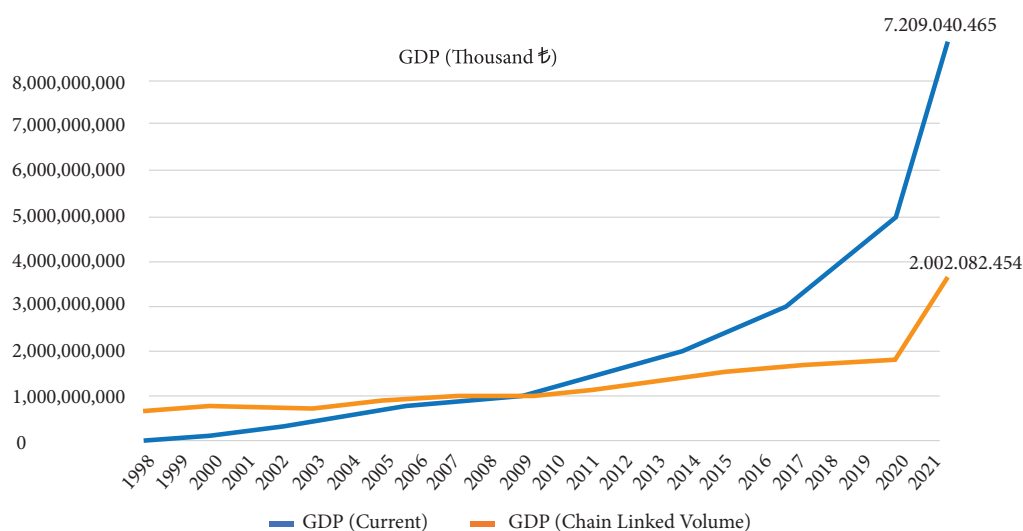
#### attention

Gross domestic product at current prices increased by 42.8% and reached 7 trillion 209 billion 40 million ₺ in 2021 compared with the previous year. But Gross Domestic Product obtained by addition of four quarters with chain linked volume index (2009=100), increased by 11.0% in 2021 compared with the previous year.

**Table 1.3** Real GDP (₺1.000)-Level in Chain Linked Volume by Expenditure Approach and Chain Linked Volume index (2009=100).

| Years | Real GDP (Chain Linked Volume, ₺1.000) | Chain linked volume index (2009=100) | Real GDP Growth Rate |
|-------|----------------------------------------|--------------------------------------|----------------------|
| 2003  | 780.150.235                            | 77,5                                 | 5,8                  |
| 2004  | 856.573.256                            | 85,1                                 | 9,8                  |
| 2005  | 933.598.935                            | 92,8                                 | 9                    |
| 2006  | 998.465.278                            | 99,2                                 | 6,9                  |
| 2007  | 1.048.822.954                          | 104,2                                | 5                    |
| 2008  | 1.057.371.118                          | 105,1                                | 0,8                  |
| 2009  | 1.006.372.482                          | 100,0                                | -4,8                 |
| 2010  | 1.091.180.541                          | 108,4                                | 8,4                  |
| 2011  | 1.213.393.968                          | 120,6                                | 11,2                 |
| 2012  | 1.271.497.249                          | 126,3                                | 4,8                  |
| 2013  | 1.379.394.179                          | 137,1                                | 8,5                  |
| 2014  | 1.447.532.323                          | 143,8                                | 4,9                  |
| 2015  | 1.535.607.237                          | 152,6                                | 6,1                  |
| 2016  | 1.586.636.759                          | 157,7                                | 3,3                  |
| 2017  | 1.705.666.209                          | 169,5                                | 7,5                  |
| 2018  | 1.756.493.104                          | 174,5                                | 3                    |
| 2019  | 1.772.118.605                          | 176,1                                | 0,9                  |
| 2020  | 1.803.902.464                          | 179,2                                | 1,8                  |
| 2021  | 2.002.082.454                          | 198,9                                | 11                   |

**Source:** Turkstat



**Figure 1.3** Nominal GDP and the Real GDP

**Source:** CBRT

In figure 1.3., the blue line represents the nominal GDP (GDP with current prices) and the orange line represents the real GDP (GDP in Chain Linked Volume). The two are equal in 2009 because 2009

is the base year for chain linked volume. After that year, the discrepancy between real and nominal GDP increases. The discrepancy between the two findings may be attributed to the fact that prices went up during the course of the time.

## GDP Level versus Growth Rate

Until this point, we have been concentrating on the level of real GDP. This is an essential data that indicates a country's economic size. A country with a bigger GDP is economically bigger than another country with a smaller GDP. So, the level of real GDP is an important data for a country. By examining the level of real GDP, both the economic condition and the country's position among others may be determined. However, when assessing the economy's performance from one year to the next, economists look at the rate of rise in real GDP, commonly known as GDP growth. The term "expansion" refers to a time period in which GDP growth is positive. Recessions are defined as the periods of declining GDP. As you can see from figure 1.4., the Turkish economy had many expansions and recessions during the 1999-2021 period. There was a large negative growth rate (%-5,8) in the 2001 economic crises and after the global economic crisis in 2009. After those recession years, there were recovery periods with high growth rates between 2002-2007 and 2010-2017. Despite the COVID-19 related contraction in economic activity, the Turkish economy grew 11% in 2021.

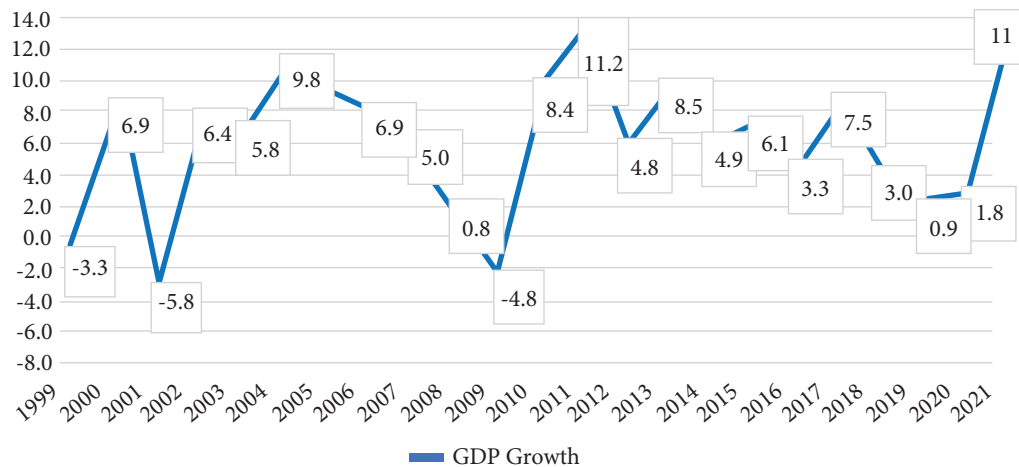


Figure 1.4 GDP Growth

Table 1.4 GDP Growth Rates

| Year | GDP Growth (Annual) % | Year | GDP Growth (Annual) % |
|------|-----------------------|------|-----------------------|
| 1999 | -3,3                  | 2011 | 11,2                  |
| 2000 | 6,9                   | 2012 | 4,8                   |
| 2001 | -5,8                  | 2013 | 8,5                   |
| 2002 | 6,4                   | 2014 | 4,9                   |
| 2003 | 5,8                   | 2015 | 6,1                   |
| 2004 | 9,8                   | 2016 | 3,3                   |
| 2005 | 9,0                   | 2017 | 7,5                   |
| 2006 | 6,9                   | 2018 | 3,0                   |
| 2007 | 5,0                   | 2019 | 0,9                   |
| 2008 | 0,8                   | 2020 | 1,8                   |
| 2009 | -4,8                  | 2021 | 11,0                  |
| 2010 | 8,4                   |      |                       |

Source: CBRT



## In Practice

### — The war is slowing the recovery

Prior to the war, the world economy was on track for a strong, albeit uneven, recovery from COVID-19. The conflict in Ukraine and the supply-chain disruptions exacerbated by shutdowns in China due to the zero-COVID policy are dealing a serious blow to the recovery.

Global GDP growth is now projected to slow sharply this year, to around 3%, and remain at a similar pace in 2023. This is well below the pace of recovery projected last December.

Growth is set to be markedly weaker than expected in almost all economies. Many of the hardest-hit countries are in Europe, which is highly exposed to the war through energy imports and refugee flows.

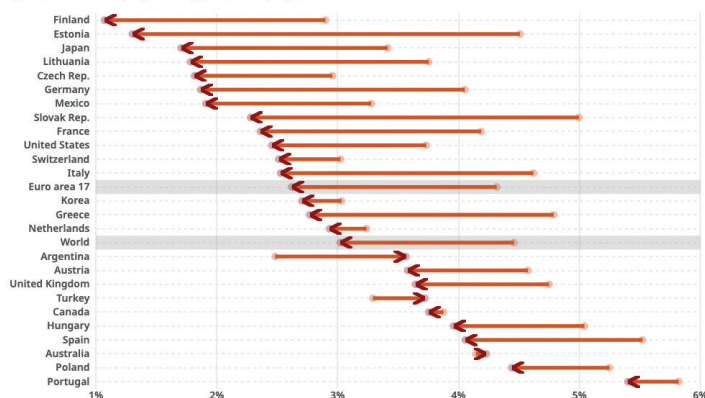
Countries worldwide are being hit by higher commodity prices, which add to inflationary pressures and curb real incomes and spending, further dampening the recovery.

This growth slowdown is a price of war which will be paid through lower incomes and fewer job opportunities.

#### Annual GDP growth projections for 2022

Year on year, %

● December 2021 projection ● June 2022 projection



Source: OECD Economic Outlook (Edition 2022/1).

Figure 1.5 Annual GDP Growth Projections for 2022.

Source: <https://www.oecd.org/economic-outlook/June-2022/>

## GDP Per Capita

GDP per capita is the gross domestic product divided by midyear population. It gives us the average standard of living of the country. It indirectly allows for qualitative characteristics such as literacy and health, but not by explicitly addressing them. Per capita GDP is a worldwide statistic for measuring the prosperity of nations, and economists use it in conjunction with GDP to examine the economic growth-based prosperity of a country. There are several methods for analysing a nation's wealth and prosperity. The per capita GDP is the most universal metric since its components are constantly monitored on a worldwide basis, making its computation and use simple. GDP per capita indicates, at its most fundamental level, how much economic production value can be assigned to each individual citizen.

There are many different numerical relationships that can have an effect on GDP per capita. If a country's gross domestic product (GDP) per capita is expanding but the population level remains the same, this might be the consequence of technical advancements that are generating more with the same population level. Some countries with high per capita GDP and a tiny population have established a self-sufficient economy on particular resources. A nation may see constant economic development, but if its population grows faster than its GDP, its GDP per capita will decline. This is not an issue for the majority of countries that are already well-established since even a moderate rate of economic development can still outrun the rate at which their populations are expanding. However, countries with low levels of GDP per capita might have fast population expansion without significant GDP growth, resulting in a continuous decline in living standards. By looking at GDP per person on a global scale, we can compare how well economies are doing and how they are changing around the world. According to the International Monetary Fund, the five nations with the greatest per capita GDP as of 2021 are shown in table 1.5..

Table 1.5 Per Capita GDP (Top Five)

| Country       | GDP per capita (USD) |
|---------------|----------------------|
| Luxembourg    | \$ 131.301           |
| Ireland       | \$ 102.394           |
| Switzerland   | \$ 93.515            |
| Norway        | \$ 82.244            |
| United States | \$ 69.375            |

Source: IMF

GDP per Capita of Türkiye reached 9.406USD in 2021, compared with 8.610 USD in Dec 2020.

## FUNDAMENTAL CONCEPTS OF MACROECONOMICS

Economics, according to British economist Alfred Marshall, is “the study of mankind in the ordinary business of life”. In macroeconomics, we study this “ordinary business of life” at the aggregate level. We examine the economy’s overall behaviour. The main factors that we examine are aggregate output in the economy, the aggregate price level, employment and unemployment, the inflation rate, wage rates, and foreign exchange rates. Macroeconomics is concerned with factors that influence both the levels and the rates of change of these variables.

### The Unemployment Rate

GDP is undoubtedly the most significant macroeconomic indicator since it measures aggregate activity. However, unemployment and inflation are two other factors that provide information about other significant aspects of an economy’s state of health. Firstly, we will focus on some definitions about **employment** and **unemployment**.

Employment comprises the persons who are engaged in any activity during the reference week for at least one hour to gain pay/profit (including contributing family workers) or persons with a job or business who were temporarily not at work but

had job attachment to their job. Regular employees, casual employees, employers, self-employed or unpaid family workers who were temporarily not at work during the reference week due to several reasons are considered as employed.

**Employment** is the number of people who have a job.

Unemployment is the number of people who were not employed during the reference week, were actively seeking work in the last four weeks ending with the reference week and were available to start work within two weeks.

**Unemployment** is the number of people who do not have a job but are looking for one.

**Labor force** covers the working-age population that is willing to supply labor for the production of economic goods and services in the relevant reference period. Labor force comprises all employed and unemployed people.

**The labor force** is the sum of employment and unemployment

$$L = N + U$$

labor force = employment + unemployment

Unemployment rate is the ratio of unemployed persons to the labor force.

$$u = \frac{U}{L}$$

unemployment rate= unemployment / labor force

The process of generating the unemployment rate is less straightforward than you may think. It is quite simple to determine whether someone is employed, but it is more difficult to determine whether they are unemployed. Remember that to be categorized as unemployed, a person must fulfil two conditions: He or she does not have a job and is seeking for one; the second criteria is more difficult to determine.



#### attention

It's important to note that only individuals searching for jobs are considered as unemployed; those who don't have a job and aren't seeking for one are considered *not in the labor force*.

When unemployment is high, a portion of the jobless cease their job search and are consequently no longer classed as unemployed. These individuals are known as *discouraged workers*. Take an extreme case: If everyone who doesn't have a job stopped trying to find one, the unemployment rate would drop to zero. This would mean that the unemployment rate doesn't really show what's going on in the labor market. When the economy slows down, we often witness an increase in both unemployment and the number of people leaving the labor force. A greater unemployment rate is often related with a lower labor force participation rate, which is the ratio of the labor force to the entire working-age population.

$$\text{Labor Force participation rate} = \frac{\text{Labor Force}}{\text{Working Age Population}}$$



#### your turn 5

In the first quarter of 2022, the working age population of Türkiye was 64.332.000 and the labor force was 33.809.000 people. Calculate the labor force participation rate for this quarter.

Currently, the majority of nations rely on massive household surveys to determine the unemployment rate. In Türkiye Turkish Statistical Institute (TurkStat) aims at revealing the situation of the population in terms of labor force, compiling detailed information about the employment and unemployment, and publishing them to the public regularly and up-to-date with the Household Labor Force Survey (HLFS). The research is the main data source that provides information on the supply side of the labor market in the country.

According to the Household Labor Force Survey that covers the January – March 2022 period, the labor force consists of 33 million 809 thousand people. In the same period, 3 million 845 thousand people were unemployed. So, the unemployment rate was  $3.845.000 / 33.809.000 = 11,37 \%$ .

Table 1.6 Seasonally adjusted main labor force indicators, 15+ age, Quarter I: January-March, 2022.

|                                     | Quarter I, 2022 |       |        | The previous quarter |       |        |
|-------------------------------------|-----------------|-------|--------|----------------------|-------|--------|
|                                     | Total           | Male  | Female | Total                | Male  | Female |
| <b>(Thousand)</b>                   |                 |       |        |                      |       |        |
| Population (15 years and over)      | 64332           | 31827 | 32505  | 64095                | 31712 | 32383  |
| Labor force                         | 33809           | 22694 | 11114  | 33571                | 22547 | 11025  |
| Employment                          | 29964           | 20369 | 9595   | 29776                | 20304 | 9472   |
| Unemployment                        | 3845            | 2325  | 1519   | 3795                 | 2243  | 1552   |
| Not in the labor force              | 30523           | 9132  | 21390  | 30523                | 6165  | 21358  |
| <b>(%)</b>                          |                 |       |        |                      |       |        |
| Labor force participation rate      | 52.6            | 71.3  | 34.2   | 52.4                 | 71.1  | 34.0   |
| Employment rate                     | 46.6            | 64.0  | 29.5   | 46.5                 | 64.0  | 29.3   |
| Unemployment rate                   | 11.4            | 10.2  | 13.7   | 11.3                 | 9.9   | 14.1   |
| Youth unemployment rate (15-24 age) | 21.1            | 18.5  | 26.0   | 21.4                 | 17.9  | 27.9   |

Source: TURKSTAT, Labor Force Statistics

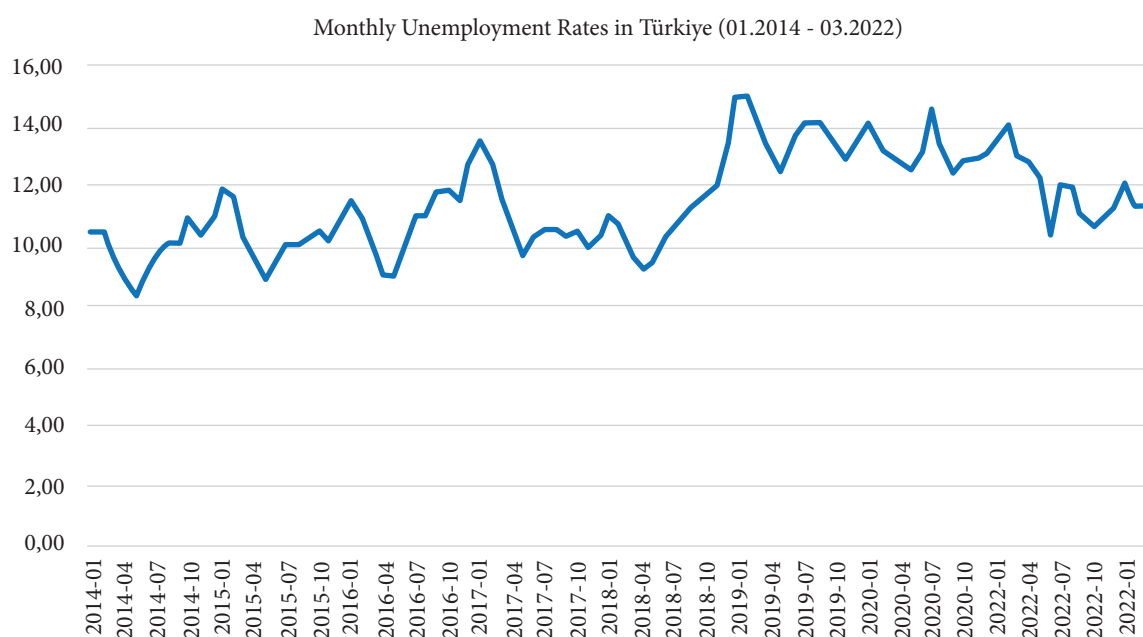


Figure 1.6 The evolution of unemployment in Türkiye between 2014 and 2022.

Source: TURKSTAT

Figure 1.6 shows the evolution of unemployment in Türkiye between 2014 and 2022. Since 2014, the unemployment rate in Türkiye has ranged between 8 and 16 percent, increasing during recessions and decreasing during booms. During this period the highest unemployment rate was 15.1% which was seen in January 2019. According to the latest press release of TURKSTAT, the seasonally adjusted unemployment rate occurred at 11.4% in March 2022.



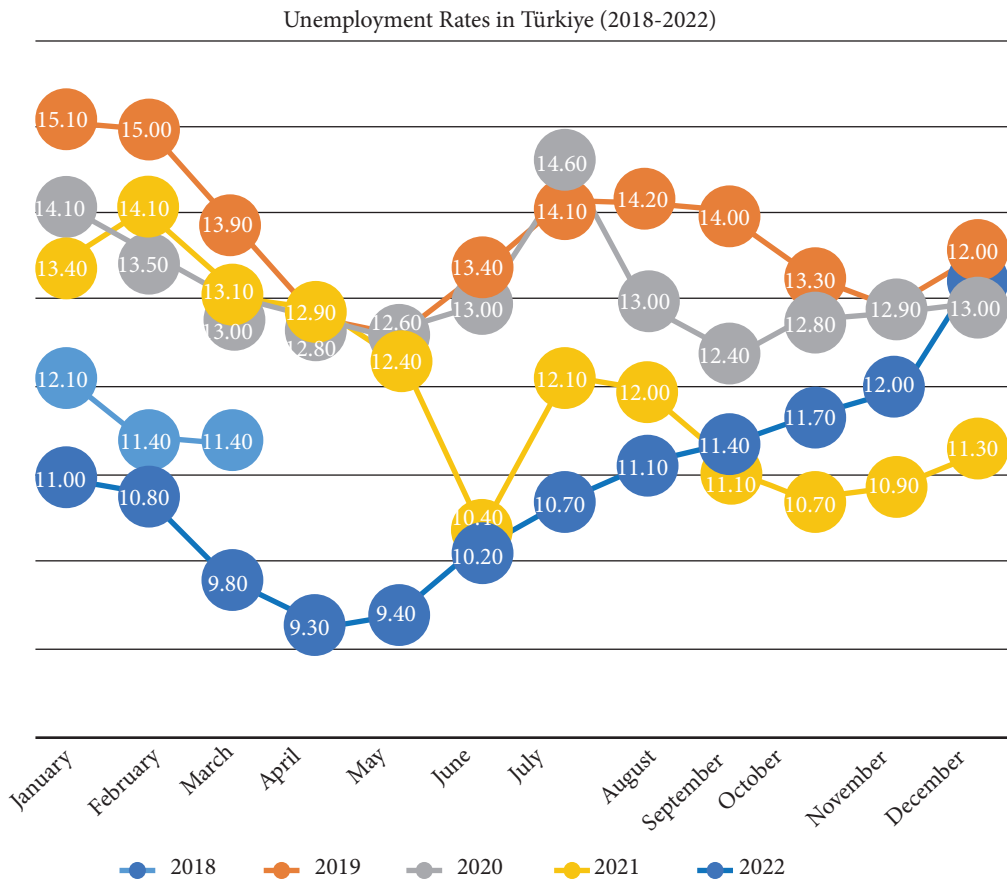


Figure 1.7 Unemployment rates in Türkiye (2018-2022).

Source: TURKSTAT Labor Force Statistics.

## Trends in the Unemployment Rate

The unemployment rate follows the same pattern of movement as the total economy. When the economy as a whole goes through a recession, which is a time when GDP goes down, the unemployment rate tends to go up. The unemployment rate often declines when the economy is strong and growing. The unemployment rate rises most dramatically during severe recessions. A certain level of unemployment, often between 4 and 5 percent, is a vital component of a well-functioning contemporary economy.

For a variety of reasons, unemployment never decreases to zero. People always change jobs, and when they do, they are temporarily marked as “unemployed.” This type of unemployment is called frictional unemployment. Their number might go down if there is a better way to share information about jobs and if they get more training. Secondly, people whose skills and locations do not match with job opportunities create structural unemployment. Even when the economy is at full employment, the unemployment rate is never zero due to the interaction of structural and frictional unemployment. The unemployment rate that exists when output and employment are at full employment level is known as the **natural rate of unemployment**. Even though there isn't a single official way of measuring the natural rate of unemployment, many economists think it was around 4% or 5% in the 1950s and slowly rose to about 6% in the 1980s.

**Natural rate of unemployment:** The unemployment rate that exists when output and employment are at full employment level.

As output changes around its full-employment level, the unemployment rate changes around the natural rate. The discrepancy between the actual and natural unemployment rates is referred to as cyclical unemployment. Cyclical unemployment has a positive value if the levels of output and employment in the economy are lower than those of full employment; however, it has a negative value whenever output and employment are higher than those of full employment.

### Why is the Unemployment Rate Important for Economists?

Although unemployment rates can vary greatly, they are one of the best indicators of labor market health. Economists care about unemployment for two reasons:

1. Unemployment has important social consequences. In addition to great financial hardship and poverty, the negative effects of unemployment on individuals and society also include debt, stress, and family conflict as well as breakup. Additionally, unemployment affects society and the economy as a whole. The longer a person remains jobless, the greater the likelihood that they may experience possible negative impacts and contribute to unemployment's multiplier effect on the community. Unemployment has costs to a society that are more than just financial.
2. They may determine if an economy is performing above or below its normal level of activity by looking at the unemployment rate. Unemployment indicates that the economy may be underutilizing some of its resources. When unemployment is high, many people who want to work can't find jobs. This means that the economy isn't making the best use of its resources. The unemployment which is too low may also be a problem. An economy with an extremely low unemployment rate may overuse its resources and have labor shortages. A greater unemployment rate may also result in increased payments made by the government in the form of unemployment benefits, food assistance, and medical support.

When examining longer-term economic trends, the first items to look at are employment, productivity, and investment.

### The Inflation Rate

**Inflation** refers to a sustained increase in the general price level. The rate at which the price level rises is referred to as the inflation rate. The opposite of inflation is **deflation**. Deflation is rare but sometimes it happens. Deflation is a sustained decline in the general price level. It indicates a negative inflation rate.

**Inflation** refers to a sustained increase in the general price level. Deflation is a sustained decline in the general price level.

**Deflation** is distinct from disinflation, a slow-down in the inflation rate. During the disinflation period inflation declines to a lower rate but is still positive.

The actual problem is figuring out how to define the price level in a way that allows the inflation rate to be calculated. The GDP deflator and the Consumer Price Index are the two price indexes that macroeconomists commonly use as the two indicators of price level.

### The GDP Deflator

The real GDP is another useful metric for analyzing the pricing structure of the economy as a whole. A measure of how much prices of goods and services produced in a nation have increased since the base year is obtained by dividing nominal GDP by real GDP in the same year and multiplying the resultant ratio by 100. This ratio is called the GDP deflator. If we call the GDP deflator in year  $t$ ,  $P_t$  it is calculated with the following formula:

$$P_t = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

The GDP deflator is an index number that is equal to 100 in the base year. Because nominal GDP is equal to real GDP in the base year. So, their ratio will be equal to 1. If we multiply this 1

with 100, we reach 100 which is the index value at the base year. The GDP deflator itself has no economic interpretation but its rate of change  $P_t - P_{t-1}/P_{t-1}$  which we can denote as  $\pi_t$  is very important. It provides the inflation rate, or the rate at which the general level of prices rises over time.

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100 \quad \text{where } \pi_t = \text{the inflation rate in year } t \text{ and } P_t = \text{GDP Deflator in year } t$$

One benefit of using the GDP deflator as the price level is that it makes clear how nominal GDP, real GDP, and the GDP deflator relate to each other. From the formula, we can easily say that Nominal GDP is equal to the GDP deflator times real GDP. Or, in terms of rates of change: The rate of growth of nominal GDP equals the rate of inflation plus the rate of real GDP growth.



#### your turn 6

Suppose that the GDP deflator in 2021 is 206 and the GDP deflator in year 2022 is 336 and calculate the inflation rate of 2022.

To make it simple, suppose that a country is producing only three goods: Egg, milk and table. The quantities produced and the price levels for 2 successive years are given in table 1.7. and table 1.8.:

Table 1.7 Prices and Quantities in 2020 (Base year).

| Output in 2020 | Quantity Produced (2020) | Price in 2020 | Total Value of output |
|----------------|--------------------------|---------------|-----------------------|
| Egg            | 10                       | 2             | 20                    |
| Milk           | 20                       | 2             | 40                    |
| Table          | 5                        | 10            | 50                    |
|                |                          |               | Nominal GDP=110       |

Table 1.8 Prices and Quantities in 2021.

| Output in 2021 | Quantity Produced (2021) | Price 2021 | Price 2020 | Total Value of Output (with 2021 prices) | Total Value of Output (with 2020 prices) |
|----------------|--------------------------|------------|------------|------------------------------------------|------------------------------------------|
| Egg            | 12                       | 2,5        | 2          | 30                                       | 24                                       |
| Milk           | 25                       | 3          | 2          | 75                                       | 50                                       |
| Table          | 5                        | 11         | 10         | 55                                       | 50                                       |
|                |                          |            |            | Nominal GDP=160                          | Real GDP=124                             |

$$\text{The GDP Deflator for 2021 is } P_{2021} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100 \quad P_{2021} = \frac{160}{124} \times 100 = 129$$

$$\text{The GDP Deflator for 2020 is } P_{2020} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100 \quad P_{2020} = \frac{110}{110} \times 100 = 100$$

By using the GDP deflators of 2020 and 2021 we can easily calculate the inflation rate in 2021.

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100 \quad \pi_{2021} = \frac{P_{2021} - P_{2020}}{P_{2020}} \times 100 \quad \pi_{2021} = \frac{129 - 100}{100} \times 100 = \%29$$

This tells us basically that the average price of goods in this country increased by 29 percent between 2020 and 2021. We can also use the consumer price index to calculate the inflation rate. But the GDP deflator is a broader measure of inflation than the consumer price index. The consumer price index only looks at a basket of goods that a typical household in a country buys. The GDP deflator, on the other

hand, looks at goods made and bought by all parts of a country's economy, including the government, private businesses, and goods made for export within the country.



The GDP deflator is the price of goods produced in Türkiye, whereas the CPI is the price of goods consumed in Türkiye.

### The Consumer Price Index

The GDP deflator provides the average price of the economy's final goods. However, customers are concerned about the average price of the products they purchase. Because of the following two factors, the set of products that are produced in the economy and the set of goods that are purchased by consumers are not the same:

1. Some of the goods in GDP are sold to companies (like machine tools), the government, or foreigners instead of consumers.
2. Some of the commodities purchased by customers are not manufactured in the country but are imported from abroad.

Macroeconomists use another index, the Consumer Price Index, or CPI, to determine the average cost of consumption or, alternatively, the cost of living. The consumer price index (CPI) tracks

changes in the current retail prices of goods and services purchased by consumers over a certain time period. The 2003-based CPI is intended to compute the inflation rate by considering the change in prices of existing goods and services. For this reason, all final monetary consumption expenditures of households, international tourists, and the country's institutional population are considered. Classification of Individual Consumption by Purpose (COICOP) is used to determine the weights and calculate the index. According to this classification, expenditures are grouped into 43 sub-groups and 12 major categories. The index is compiled by using 409 different goods. The prices of products and services covered in the index include taxes but exclude deposits and instalments. The CPI baskets and weights are adjusted at the end of each year and linked to the Laspeyres formula. Every December, new goods and services are added to the basket, goods and services that are no longer useful are taken out, and the index is recalculated using new weights.

The CPI is an index, just like the GDP deflator. In the period chosen as the base period, it is set to 100, so its level doesn't mean much. In Türkiye, 2003 is chosen as the base year and therefore, the index value is equal to 100 in 2003. At the end of May 2022, the CPI reached 931 due to the high inflation rates in recent months. In table 1.9., you can see the monthly inflation rates in the first 5 months of 2022.

Table 1.9 Consumer Price Index.

|         | CPI (Year to Year % Changes) | CPI (Month to Month % Changes) |
|---------|------------------------------|--------------------------------|
| 05-2022 | 73.50                        | 2.98                           |
| 04-2022 | 69.97                        | 7.25                           |
| 03-2022 | 61.14                        | 5.46                           |
| 02-2022 | 54.44                        | 4.81                           |
| 01-2022 | 48.69                        | 11.10                          |

Source: TURKSTAT

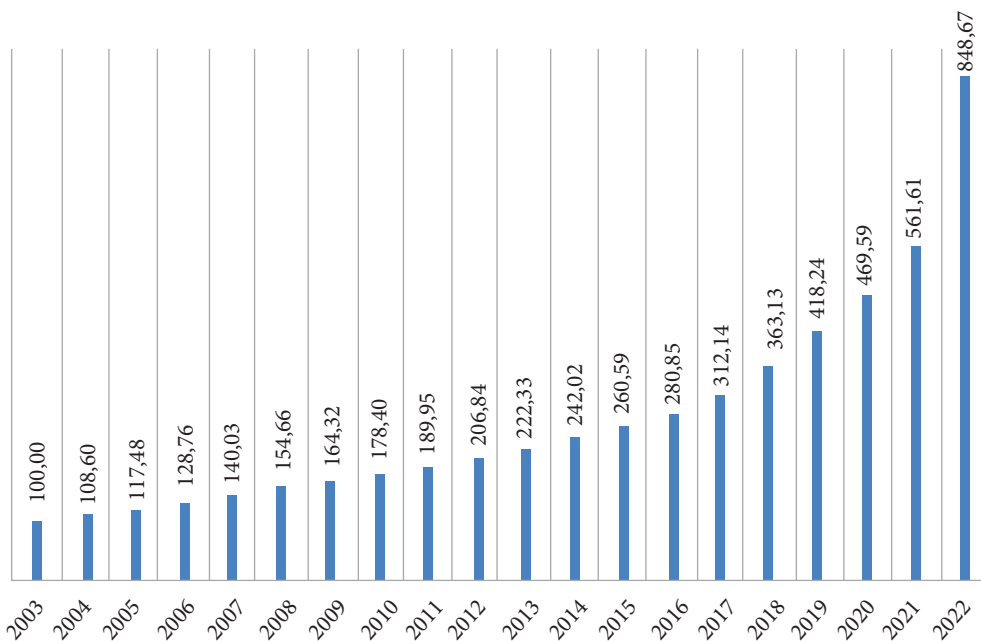


Figure 1.8 Consumer Price Index (2003=100).

Source: CBRT

## Negative Effects of Inflation

The primary consequences of inflation are discussed here, but it's crucial to remember that they will vary depending on the rate of inflation. A rate of 10%, for example, will not have the same effect as a rate of 100% a year.

**1-Loss of Value:** The loss of purchasing power is one of the most serious consequences of inflation. As prices go up, so does the value of money. For example, if you put ₺100 under your pillow and leave it there for ten years, you won't be able to buy as much as you can today because of inflation. Inflation drives people to seek a return on their money as a result of the loss of purchasing power. It encourages people to find better returns for their money instead of putting it under the mattress or in a bank account with a low interest rate. People are afraid that the money they have saved over the years will lose its value over time. Additionally, as a result of inflation, firms are under more pressure to invest any extra cash. Therefore, if money is not being used in some way, it will begin to lose value, regardless of whether this involves investing in stocks or another type of financial instrument.

**2-Increases in Inequality:** Low-income households are typically hit the most by inflation. They spend the vast majority of their money,

therefore price hikes often consume a larger portion of their salaries. When the price of food and housing goes up, for example, the poor have really no choice but to accept paying. If the price of food goes up to ₺500 a week, it damages people who make ₺4.250 a month more than people who make ₺30.000 a month. For example, retirees' payments don't keep up with the price level, so when inflation is high, they lose out compared to other groups. During inflationary periods, not all prices and earnings increase proportionally. As they do not, inflation influences the distribution of income.

One effect of inflation is that the prices of assets tend to go up. Assets like houses, stocks, and commodities like gold tend to grow faster than inflation. This raises inequality since wealthier households have more assets. This means that when inflation happens, the price of these assets rises more than the price of everyday products like bread, cheese, potato, and so on. Because of this, they end up with more money and can buy more goods and services than they could before. At the same time, people with low incomes have to spend more just to stay alive. Those with lower incomes typically spend a greater proportion of their incomes, leaving them with less money to save and invest in stocks, bonds, and other assets. Additionally, they are unlikely to be able to afford

big capital expenditures such as purchasing a home. Those who are able to invest a portion of their wages in inflation-protected assets, such as stocks, are consequently better off.

**3- Exchange Rate Fluctuations:** When the inflation rate increases, generally the money supply also increases. A nation's currency could experience a loss in value if both the amount of money in circulation and the level of prices rise. For example, suppose that a Turkish carpet is worth ₺1000. This is exchanged for a barrel of American oil worth 100\$. Based on this transaction, the exchange rate would be 1:10. However, Türkiye continues to print money, and inflation drives up the price of the carpet to ₺2000. The carpet's worth to the United States has not increased. So, they wouldn't be willing to trade more barrels of oil for the same carpet. As a result, the exchange rate adjusts to the new reality. With 100 USD worth of American oil and ₺2000 worth of Turkish carpet, the exchange rate would rise to 1:20.

**4- Increase in Cost of Borrowing:** In order to insulate themselves against inflationary pressures, financial institutions may increase their interest rates in response to persistent and high levels of inflation. Therefore, borrowers can actually find it more difficult to get credit. Even if they can borrow credit, it is costlier and difficult for them to pay back.

**5- Increase in Cost of Living:** As the prices of goods go up, people will have to pay more for both necessities and luxuries. This may not be a problem if salaries rise in line with inflation, but individuals whose incomes do not increase will experience

higher real prices. In other words, they will have to spend a bigger share of their income on the same number of goods.

**6- Create Taxation Problems:** Inflation also causes taxpayers to move into higher tax brackets, which results in some paying greater taxes. If tax brackets aren't changed to account for inflation, for example, people whose nominal income goes up but whose real income stays the same, will move into higher and higher tax brackets. In the United States, the tax brackets are adjusted automatically for inflation: If inflation is 10%, all tax brackets also go up by 10%. By contrast, in Türkiye there is not an automatic adjustment in tax brackets and this results in a rise in the rate of income taxation.

**7- Create Relative Price Distortions:** Some prices that are fixed by law or regulation lag behind others, causing relative price variations. Variations in relative pricing also increase uncertainty, making it more difficult for businesses to make future decisions, such as investment decisions.

Both high inflation and high deflation are bad for an economy. A large negative rate of inflation (high deflation) would cause many of the same problems as high inflation. Even at a low rate of deflation, monetary policy has limited the impact on production. Japan is the most notable example of deflation in recent history, with the consumer price index falling from the late 1990s to 2005. Therefore, what would be considered as the "optimal" rate of inflation? Most macroeconomists think that the best rate of inflation is the one that is low and stable, between 1% and 4%.





## In Practice

### — Inflationary pressures have intensified

The war in Ukraine has quashed hopes for a quick end to rising inflation from COVID-19 related supply bottlenecks seen across the global economy during 2021 and early 2022.

High food and energy prices and the continued worsening of supply-chain problems imply that consumer price inflation will peak later and at higher levels than previously foreseen.

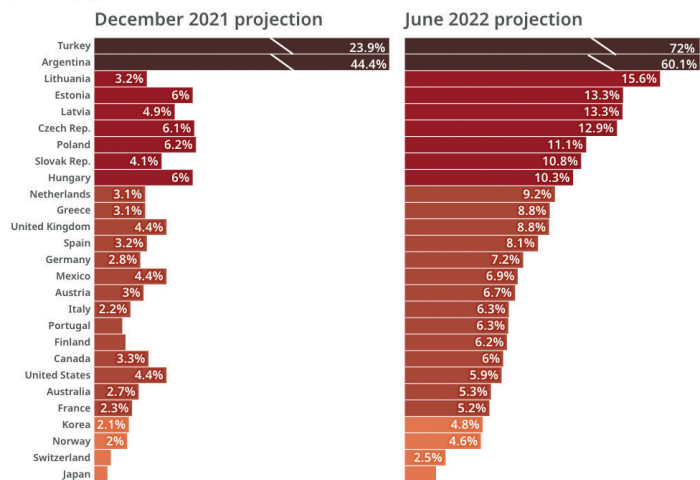
The new OECD projections show the large and global impact the war is having on inflation, which has already reached 40-year highs in Germany, the United Kingdom and the United States.

A gradual reduction of supply chain and commodity price pressures and the impact of rising interest rates should begin to be felt through 2023, but core inflation is nonetheless projected to remain at or above central bank objectives in many major economies at year-end.

#### Annual inflation projections for 2022

Year-on-year, %

June 2022 projection: ■ >20% ■ 10-20% ■ 5-10% ■ <5%



Source: OECD Economic Outlook (Edition 2022/1).

Figure 1.9 Annual inflation projections for 2022

Source: <https://www.oecd.org/economic-outlook/June-2022/>

## The Producer Price Index

Domestic Producer Price Index (DPPI) is a measure of the change in the prices of goods and services sold as output by domestic producers in a given reference period. Industrial coverage consists of Mining and Quarrying, Manufacturing, Electricity, Gas, and Water. Prices are cash prices, excluding VAT and all relevant taxes. In Türkiye, results of the D-PPI are announced to the public on the 3rd or consequent working day of the month at 10:00 with a news bulletin by TURKSTAT.

According to the latest press release, the Domestic producer price index (D-PPI) (2003=100) increased by 8.76% on a monthly basis, by 132.16% on the same month of the previous year basis in May 2022.



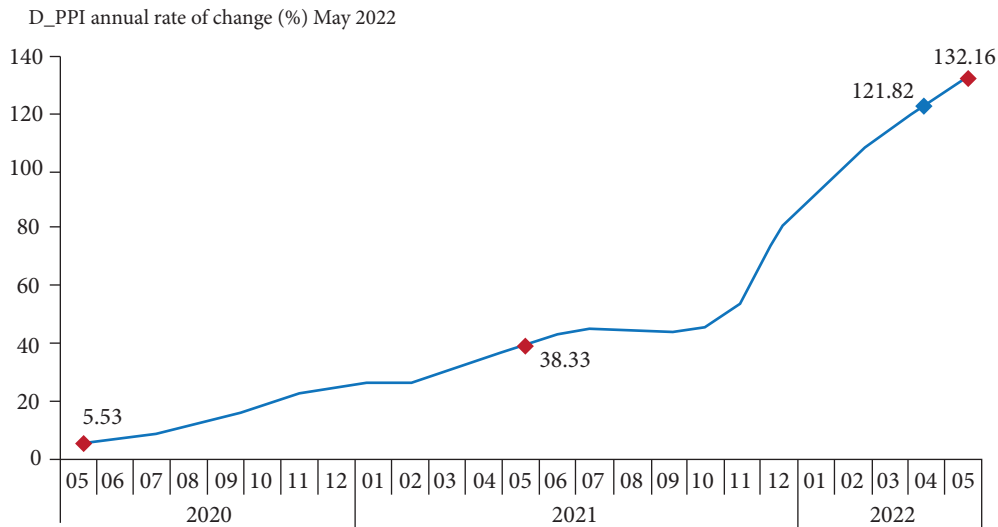


Figure 1.10 D-PPI annual rate of change (%), May 2022

Source: TURKSTAT

## RELATIONSHIPS BETWEEN MACROECONOMIC VARIABLES

We examined each of the three major aspects of total economic activity separately: Growth of output, the unemployment rate, and the inflation rate. They are obviously not independent of one another, and a large portion of this book will be devoted to examining their close relationships. However, it would be helpful to take a first glance right now.

### Relationship between Actual and Potential GDP

Forgone output is the fundamental economic cost of unemployment. Potential output of goods and services is irreversibly lost when the economy fails to produce enough employment for everybody who are able and willing to work. The discrepancy between actual and potential GDP is referred to by economists as the GDP gap. Which is:

$$\text{GDP Gap} = \text{Actual GDP} - \text{Potential GDP}$$

If actual GDP is smaller than potential GDP, the GDP gap is negative.

If actual GDP is greater than potential GDP, the GDP gap is positive.

When unemployment exceeds the natural rate, it is negative because actual GDP is less than potential GDP. The GDP gap and the unemployment rate are closely correlated. The GDP gap widens as the unemployment rate rises.

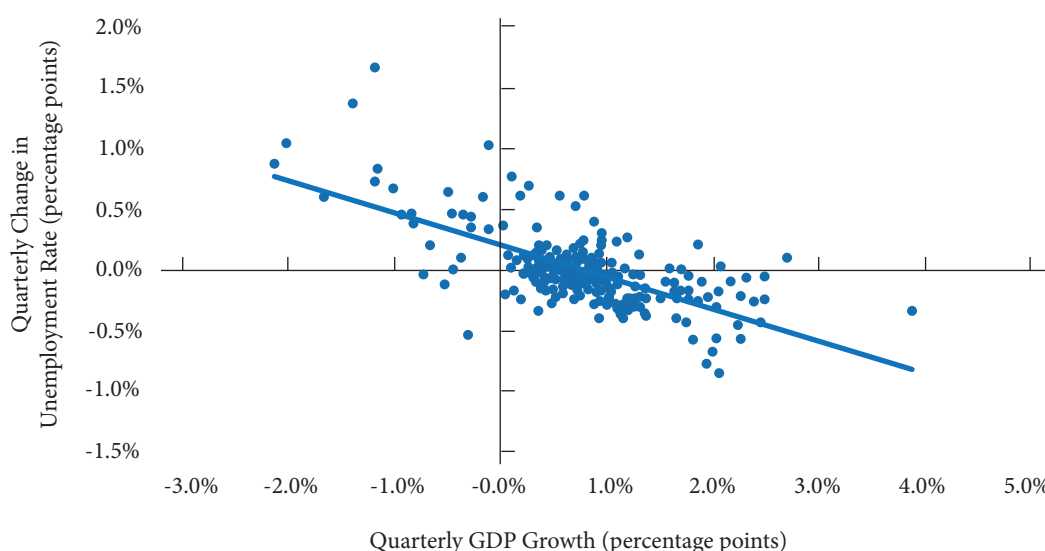


Figure 1.11 Okun's Law for the US 1960-2013

Source: Mishkin, Macroeconomics Policy and Practice, 2nd Edition, 2015, Pearson

## Relationship Between GDP Growth and Unemployment Rate

When the unemployment rate goes up, this can lead to a drop in real GDP. Okun's law is the name given to a negative relationship between GDP and unemployment, which was originally discovered by economist Arthur Okun. Okun said that because the number of people working and the level of productivity are always increasing, real GDP growth close to its potential growth rate is usually needed just to keep the unemployment rate the same. In order to minimize the unemployment rate, the economy must grow faster than its potential. According to Okun's law, in order for the unemployment rate to fall by one percentage point in a single year, the actual GDP must rise around two percentage points faster than the potential GDP during the same year.

Figure 1.11 uses quarterly data for the United States to illustrate Okun's law. In this scatterplot, each point represents the data for one quarter. The horizontal axis shows the change in unemployment rate from the previous quarter, while the vertical axis shows the percentage change in GDP. By using the negatively sloped line, the scale of the Okun's law connection may be specified more precisely. The slope of the line is  $-1/2$ . Unemployment decreases by 0.5 percentage points for every percentage point increase in production (real GDP). In contrast, real GDP declines by two percentage points for every percentage point increase in unemployment.

## Relationship Between Inflation and Unemployment

Unemployment and inflation are two of the hardest and most politically sensitive economic problems that policymakers have to deal with. High unemployment and inflation rates provoke great public anxiety due to their immediate and apparent effects. Rising costs affect almost everyone, and few people can be certain that they will never lose their jobs.

The empirical relationship between inflation and unemployment is represented by the Phillips curve. The Phillips curve indicates that inflation tends to be high when unemployment is low and low when unemployment is high. The "trade-off" between inflation and unemployment is frequently mentioned in newspaper editorials and public debates on economic policy. The idea is that if the economy wants to lower inflation, it must accept high unemployment, or if it wants to lower unemployment, then it must accept more inflation. The economist A. W. Phillips initially proposed the idea of a trade-off between inflation and unemployment in a 1958 study. Phillips looked at 97 years of data from Britain about unemployment and the growth of nominal wages. He found that unemployment was low when nominal wages grew quickly and high when they grew slowly. Economists who expanded on Phillips's research focused their

attention on the relationship between unemployment and inflation, rather than the relationship between unemployment and wage growth. Many statistical studies conducted in the late 1950s and early 1960s evaluated inflation and unemployment statistics for a variety of nations and time periods, often discovering a negative relationship between the two variables. The Phillips curve describes this negative empirical link between unemployment and inflation.

Figure 1.12 plots the change in the inflation rate on the vertical axis against the unemployment rate on the horizontal axis. In this scatterplot, the negative relationship between inflation and unemployment rate can easily be seen. In general, lower unemployment causes inflation to rise whereas higher unemployment causes it to fall. However, this only holds true on average. Occasionally, rising unemployment is accompanied by a rise in inflation.

The line crosses the horizontal axis at the point where the unemployment rate is equal to the natural rate of unemployment. This is roughly equal to 6% for the US. When unemployment has been below 6 percent, inflation has usually gone up. This shows that the economy was overheating, or working at a higher level than it could. When unemployment exceeds 6%, inflation often falls, indicating that the economy is performing below its potential. However, the relationship is not strong enough to allow for accurate determination of the unemployment rate at which the economy overheats.

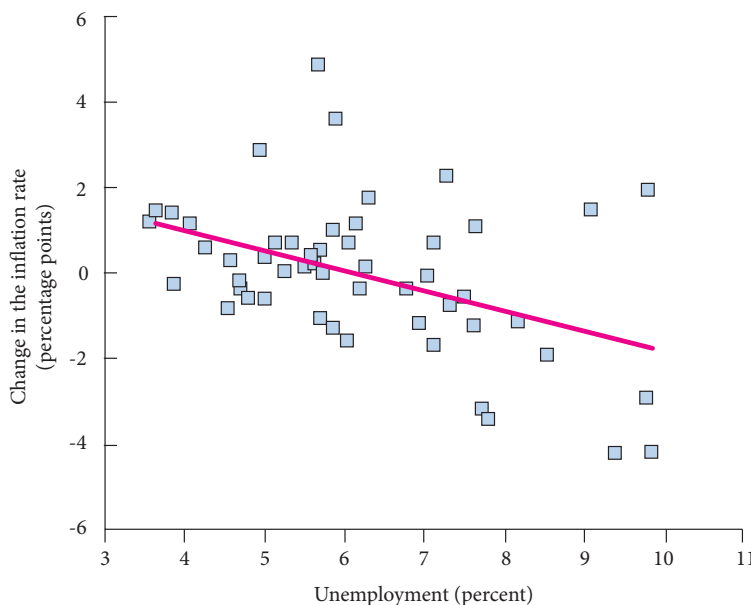


Figure 1.12 Phillips Curve for US 1960-2014

Source: Blanchard, Macroeconomics, 7th Edition, 2017, Pearson

## The History of the Modern Phillips Curve

The Phillips curve used by economists today varies from the relationship that Phillips explored in three ways.

First, wage inflation is replaced with price inflation in the current Phillips curve. This distinction is not significant because price and wage inflation are closely related. In periods of rapid wage growth, prices also increase rapidly.

Second, the modern Phillips curve includes expected inflation. This enhancement is the result of the efforts of Milton Friedman and Edmund Phelps. In the 1960s, when these economists made the first versions of the imperfect-information model, they emphasized how important expectations were for aggregate supply.

Third, the modern Phillips curve includes supply shocks. OPEC generated significant rises in the international price of oil in the 1970s, which made economists more conscious of the relevance of shocks to aggregate supply.

## LO1

Explain the primary causes of the evolution of macroeconomics

Modern macroeconomics began in 1936 with the publication of *General Theory of Employment, Interest, and Money* by John Maynard Keynes. According to Keynesian theory, unemployment might continue because wages and prices adjust slowly. In general, Keynesians, unlike classical economists, are suspicious of the invisible hand and hence more ready to advocate for the involvement of government in improving macroeconomic performance. According to Keynes, active fiscal policy was required to return the economy to full employment. The IS-LM model established by John Hicks and Alvin was the most influential formalizations of Keynes's concepts. During the 1960s, the main debate was between Keynesians and monetarists. Monetarists support that monetary policy was powerful and movements in money explain most of the fluctuations in output. In the 1970s, there was a crisis in macroeconomics. There were two causes behind this: One was the emergence of stagflation and the other was a theoretical attack led by Robert Lucas. Integrating rational expectations into macroeconomics dominated the 1970s and 1980s. From the late 1980s up to the 2009 crisis, three groups dominated the research headlines of macroeconomics: the new classicals, the new Keynesians, and the new growth theorists.

## LO2

Understand the importance of Measurement and Explain the Structure of the National Economy

For a serious understanding of the economy, it is very important to measure the economy carefully. National income accounts are a frequently used framework for monitoring economic activity. Also, the national income accounts are set up in a way that makes sense and matches the structure of the economy. The final and most important measure of macroeconomics is total production, or, technically, Gross Domestic Product (GDP). Because GDP determines income and income determines consumption. Gross domestic product (GDP) is a measure of all currently produced final goods and services evaluated at market prices. GDP includes only currently produced goods and services. Only final goods and services are included in GDP. GDP is the worth of goods and services as measured by market prices. Since GDP is a measure of the value of production in terms of market prices, it is vulnerable to fluctuations in the average price level.

## LO3

Explain how the national income is measured by using production, income and expenditure approaches

Economic activity as a whole may be quantified in three distinct but equal ways: The quantity of output generated (the production approach), the earnings obtained by output producers (the income approach), the sum of spending made by output's final consumers (the expenditure approach). Production, income, and expenditure approaches all give the same answer. The production approach computes economic activity by summing the value added by all producers. The income approach consists of the sum of the incomes of households, firms and government, which are defined as economic actors. The expenditure approach measures GDP as total spending on final goods and services produced within a nation during a specified period of time. If the buyers of these goods are households (=consumers), it is called consumption expenditure (C); if the buyers are firms, it is called investment expenditure (I); if the buyers are governments, it is called Government expenditure (G) and if the buyers are foreign countries, it is called net exports (NX).  $Y = C + I + G + NX$ . This is called the income–expenditure identity because it states that income, Y, equals total expenditure. Gross national product (GNP) is the market value of new final goods and services generated by domestic factors of production. Nominal GDP is a measure of currently produced goods and services valued at current market prices. Real GDP is the total value of final goods and services calculated by using market prices from a base year. When evaluating the success of the economy from one year to the next, economists focus on the rate of increase of real GDP, also known as GDP growth. GDP per capita is the gross domestic product divided by midyear population.

## LO 4

Explain the Fundamental Concepts of Macroeconomics like Unemployment and Inflation and explain why they are important for all of us

Unemployment and inflation are the two factors that provide information about an economy's state of health. Unemployment is the number of people who do not have a job but are looking for one. Unemployment rate is the ratio of unemployed persons to the labor force. Only individuals searching for jobs are considered as unemployed and those who don't have a job and aren't seeking for one are considered not in the labor force. When the economy as a whole goes through a recession, which is a time when GDP goes down, the unemployment rate tends to go up. The unemployment rate that exists when output and employment are at full employment level is called the natural rate of unemployment. Inflation refers to a sustained increase in the general price level. Deflation is a sustained decline in the general price level. Deflation is distinct from disinflation, a slow-down in the inflation rate. During the disinflation period, inflation declines to a lower rate but is still positive. Inflation can be measured by using the GDP deflator, the consumer price index (CPI) or the Producer price index (PPI). Inflation is a very serious problem and it has many negative effects. Loss of value, increases in inequality, exchange rate fluctuations, increase in cost of borrowing, increase in cost of living, taxation problems and relative price distortions are some of them.

## LO 5

Explain the relationships that exist among key macroeconomic variables and among the different sectors of the economy

The discrepancy between actual and potential GDP is referred to by economists as the GDP gap. If actual GDP is smaller than potential GDP, the GDP gap is negative. If actual GDP is greater than potential GDP, the GDP gap is positive. There is a close correlation between the unemployment rate and the GDP gap. The higher the unemployment rate, the larger the GDP gap. Increases in the unemployment rate can be associated with decreases in real GDP. This negative relationship between unemployment and GDP is called Okun's law. Okun's law says that for every percentage point rise in output (real GDP), unemployment falls by one-half of a percentage point. Alternatively, for every percentage point rise in unemployment, real GDP falls by two percentage points. The empirical relationship between inflation and unemployment is represented by the Phillips curve. According to the Phillips curve, inflation tends to be low when unemployment is high and high when unemployment is low. The Phillips curve used by economists today varies from the relationship Phillips explored in three ways. First, wage inflation is replaced with price inflation in the current Phillips curve. Second, the modern Phillips curve includes expected inflation. Third, the modern Phillips curve includes supply shocks.

1 According to Keynes, what was the reason for permanent unemployment in the economy?

- A. Government intervention
- B. Slow adjustment of wages and prices
- C. Fiscal policy
- D. Increases in the money supply
- E. Transfer payments

2 According to Keynes, what was the best way to deal with high unemployment?

- A. Increasing money supply
- B. Forcing the private sector to hire more people
- C. Increasing the government expenditures
- D. Decreasing the budget deficit
- E. Searching for external debt

3 GDP Is the value of----- produced in the economy during a given period.

Which of the following completes the sentence above?

- A. The final goods and services
- B. The intermediate goods
- C. The services
- D. The agricultural products
- E. The industrial products

4 Which of the following about GDP is **not correct**?

- A. GDP includes only currently produced goods and services
- B. Intermediate goods are not included in GDP
- C. The trade of previously manufactured houses is excluded from GDP
- D. Stock and bond exchanges are not included in GDP
- E. Homemaker services and garden productions are included in GDP

5 What is the total value of all the payments to the production factors, in all kinds of economic activities, by all producing units in the country?

- A. GDP by expenditure approach
- B. GDP by production approach
- C. Real GDP
- D. GDP by income approach
- E. GDP per capita

6 While calculating the GDP with the expenditure approach which of the following is **not included**?

- A. Consumption
- B. Investment
- C. Saving
- D. Government Expenditure
- E. Net Export

7 Suppose you have the following information about Türkiye for a certain month: 30 million people are working, 10 million are not working but are looking for work, and 15 million are not working and have given up looking for a job. What is the unemployment rate for that month?

- A. 10%
- B. 15%
- C. 20%
- D. 25%
- E. 40%

8 What is obtained by dividing nominal GDP by real GDP in the same year and multiplying the resultant ratio by 100?

- A. GDP deflator
- B. GDP per capita
- C. Inflation rate
- D. GNP
- E. GDP gap

9 Okun's law shows the relationship between-----.

Which of the following completes the sentence above?

- A. Inflation rate and unemployment rate
- B. GDP growth and unemployment rate
- C. Actual GDP and potential GDP
- D. Inflation rate and money supply
- E. Exchange rate and unemployment rate

10 Which of the following about the Phillips curve is **not correct**?

- A. It is the empirical relationship between inflation and unemployment
- B. It was first introduced in a 1958 paper by the economist A. W. Phillips
- C. The original Phillips curve was the relationship between unemployment and nominal wage growth
- D. The modern Phillips curve includes expected inflation
- E. There is a positive relationship between unemployment and inflation

1. B

If your answer is wrong, please review the “A Brief History of Macroeconomics and Macroeconomic Thought” section.

6. C

If your answer is wrong, please review the “The Measurement of Production, Income and Expenditure” section.

2. C

If your answer is wrong, please review the “A Brief History of Macroeconomics and Macroeconomic Thought” section.

7. D

If your answer is wrong, please review the “Fundamental Concepts of Macroeconomics” section.

3. A

If your answer is wrong, please review the “The Measurement and Structure of the National Economy” section.

8. A

If your answer is wrong, please review the “Fundamental Concepts of Macroeconomics” section.

4. E

If your answer is wrong, please review the “The Measurement and Structure of the National Economy” section.

9. B

If your answer is wrong, please review the “Relationships Between Macroeconomic Variables” section.

5. D

If your answer is wrong, please review the “The Measurement of Production, Income and Expenditure” section.

10. E

If your answer is wrong, please review the “Relationships Between Macroeconomic Variables” section.

Determine whether each economic action given below is included in the calculation of GDP.

1. Toyota will increase its inventory of (unsold) cars if it manufactures a car in 2022 but doesn't sell it in 2022.
2. Government's old-age payments to the elderly.
3. Leaving ₪1000 to your spouse who looks after the children at home.
4. The government gives salaries to civil servants.
5. Your purchase of a new phone.
6. Your purchase of a second hand phone.

your turn 1

1. YES. GDP is a measure of production, not a measure of sales to consumers. So, something that is produced is counted in GDP even if it is not sold to a customer. Production that goes into inventories counts as part of GDP.
2. NO. The old-age payment is a transfer payment. Transfer payments are not part of the GDP calculations because they mean nothing more than a redistribution of the income generated.
3. NO. All unregistered housework done by housewives is not included in GDP.
4. YES. Registered salary payments are included in GDP.
5. YES. Recorded consumption expenditures are included in GDP.
6. NO. Second hand sales are not included in the GDP calculations.



Explain if it is possible for nominal GDP to increase and real GDP to decrease in the same period.

your turn 2

Nominal GDP can rise because either the price level is rising or the real quantity of goods and services produced has increased. Nominal GDP can increase while real GDP falls if the increase in the aggregate price level is larger than the drop in real economic activity.

If the total value of real output in 2021 is ₺150.000 and the total value of real output in 2020 is ₺120.000, what is the growth rate of real GDP?

your turn 3

$$\text{Real GDP growth in 2021} = \frac{(\text{Real GDP in 2021}) - (\text{Real GDP in 2020})}{\text{Real GDP in 2020}}$$

$$\text{Real GDP growth in 2021} = \frac{150.000 - 120.000}{120.000} \times 100 = \%25$$

Change the base year to 2020, calculate real GDP with 2020 prices and find the growth rate of real GDP from 2020 to 2021 and from 2021 to 2022. Compare the results with the 2021 base year case.

your turn 4

| Year | Quantity of Automobiles | Price of Automobiles | Nominal GDP | Real GDP (with 2020 prices) |
|------|-------------------------|----------------------|-------------|-----------------------------|
| 2020 | 100                     | ₺200.000 TL          | ₺20.000.000 | ₺20.000.000                 |
| 2021 | 140                     | ₺240.000 TL          | ₺33.600.000 | ₺28.000.000                 |
| 2022 | 170                     | ₺300.000 TL          | ₺51.000.000 | ₺34.000.000                 |

Real GDP growth from 2020 to 2021 is: %40

Real GDP growth from 2021 to 2022 is: %21

These results are the same as the 2021 base year case. So even if you change the base year, the rate of change from year to year would be the same.

In the first quarter of 2022, the working age population of Türkiye was 64.332.000 and the labor force was 33.809.000 people. Calculate the labor force participation rate for this quarter.

your turn 5

$$\text{Labor Force participation rate} = \frac{\text{Labor Force}}{\text{Working Age Population}} = \frac{33.809.000}{64.332.000} = 52,55\%$$

Suppose that the GDP deflator in 2021 is 206 and the GDP deflator in year 2022 is 336 and calculate the inflation rate of 2022.

your turn 6

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100 \quad \pi_t = \frac{336 - 206}{206} \times 100 \quad \pi_t = \%63.1$$

## References

- Abel, A. B., Bernanke, B. S. & Croushore, D. (2014). *Macroeconomics* (8<sup>th</sup> ed.). Pearson.
- Acemoglu, D., Laibson, D. & List J. A. (2016). *Macroeconomics* (Global ed.). Pearson.
- Baumol, W. J., Blinder, A. S. & Solow, J. L. (2020). *Macroeconomics Principles and Policy* (14<sup>th</sup> ed.). Cengage.
- Blanchard, O. (2017). *Macroeconomics* (7<sup>th</sup> Ed.). Pearson.
- Dornbusch, R., Fischer, S. & Startz, R. (2011). *Macroeconomics* (11<sup>th</sup> ed.). McGraw-Hill Irwin.
- Froyen, R. T. (2013). *Macroeconomics Theories and Policies* (10<sup>th</sup> ed.). Pearson.
- Mankiw, N. G. (2019). *Macroeconomics* (10<sup>th</sup> ed.). Worth publishers Macmillan Learning.
- McConnell, C. R., Brue, S. L. & Flynn, S. M. (2018). *Macroeconomics: Principles Problems and Policies* (21<sup>st</sup> ed.). McGraw Hill Education.
- Mishkin, F. S. (2015). *Macroeconomics Policy and Practice* (2<sup>nd</sup> ed.). Pearson.
- Williamson, S. D. (2018). *Macroeconomics* (6<sup>th</sup> ed.). Pearson.

## Chapter 2 The Goods and Services Market

After completing this chapter you will be able to;

# Learning Outcomes

## 1 Define the components of aggregate demand

### 3 Understand the determination of output in the short run

5 Evaluate the determinants of the slope of IS curve

2 Explain the determinants of consumption, saving, and investment

#### 4 Derive the IS curve

6 Identify what causes the IS curve to shift

## Chapter Outline

- Introduction
- The Aggregate Demand and its Components
- The Determination of Equilibrium Output
- Derivation of the IS Curve
- Shifts in the IS Curve

## Key Terms

- Consumption
- Investment
- GDP
- Interest Rate
- Multiplier
- IS Curve



## INTRODUCTION

Gross Domestic Product is the most commonly used measure to assess the size of the economy, while GDP growth rate is considered to be the best indicator of economic growth. Figure 2.1 shows the evolution of Turkish GDP for the 1998-2020 period, as well as the economic growth rate. Although the level of real GDP has an increasing trend, the GDP growth rate shows volatility, where the negative effects of the economic crises of 2001 and 2008, and of Covid-19 pandemic can be observed.

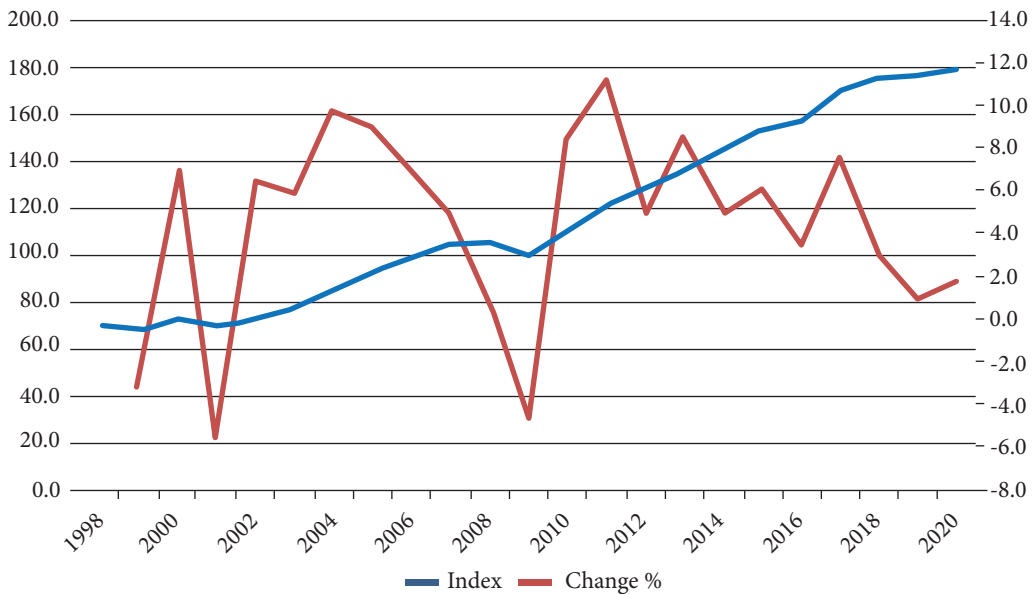


Figure 2.1 Gross Domestic Product Expenditure Approach (Chain Linked Index and Percentage Change)

Source: TurkStat.

In addition to the overall performance of the economy, the allocation of total output to alternative uses is important for policy making purposes. The following components make up the GDP by expenditure approach: Consumption (C), Investment (I), Government purchases (G), and Net Exports (NX). The consumption expenditures cover all expenditures made by the households for goods and services. They are generally the major components of the total expenditure and are considered as the primary engine for economic activity.

Investment expenditures consist of nonresidential and residential investment. Nonresidential investment contains the purchases of new equipment, plants, and machines, tools, and buildings by businesses and the government. Since it takes a long time to plan and make such types of investments as building a factory, a plant, or an infrastructure investment, they are less likely to be affected by business cycles. Residential investments are purchases of new buildings and houses by individuals and they are very sensitive to any changes in interest rates and thus are procyclical.

Government spending represents purchases of final goods and services by the government, but excludes government transfer payments, social security payments, and interest payments on the government debt.

Finally, net exports are the difference between export revenue and import spending. Foreigners' spending on Turkish goods and services is called exports. Turkish spending on goods and services produced abroad is called imports. If a country's export revenue is greater than its import spending, then this country has a trade surplus or positive trade balance. Alternatively, if a country spends more on imports compared to its export revenues, then this country has a trade deficit or negative trade balance.

The decomposition of Turkish GDP in Table 2.1 shows that consumption is the most important component of GDP accounting for more than half of the GDP in 2020, while gross investment comprises 27.38 percent of GDP. Government spending comprises 15.18 percent of GDP. As the import spending is greater than the export revenue, there is a trade deficit in 2020, accounting 3.81 percent of GDP.

Table 2.1 The Composition of Turkish GDP, 2020.

|                               | Value       |                |
|-------------------------------|-------------|----------------|
|                               | (Billion ₺) | Percent of GDP |
| <b>Consumption( C )</b>       | 2863.97     | 56.75          |
| <b>Government Consumption</b> | 765.98      | 15.18          |
| <b>Gross Investment</b>       | 1382.09     | 27.38          |
| <b>Change in Stocks</b>       | 227.17      | 4.50           |
| <b>Net Exports</b>            | -192.33     | -3.81          |
| <b>Exports</b>                | (1446.68)   | (28.66)        |
| <b>Less Imports</b>           | (-1639.01)  | (32.48)        |
| <b>Gross Domestic Product</b> | 5046.88     | 100.00         |

Source: TurkStat, Annual Gross Domestic Product, 2020.

## THE AGGREGATE DEMAND AND ITS COMPONENTS

As pointed out in Chapter 1, there are three ways to measure the level of economic activity which are output, income, and expenditure approaches, respectively. This chapter discusses the factors that determine the level of national income. The simple Keynesian Income Determination model is introduced to understand the effects of changes in consumption, investment, government spending, and net exports on economic activity. The basic assumptions of the model can be summarized as follows: The Keynesian model is only concerned with the short-run where prices are constant implying that the level of total production in the country is infinitely flexible. There is only one commodity in the economy, which is used for private consumption, investment, and government consumption. In equilibrium, supply equals demand so that firms are willing to supply any amount of the good at a given price. There is no interaction with the rest of the world indicating that the economy is closed. This model emphasizes the role of aggregate demand in income determination. Given that firms supply any amount of the goods at a given price, the equilibrium level of real GDP depends on how much demand exists across the economy.

Accordingly, the total demand for goods can be expressed as an identity, where total demand is the sum of consumption, investment, and government spending.

$$Z \equiv C + I + G$$

### Consumption Function

Consumption expenditures make up the largest part of total expenditure in the economy. Hence, consumer spending is regarded as a key driver of short-run economic growth. Yet consumption expenditures are less volatile compared to GDP in the short-run. Generally, the growth rates of consumption expenditures are close to GDP growth in the long run. During recessions, consumer expenditures generally decrease, as more people are unemployed, thereby leading to a decrease in disposable income. In expansion periods of the business cycles, consumption expenditures increase following an increase in disposable income. Figure 2.2 shows the shares of household expenditures on consumption categories in Türkiye in 2020. Slightly more than half of the families' spending is allocated to basic needs: housing, food, and transportation. In 2020, food expenditures accounted for the largest share of household pretax income, about 24 percent.

The second-largest expenditure items are housing and transportation, each having a 15 percent share in total household consumption. However, only 4 percent of total spending is allocated to the two most important categories of spending for human capital accumulation, education, and health.

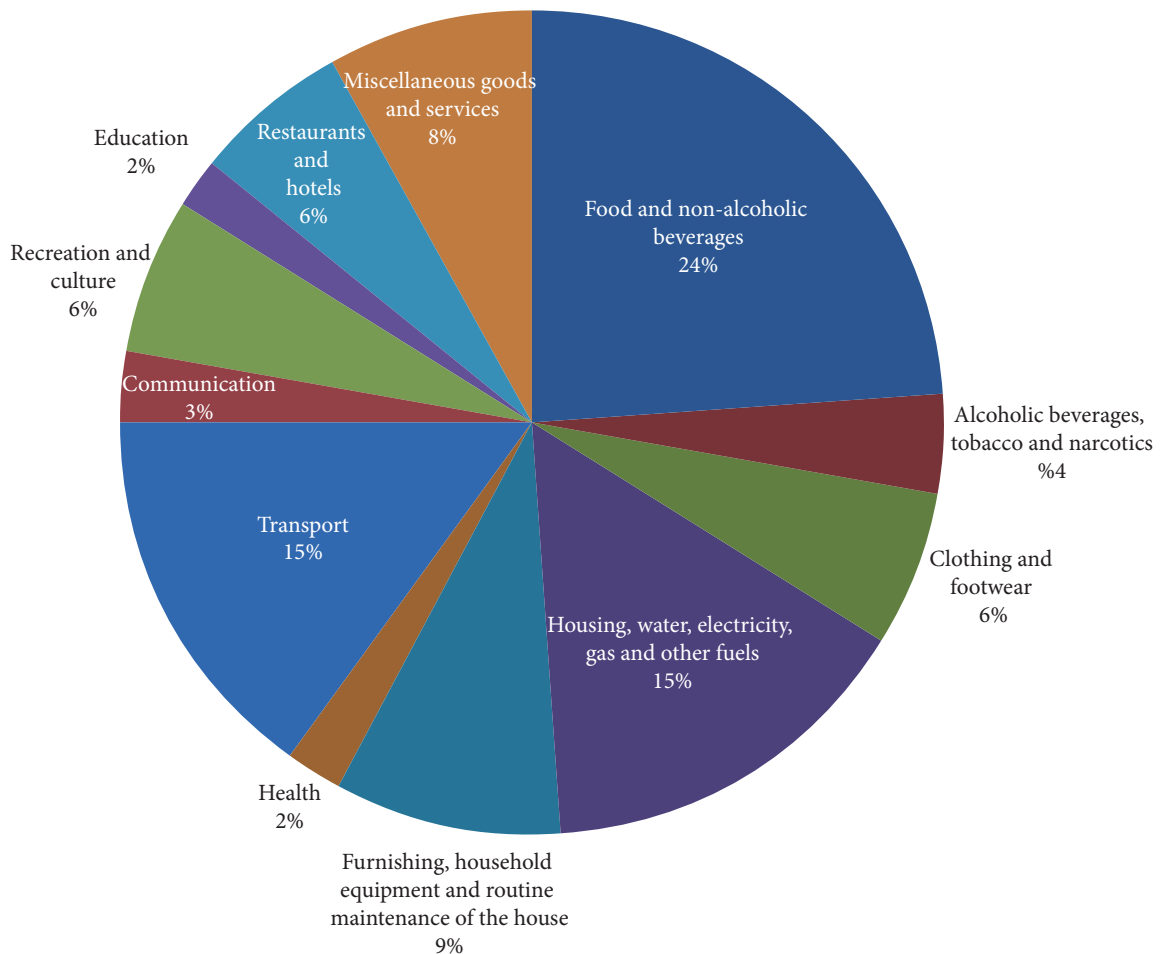
Many factors affect consumption such as disposable income, interest rates, wealth, and the price level. Since Keynes was concerned with short-run consumption function, his model assumes that price level, interest rate, and the stock of wealth are constant. The main determinant of consumption is regarded as the disposable income ( $Y_D$ ). The consumption function describes the relation between the current disposable income and the current consumption. The disposable income is the amount left after consumers receive transfers (TR) from the government and pay their taxes (T).

More precisely, the consumption function can be represented as

$$C = c_0 + c \cdot Y_D \quad (2.1)$$

Where  $Y_D$  denotes the disposable income

$$Y_D = Y - \text{taxes} + \text{government transfers} \quad (2.2)$$



**Figure 2.2** Share of Resident and Non-Resident Households Final Consumption Expenditure by Expenditure Approach, 2020.

**Source:** TurkStat.



Equation (2.1) shows that the consumption is the sum of autonomous consumption and induced consumption. The level of consumption that does not respond to changes in income, but rather influenced by wealth and consumer sentiment, is called autonomous consumption ( $c_0$ ), which is always positive ( $c_0 > 0$ ). If, for example, the consumer receives no income in the current year, she/he still needs to spend, at least for her basic needs, by dissaving.

The second part of Equation (2.1) represents the induced consumption, which depends on disposable income. Keynes suggested that an increase in disposable income leads to an increase in consumption, but this increase in consumption is less than the increase in disposable income ( $0 < c < 1$ ).

$c$  denotes the marginal propensity to consume (mpc) in Equation (2.1). The ratio of changes in consumption to changes in income is known as the marginal propensity to consume (mpc). It can be expressed as

$$c = mpc = \frac{\Delta C}{\Delta Y_D} \quad (2.3)$$

where  $\Delta C$  denotes the change in real consumption and  $\Delta Y_D$  represents the change in real disposable income.

An increase in disposable income has a positive impact on consumption. Consequently mpc measures the increase in the amount of consumption due to an increase in the amount of income in the country. It is assumed that individuals allocate their disposable income between consumption and savings. Thus, any additional income can either be consumed or entirely saved which implies that  $0 < c < 1$ .

If all of the increased income is consumed, then the change in consumption will be equal to the change in income making and  $c=1$ . Or alternatively, if consumers allocate the increased income to savings, then  $c=0$ . In general, consumers divide the additional income between consumption and savings, then  $c$  varies between 0 and 1.

The average propensity to consume (apc) is the proportion of consumption to disposable income, which indicates how much money is spent on consumption.

$$apc = \frac{C}{Y_D} \quad (2.4)$$

Figure 2.3 depicts the consumption function given in Equation (2.1). Since Equation (2.1) is represented as a linear function, the consumption function in Figure 2.3 is a straight line. As shown in Figure 2.3, consumption function (C) starts from a point at  $c_0$  on the vertical axis, indicating the autonomous consumption level. The slope of the consumption function is the marginal propensity to consume ( $c$ ). The average propensity to consume at a point on the consumption function, on the other hand, can be determined by measuring the slope of the ray from the origin to that point. Although marginal propensity to consume is constant along the consumption function, the average propensity to consume tends to decrease as the level of income increases within the Keynesian cross model. This can be seen by the decreasing slope of the ray connecting the consumption point to the origin, as income increases. For example, the average propensity to consume (apc) is the slope of the ray OA for income level  $OY_1$ . Similarly, at income level  $OY_2$ , the average propensity to consume is the slope of the ray OB. Figure 2.3 shows that the slope of OA is greater than that of OB. Therefore, the average propensity to consume at income level  $OY_1$  is greater than that at income level  $OY_2$ . As the consumption function curve is a straight line, the slope ( $\Delta C/\Delta Y$ ) is constant. However average propensity to consume ( $C/Y$ ) declines as income increases.

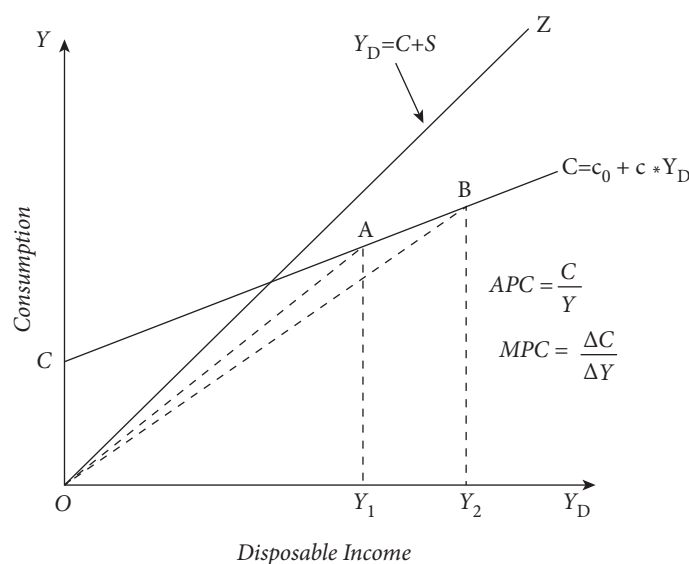


Figure 2.3 Consumption Function



## In Practice

### Gary Becker and Human Capital

Gary Becker (1940-2014) was a Professor of Economics and Sociology at the University of Chicago, who received the 1992 Nobel Memorial Prize in Economic Sciences. He formulated human capital theory, which regards an individual's skills and capacities as capital stock that can be enhanced by investment in education and training. Individuals' decisions such as having education, learning a new computing language, learning how to operate a machine require a decision making analysis where future returns are compared with the current effort required for acquiring the skill or education, similar to an investment decision. In this sense, investment in human capital is very similar to capital investment, as individuals compare the present discounted value of their earnings associated with their choices. For example, having a university education is a human capital investment decision. Individuals compare the cost of education, both direct costs and foregone earnings, with prospective earnings after graduation, taking into account the duration of time they are employed.

Human capital can be defined as the collection of knowledge, skills or characteristics that improve an individual's productivity, which in turn determine her level of earnings in the labor market. Hence depending on the level of human capital, people expect to earn different earnings in the labor market. Therefore, individuals with higher human capital are more likely to earn higher wages.

### Duality of Consumption and Household Saving

Since consumers can allocate their disposable income between consumption and savings,

$$Y_D = C + S \quad (2.5)$$

the part of income that is not consumed is defined as saving,

$$S = Y_D - C \quad (2.6)$$

which implies that saving is a function of disposable income. Thus, the consumption function implicitly establishes the saving-income relationship.

By substituting consumption function in Equation (2.6), we can derive the saving function that accord the saving and income relationship in the economy:

$$\begin{aligned} S &= Y_D - c_0 + c \times Y_D \\ S &= -c_0 + (1 - c) \times Y_D \end{aligned} \quad (2.7)$$

Where  $(-c_0)$  denotes the autonomous saving, the intercept of the saving function, it is the level of saving when disposable income is zero which is equal to the negative of autonomous consumption. The slope of the saving function is  $(1 - c)$ , which is the value of marginal propensity to save (mps).

$$0 < mps < 1 \quad (2.8)$$

The Equation (2.8) also implies that

$$\begin{aligned} Y_D &= C + S \\ \Delta Y_D &= \Delta C + \Delta S \end{aligned}$$

Divide both sides by  $\Delta Y_D$

$$1 = \frac{\Delta C}{\Delta Y_D} + \frac{\Delta S}{\Delta Y_D} \quad (2.9)$$

Indicating that the marginal propensity to consume and marginal propensity to save add up to one.

Average propensity to save (aps) is defined as the proportion of disposable income that is saved (i.e. not consumed), which can be represented as

$$aps = \frac{S}{Y_D}, \quad 0 < aps < 1 \quad (2.10)$$

Keynesian consumption function predicts that consumption increases more slowly than income over time, implying that the average propensity to save (aps) will increase as income rises.

$$Y_D = C + S$$

When both sides are divided by  $Y_D$  we get

$$\begin{aligned} 1 &= \frac{C}{Y_D} + \frac{S}{Y_D} \\ apc + aps &= 1 \end{aligned} \quad (2.11)$$

## Investment Function

Figure 2.4 depicts the share of total, public and private investment out of GDP for Türkiye over the period of 2002-2019. Figure 2.4 shows that there has been an increase in the share of total investment out of GDP from 20% in 2002 to 26% in 2019. Similarly, the share of private investments in GDP increased from 15% in 2002 to 23% in 2019, while the share of public investments in GDP was around 4% in that period.

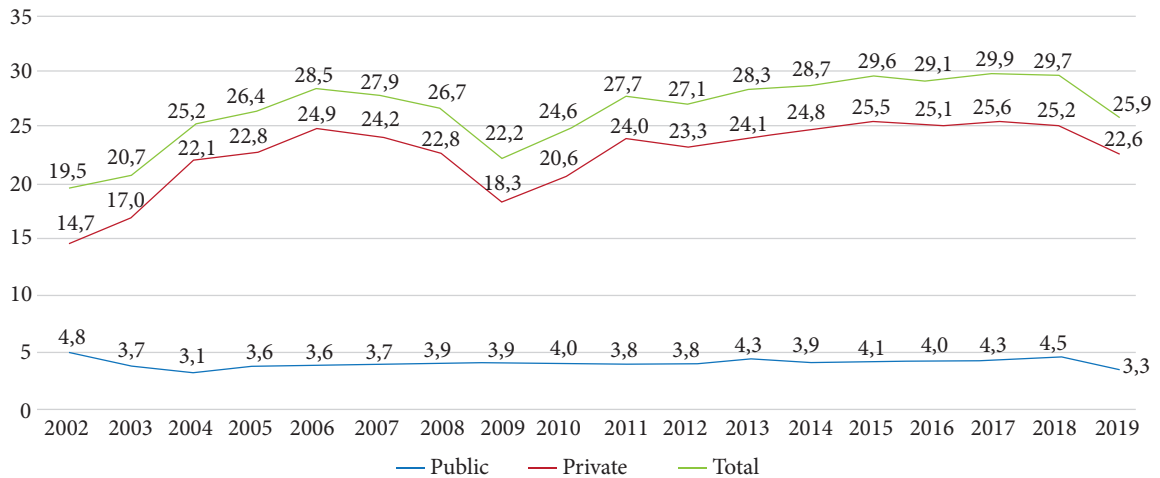


Figure 2.4 Share of Investment out of GDP (%).

Source: Turkish Republic Presidential Strategy and Budget Department

A country's long-run growth depends on its ability to invest and efficiently allocate its resources. Investment is a key factor for the provision of required capital for the production of goods and services, as it augments the physical stock of capital. Total investment has two components: planned and unplanned investment. Firms' planned investments are the amount of investment expenditure they plan to undertake during a specific time period, given the economic environment. They include additions to capital stock. However, there may be unforeseen economic developments that may prevent firms from realizing their planned investments. In such a case, unintended inventory changes make up the unplanned investment, which evolves in accordance with the unexpected changes in firms' sales. If firms' sales are greater than what is expected, unplanned inventory change will be negative, and vice versa. Changes in inventories play an important role in the determination of equilibrium national income. While planned inventory investments grow in line with the final sales and suggest that an economic expansion is in progress, unplanned investments are more volatile and they may be an indicator of a forthcoming recession. The difference between production and sales in a given year is called the inventory investment. It is not included in the investment. It influences the demand, yet it is not influenced by changes in demand. The inventory investment is determined by exogenous factors such as population growth, research, innovations, inventions, war, climate change etc.

The major determinants of total investment in any country are the interest rate and income level. It is composed of autonomous and induced parts. Autonomous investment, similar to autonomous consumption, is vital for achieving stable production. It includes total expenditure made independent of economic conditions of the economy, such as infrastructure expenditures, education, health, and security spending. The main drivers of autonomous investment are growth and technical progress. Induced investment, on the other hand, depends on changes in income and interest rates, which may generate a profit. Hence, it is more likely to be volatile compared to the autonomous investment. The autonomous investment can be made by the government or the private enterprise. It includes any investment expenditure made for the improvement of economic and social infrastructure, such as energy, telecommunications, irrigation, the transport, environment, health, and education.

Equation (2.12) presents the investment function

$$I = I_0 + e \cdot Y_D \quad (2.12)$$

where  $I_0$  denotes the autonomous investment and  $e \cdot Y_D$  is the induced investment.

$$e = \text{marginal propensity to invest} = \frac{\Delta I}{\Delta Y_D}$$

is the marginal propensity to invest, which shows the change in investment in response to a change in income.

### Investment Demand

Various factors may affect firms' decisions to invest. If economic conditions are favorable and firms expect an increase in their future sales, their planned investment is more likely to increase. For this, firms may use their own funds, which is internal funding. If they do not have enough resources for financing new investments, they need to borrow them. They may either borrow from the banks or they may issue some financial assets, such as long-term bonds or short-term commercial paper. Each alternative involves a cost of borrowing. If the firm uses its own funds, the cost of borrowing is simply the interest earning foregone. If the firm borrows from a bank, then it has to pay interest for the loan.

Firms' investment expenditures can be regarded as the demand for capital goods that will be used for the production of goods and services in the future. Hence, expectations about the future stance of the economy play an important role in firms' decision-making process. A firm has to compare both costs associated with these investment projects as well as the future stream of revenues that can be obtained if the investment is realized. Since the current investment decision involves assessing the future stream of revenues, a firm needs to compare costs and revenues that occur in different time periods, by bringing all future costs and revenues to their value in the current period.

For this purpose, a firm can utilize the Present Discounted Value of future income from the investment concept. The present value of a future income depends on the rate of interest at which it is discounted. Suppose a firm expects to receive ₦1000 from a machine in a year's time and the rate of interest (denoted by  $i$ ) is 5 percent. The present discounted value of this machine is

$$PDV = \frac{R_1}{1+i} = \frac{1000}{1+0.05} = \text{₦}952$$

The present value of a future income is negatively related to the discount factor, which is the interest rate ( $i$ ). The higher a firm's present value of future revenues, the lower the interest rate is. For example, suppose that the interest rate falls to 3 percent, the present value of this machine is

$$PDV = \frac{R_1}{1+i} = \frac{1000}{1+0.03} = \text{₦}970$$

While calculating the Present Discounted Value of a project, a firm needs to know or predict the project lifetime ( $n$ ), that is the time period over which project activities are implemented. Firm then weighs the discounted value of the future stream of revenues against the cost,  $C$ , of the project using the following formula where there are only initial capital costs in the current period:

$$PDV_t = -C + R_t + \frac{R_{t+1}}{1+i} + \frac{R_{t+2}}{(1+i)^2} + \dots + \frac{R_{t+n}}{(1+i)^n} \quad (2.13)$$

Alternatively, there may be future costs associated with the project. In that case, PDV is expressed as follows:

$$PDV_t = -C + R_t + \frac{R_{t+1} - C_{t+1}}{1+i} + \frac{R_{t+2} - C_{t+2}}{(1+i)^2} + \dots + \frac{R_{t+n} - C_{t+n}}{(1+i)^n} \quad (2.14)$$

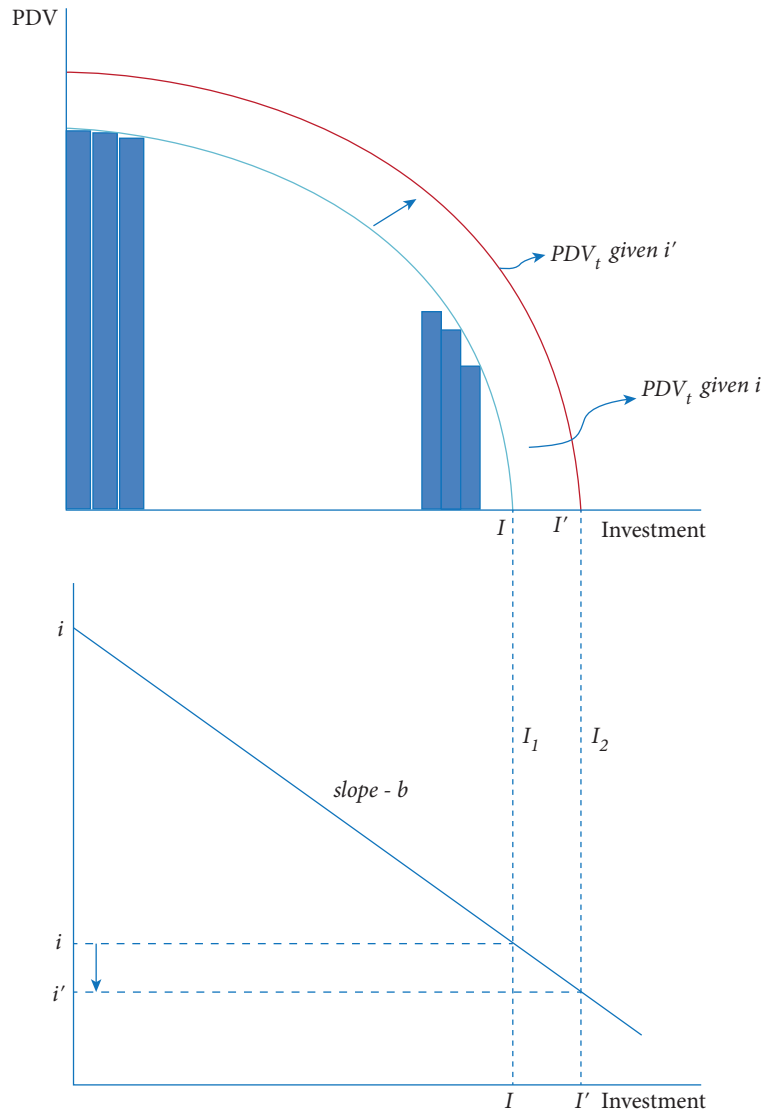


Figure 2.5 Investment Function.

Faced with alternative investment projects, a firm can rank these projects according to their PDV's, which is shown in Figure 2.5. Since the firm's objective is to maximize its overall net present discounted value, any project with a non-negative net present value, given the interest rate, will be realized, leading to an investment level of  $I$ . However, if the firm has limited funds, it will undertake the most productive projects and hence investment level will be to the left of  $I$ .

Assume that there is a fall in interest rates to  $i'$ . Then, the denominator of all entries in the PDV formula will be smaller, leading to a larger PDV. Hence, as the interest rate falls, all PDVs will increase, and the PDV curve in Figure 2.5 shift outwards, increasing the level of investment to  $I'$ . Therefore, if other variables are held constant, the investment demand function can be represented as a negative function of the interest rate:

$$I = I(i) \quad (2.15)$$

Assume a linear investment demand function

$$I = \bar{I} - b i, \quad b > 0 \quad (2.16)$$

$$i = \frac{1}{b} (\bar{I}_0 - I) \quad (2.17)$$

In the investment demand function,  $\bar{I}$  is the autonomous investment demand and  $-bi$  is the induced investment demand. The slope of the investment function (Figure 2.5) is  $\left(-\frac{1}{b}\right)$ . Here, the constant parameter  $b > 0$  measures the sensitivity of investment demand to changes in the interest rate: the higher the parameter  $b$ , the higher the decrease in investment demand for every unit increase in interest rate. In Figure 2.6, a fall in interest rate from  $i$  to  $i'$  leads to a larger increase in investment for a highly interest elastic (flat) investment demand function compared to a less interest elastic investment demand function. When there is a change in variables affecting investment demand other than the interest rate, such as a change in business confidence, or an improvement in profit rates, the investment demand function will shift depending on the direction of the effect. For example, if there is an increase in expected profits, the investment demand curve will shift to the right as there is an increase in investment.

#### Factors affecting planned investment:

- The demand for goods and services, both actual and anticipated
- Expected profits
- Business taxes
- Interest rate
- Credit market conditions
- Business confidence

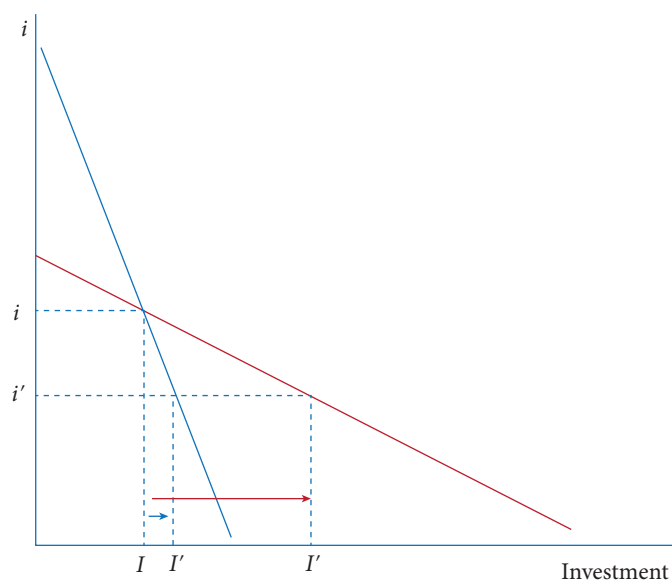


Figure 2.6 Interest Elastic vs Interest Inelastic Investment Functions.



## Marginal Efficiency of Capital

In his General Theory, Keynes states that “current investment will depend on what we shall call the inducement to invest; and the inducement to invest will be found to depend on the relation between the schedule of the marginal efficiency of capital and the complex of rates of interest on loans of various maturities and risks”. Keynes presents the marginal efficiency of capital as follows: “The rate of discount which makes the present value of the returns expected from the capital asset during its life just equal to its supply price”. The supply price should not be confused with its current price. But rather it is “the price which would just induce a manufacturer to produce additional units of such assets, i.e., what is sometimes called its replacement cost”. Thus the definition of marginal efficiency of capital depends on expected returns from an investment project.

More precisely, the marginal efficiency of capital or MEC is an indicator of the expected profitability of investment over its cost. The marginal efficiency of a given capital asset is the highest return that can be yielded from the additional unit of that capital asset.

The following equation  $S_p$  denotes the supply price of the new capital asset (or the cost of a capital good), and  $R$  represents the successive anticipated annual earnings during the lifetime of the investment,  $n$ .  $r$  is the rate of discount which makes the capital asset exactly equal to the present value of the expected yield from it.

$$S_p = R_t + \frac{R_{t+1}}{1+r} + \frac{R_{t+2}}{(1+r)^2} + \dots + \frac{R_{t+n}}{(1+r)^n} \quad (2.18)$$

While deciding whether an investment project is feasible, firms generally compare the present value of the capital asset with its cost. Similarly, a firm can compare MEC with the prevailing interest rate in the economy to assess the profitability of an investment. An investment decision is made as long as MEC is greater than the interest rate which can be regarded as the opportunity cost of capital expenditure. A firm will invest in new projects until the MEC and the rate of interest are equalized. Figure 2.7 presents the MEC curve of an economy, which has a negative slope indicating that the higher the MEC, the smaller the capital stock is. Alternatively, as the capital stock increases, the MEC falls, because of the law of diminishing returns in production. Any improvement in business confidence or technology will shift the MEC curve outwards.

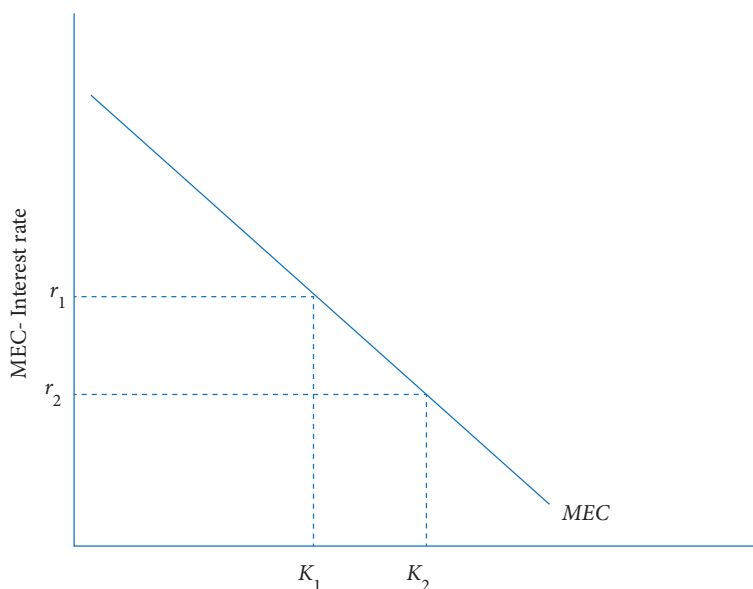


Figure 2.7 Marginal Efficiency of Capital

## Government Spending

Government spending (G) is the final component of the demand. Taxes (T) and government spending are the main tools of fiscal policy. Government spending is assumed to be exogenous, since the main components of government expenditure, such as education, health, and security, may need to be realized irrespective of the level of national income. Taxes are the main component of the government revenues, they can be direct or indirect. Figure 2.8 and Figure 2.9 show the composition of government revenues and government spending as a share of GDP for 2019 for Türkiye, respectively. Figure 2.8 indicates that the share of the total government revenues in GDP is 33.10, with taxes accounting 48 percent of the total government revenues. The share of government expenditures in GDP in 2019 is 36.14 percent. The major component of government expenditure is current spending, which is followed by the current transfer payments. The revenue and spending figures indicate that there is a budget deficit accounting for 3.04 percent of GDP.

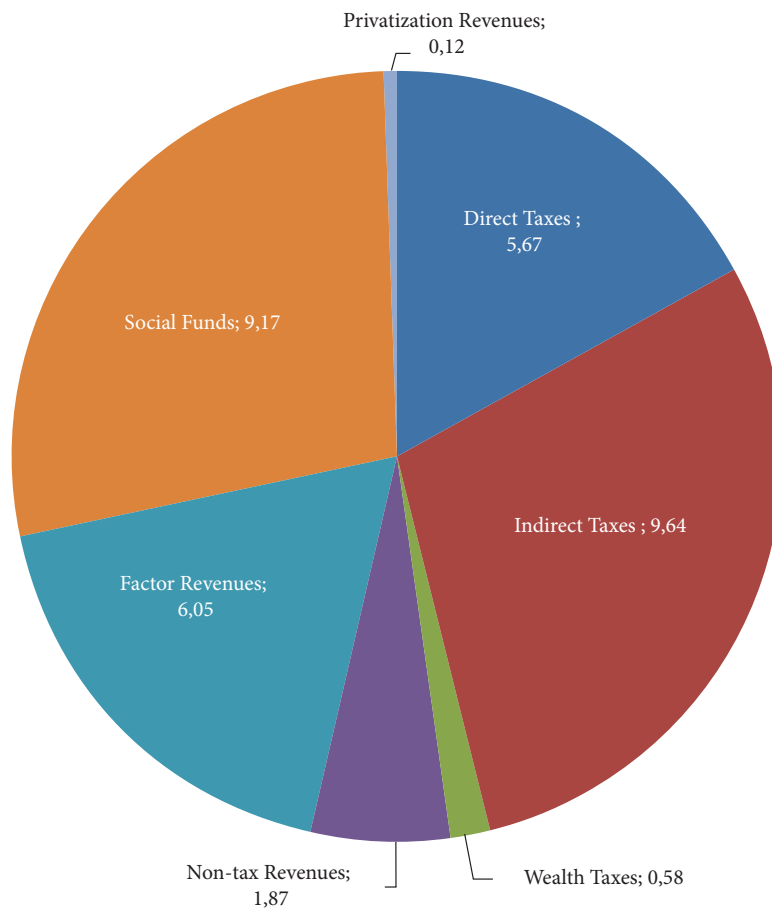


Figure 2. 8 Tax Revenues 2019 as a share of GNP

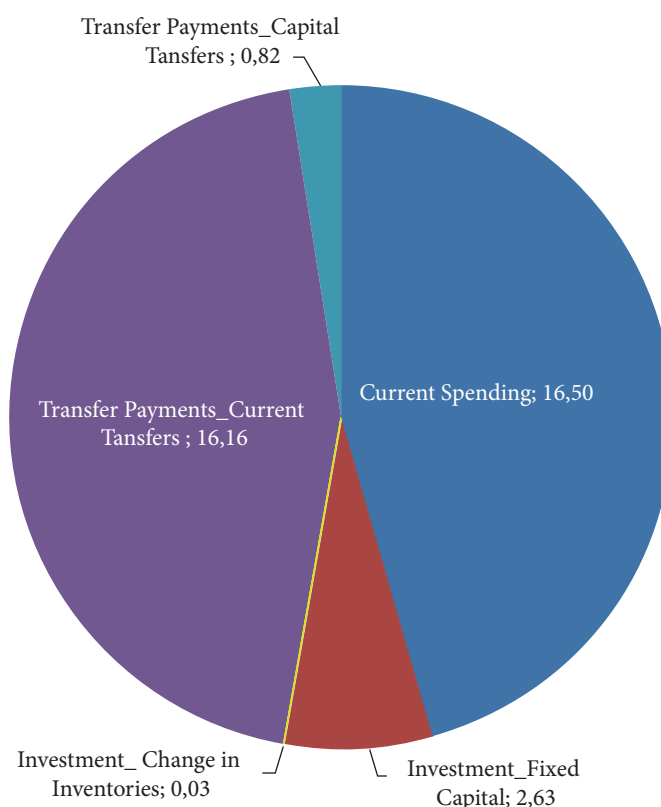


Figure 2. 9 Government Expenditures 2019, as a share of GNP

According to the Keynesian model of macroeconomics, aggregate demand is composed of consumption, investment, and government spending in a closed economy:

$$AD \equiv Z = C + I + G \quad (2.19)$$

which links the components of aggregate demand to the level of economic activity. In the short run, with a constant price level, the output level, the amount of goods and services actually being sold, is determined by the aggregate demand generated in the economy.

More specifically, consumption is a positive function of disposable income  $Y_D$  as follows

$$\begin{aligned} C &= c_0 + cY_D \\ &= c_0 + c(Y - T) \end{aligned} \quad (2.20)$$

where  $c_0$  is autonomous consumption,  $0 < c < 1$  is the marginal propensity to consume out of disposable income, and  $T$  is the net taxes. We can express net taxes as the difference between taxes collected by the government and transfers,  $TR$ :

$$T = tY - TR \quad (2.21)$$

where  $0 < t < 1$  is the marginal tax rate. After we replace the tax function, the consumption function becomes

$$C = c_0 + c(Y - tY + TR)$$

$$C = c_0 + cTR + c(1-t)Y \quad (2.22)$$

Then, the aggregate demand function becomes

$$Z = c_0 + c(Y - T) + I(i) + GZ = c_0 + cTR + c(1-t)Y + \bar{I} - bi + G$$

$$Z = \bar{A} - bi + c(1-t)Y \quad (2.23)$$

Where  $\bar{A} \equiv c_0 + cTR + \bar{I} + G$  represents the sum of all autonomous spending in the economy that does not depend on income.

Equation (2.23) shows that aggregate demand depends positively on the disposable income but negatively on the interest rate. The aggregate demand function is shown in Figure 2.10, where we measure AD on the y-axis and output on the x-axis. The slope of the aggregate demand curve is  $[c(1-t)]$ . Given the level of interest rate, whenever there is an increase in income ( $Y$ ), aggregate demand increases by  $[c(1-t)]$ . The intercept is given by  $(\bar{A} - bi)$  as at a given rate of interest  $i$ , the term ' $bi$ ' becomes a constant. Since both  $c$  and  $t$  are between 0 and 1,  $0 < [c(1-t)] < 1$ .

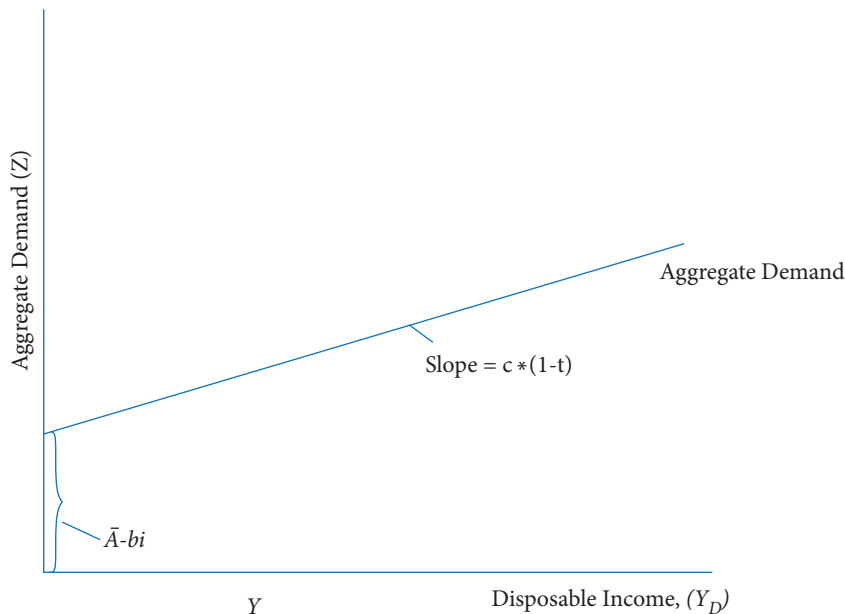


Figure 2.10 Aggregate Demand Function.

- An endogenous variable is one that the model explains.
- Exogenous variables are those that are influenced by factors outside of the model.



## your turn 1

Assume the following consumption function for a closed economy:

$$C = 20 + 0.75 Y_D$$

$$T = 40$$

$$G = 30$$

$$I = 30$$

- What is the marginal propensity to consume?
- What is the short-run equilibrium value of  $Y$  in the economy?
- What is the short-run equilibrium value of consumption in the economy?
- What is the short-run equilibrium value of inventory investment in the economy?
- Suppose investment increases by 10. How much would the short-run equilibrium value of GDP ( $Y$ ) change?

## THE DETERMINATION OF EQUILIBRIUM OUTPUT

Given that they maintain some planned inventory, firms manufacture the quantity of goods and services that they anticipate selling. In equilibrium, firms do sell what they plan to sell so that production equals demand with no unplanned inventory changes. When there is an unexpected increase in sales, firms may meet the increased demand by supplying from their inventories. Alternatively, when they cannot sell the expected amount of production, there is an accumulation in the inventories, as the unplanned changes in inventories are positive. Thus, the equilibrium condition requires that production or income (left-hand side of the equation) equals to aggregate demand (right side of the equation):

$$Y = Z \quad (2.24)$$

Substituting aggregate demand ( $Z$ ) in Equation (2.23) gives

$$Y = C + I + G \quad (2.25)$$

The equilibrium condition requires that

$$Y = Z$$

Recall that aggregate demand is given by Equation (2.23)

$$Z = \bar{A} - bi + c(1-t)Y$$

Solving for  $Y$ , gives,

$$Y^E = \frac{1}{1-c(1-t)} \times [c_0 + cTR + \bar{I} + G] - \frac{bi}{1-c(1-t)}$$

Recall

$$\bar{A} \equiv c_0 + cTR + \bar{I} + G$$

Then equilibrium output is

$$Y^E = \frac{\bar{A} - bi}{1 - c(1-t)} \quad (2.26)$$

Equation (2.26) characterizes the equilibrium output, where demand equals production. The goods market-clearing condition requires that for some interest rate  $i$ , and given the autonomous expenditures  $\bar{A}$ , production is equal to demand for goods at some equilibrium income level,  $Y^E$ .

Figure 2.11 depicts the determination of equilibrium income. In this figure the vertical axis shows aggregate expenditures as a measure of spending and the horizontal axis shows real GDP, as a measure of output. Any point along the 45-degree line corresponds to the same vertical and horizontal distances. Therefore the 45-degree line identifies all points where production equals demand, as required for equilibrium. The equilibrium is achieved at the intersection of the 45-degree line and the aggregate demand function, at point A. The slope of the aggregate expenditure function is the marginal propensity to spend, i.e.  $c(1-t)$ . The aggregate expenditure curve is steeper as the marginal propensity to consume gets higher.

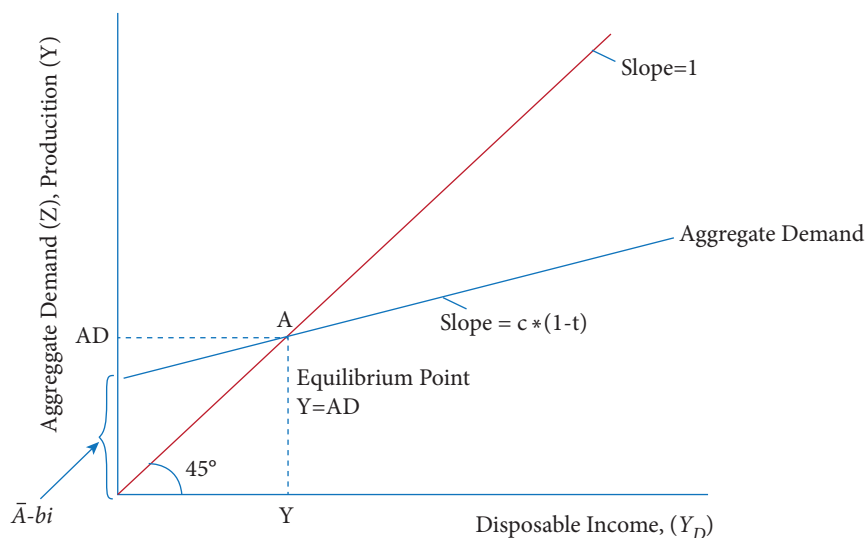


Figure 2.11 Determination of Equilibrium Income

In Figure 2.12, for income levels less than the equilibrium income  $Y^E$ , aggregate demand is greater than the level of production implying that firms' sales cannot keep up with new product orders. Therefore, inventories decline, forcing producers to increase production in order to meet the increased expenditures. There will be an increase in output until equilibrium is achieved at point A with output level  $Y^E$ . Similarly, for income levels above income  $Y^E$  aggregate demand is less than production, in which case firms realize that they are behind their planned sales. Hence, there will be an increase in inventories, which can be a signal for firms to decrease production until the inventory change is zero. The equilibrium is achieved at  $Y^E$ . Thus, inventories play an important role in achieving a stable equilibrium.

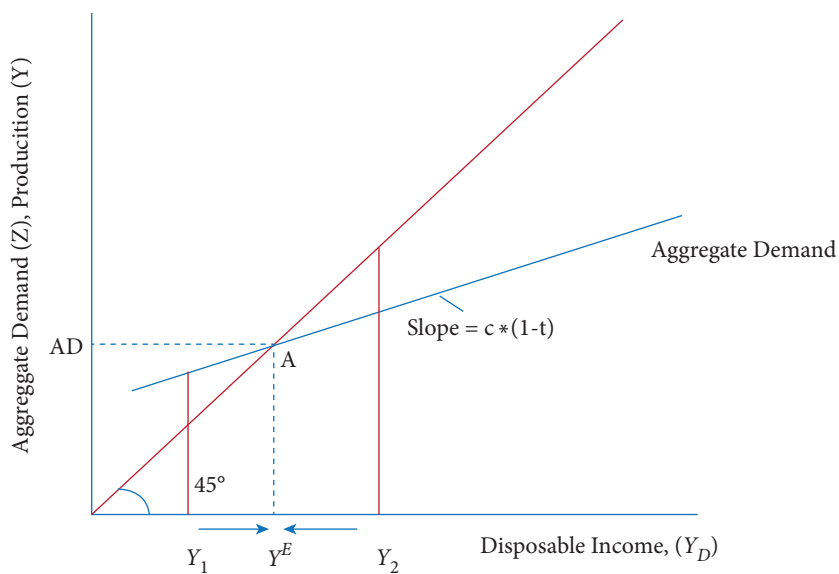


Figure 2.12 The Mechanics of Income Determination.

Aggregate Demand and GDP

| When                      | Inventories | Output                               |
|---------------------------|-------------|--------------------------------------|
| Aggregate demand < Output | Increase    | Falls                                |
| Aggregate demand = Output | No change   | No change - Goods market equilibrium |
| Aggregate demand > Output | Decrease    | Increases                            |

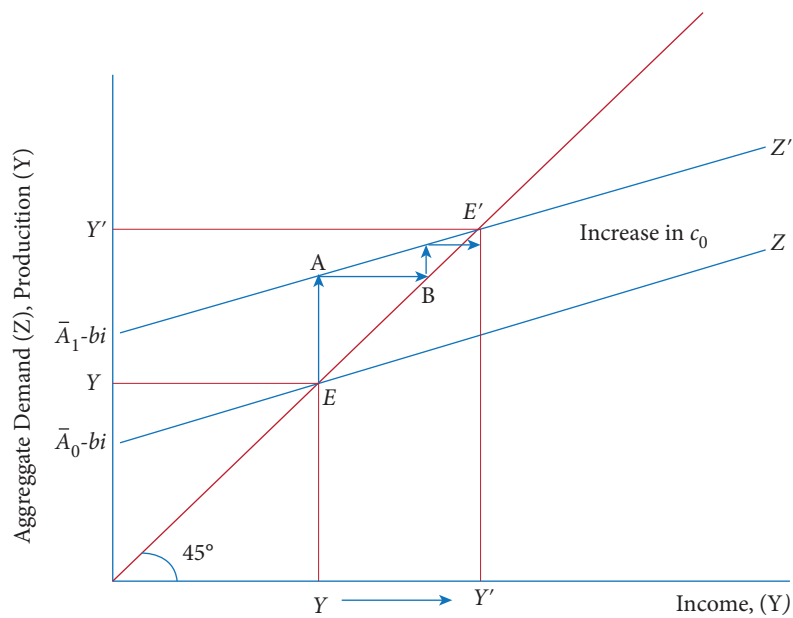


Figure 2.13 The Impact of an Increase in Autonomous Consumption.



In Equation (2.26),  $\frac{1}{1-c(1-t)}$  is the autonomous expenditure multiplier. When there is a change in autonomous components of aggregate demand, such as autonomous consumption ( $c_0$ ), autonomous investment ( $\bar{I}$ ), and government spending ( $G$ ), the corresponding change in output is determined by the magnitude of the multiplier

$$\frac{\Delta Y}{\Delta A} = \frac{1}{1-c(1-t)} \quad (2.27).$$

Since  $0 < c < 1$  and  $0 < t < 1$ ,  $\frac{1}{1-c(1-t)}$  is always greater than one. The steepness of the aggregate demand curve determines the magnitude of the multiplier. A flatter slope means a smaller multiplier. The multiplier's magnitude is determined by the marginal propensity to consume and tax rate, which determines how much of the change in income is allocated to consumption and taxes. The multiplier increases as the marginal propensity to consume increases. Because, an increase in individual spending will be someone else's income, stimulating the economic activity over the initial increase in autonomous spending. The process of income generation following an increase in any of the autonomous expenditure items is not endless. It slows down and ultimately comes to an end. However, an increase in tax rates results in a reduction in disposable income that would otherwise be allocated on currently produced products and services, as though there is a leakage from the income stream. Therefore, an increase in tax rate causes the multiplier to fall.

The effect of increased autonomous consumption on output is shown in Figure 2.13. The economy is at initial equilibrium at  $E$  with equilibrium level of income  $Y$ . Assume that the autonomous consumption increases from  $c$  to  $c'$ . The initial impact of an increase in autonomous consumption expenditure is reflected in the autonomous part of the aggregate demand function as follows:

$$\bar{A}_0 \equiv c + cTR + \bar{I} + G > \bar{A}_1 \equiv c' + cTR + \bar{I} + G > Y$$

shifting aggregate demand curve up from  $Z$  to  $Z'$ . At the initial level of equilibrium, there is now an excess demand for goods and services (point A). The increase in aggregate demand results in the depletion of inventories. The decrease in inventories prompts producers to expand production by  $\Delta c$  (point B). The increase in income further increases aggregate demand, resulting in, once again, a higher level of production (point C), until the equilibrium is restored at  $E_1$  with the new equilibrium output level of  $Y'$ . The increase in equilibrium production thus surpasses the initial increase in autonomous consumption due to the multiplier effect,  $Y' > \Delta c$ .



**Injections and Leakages:** Some transactions function as economic stimulants, generating additional income as a result of their spending. These are called injections, and they include autonomous consumption, autonomous investment and government spending. Some transactions, on the other hand, may withdraw money out of the economy, that is, the money is not being utilized elsewhere in the economy. These are leakages, such as taxes and savings.



**Multiplier Effect:** A change in aggregate demand leads to a much larger final impact on the level of equilibrium national income. For example if an increase of ₺1000 in government spending leads to a ₺4000 increase in real GDP, the multiplier is 4, suggesting that any increase in autonomous expenditures has a fourfold impact on real GDP.

## Saving – Investment Equality

The goods market equilibrium can also be expressed in terms of desired national saving and desired investment. National production consists of consumption, investment, and government spending in a closed economy as presented in Equation (2.28) for a closed economy.

$$Y_D = C + S \quad (2.28)$$

$$\text{As } Y_D = Y - T$$

$$Y = C + S + T$$

Then

$$S = Y - C - T$$

$$Y = C + I + G$$

Subtract taxes (T) from both sides and move consumption to the left side:

$$Y - C - T = I + G - T$$

The left side of this equation is simply private saving S, so

$$S = I + G - T$$

$$I = S + T - G \quad (2.29)$$

$$I = S_{\text{private}} + S_{\text{public}}$$

Equation (2.29) shows that, in a closed economy, private sector investment (I) equals the sum of private saving (S) and public saving ( $T - G$ ). The private saving ( $S = Y - T - C$ ) is the part of disposable income that is not consumed. A budget surplus ( $T - G$ ) is considered as public saving, since tax revenue is higher than government spending. Note that G and T are exogenous variables determined by the government while saving is a function of income. In Figure 2.14, the vertical line represents the saving function, as it is assumed to depend only on income but not on the interest rate, while investment is negatively related to interest rate and downward sloping. The interaction of saving and investment curves determines the equilibrium interest rates in the economy ( $i^e$ ), where individuals' desire to save balances firms' desire to invest.

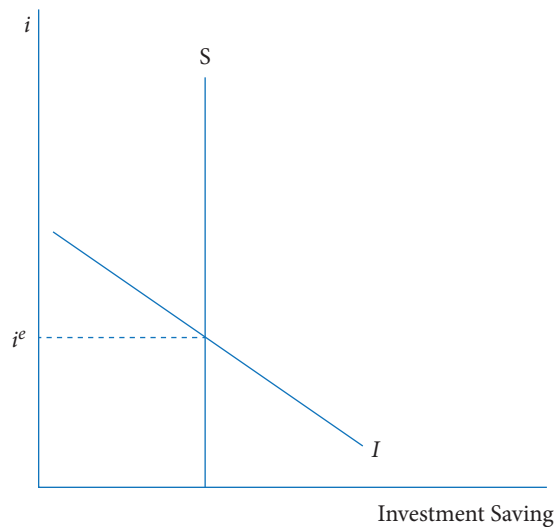


Figure 2.14 Saving Investment Equality.

Investment must equal total saving in order for the goods market to be in equilibrium, meaning that the amount that firms want to invest must match the amount that individuals and the government want to save. Therefore, it is called the IS relation.



If  $T > G$ , there is a budget surplus and positive public savings. If  $T < G$ , there is a budget deficit and negative public savings.

Saving is a flow, or a rate of saving per period of time, like a year. A stock of savings forms as a result of the flow of savings. Savings increase over time when saving takes place.

## Paradox of Thrift

There are Turkish proverbs such as “save up something for a rainy day”, “a penny saved is a penny earned”, and “waste not, want not” which emphasize the importance of qualities such as frugality and thriftiness. Moreover, there are research papers and newspaper articles arguing that the private saving rate of Turkish households is low compared to that of the Western countries’.

People save for various reasons, such as to have a vacation, or to buy a computer or a car. Economists generally believe that people save in order to buy durable goods in the future or to accumulate wealth for future consumption, for example, to have a financially secure retirement. Suppose that you are planning to buy a new mobile phone. You start to save ₺500 each month for this purpose. It means that you need to cut your expenditure by that amount so that you would not eat out or go to the cinema with your friends. If your friends and, more generally, the society follow the same pattern, then there would be a decrease in consumption. Through the multiplier effect, the decrease in consumption will incite a fall in income.

Another recent example is the increase in the number of adults living with their families because of the uncertainties due to the recent COVID-19 pandemic which can be regarded as an exogenous shock. According to a PEW Research Center report, the share of 18- to 29-year-olds living with their parents has become significant, reaching the highest value since the Great Depression. As of July 2020, 52% of young adults resided with one or both of their parents in the US (<https://www.pewresearch.org/fact-tank/2020/09/04/a-majority-of-young-adults-in-the-u-s-live-with-their-parents-for-the-first-time->

since-the-great-depression). Moving back to the family house may reduce accommodation, utility, and services expenditures, and may increase savings. The subsequent decrease in demand for rental houses, transportation, and other services, may hinder the economic activity, as predicted by Keynesian model presented in this chapter.

Recall from the previous subsection regarding the duality of consumption and saving, individuals allocate their disposable income to consumption and saving. If they save more, given that there is no change in disposable income and public savings, they need to reduce their consumption. The saving function in Equation (2.7) suggests that a decrease in consumption (that is  $-c_0$  is more negative), leads to an increase in saving.

$$S = -c_0 + (1 - c) Y_D \quad (2.7)$$

We have shown in Equation (2.7) that a decrease in consumption results in a reduction in equilibrium income. Hence, this reduction in the equilibrium level of income, in turn, curbs their saving, making the net effect seem ambiguous. However, Keynes' investment-saving equality identity can be of use here to make the net effect clearer.

$$S = I + G - T \quad (2.30)$$

We assumed that investment depends only on the interest rate and is independent of income. Then investment, government spending, and taxes can be considered as exogenously determined in this framework. Thus, the equilibrium condition implies that saving cannot change either. Even if individuals save more, the decrease in income is such that their savings are unchanged. Thus, the paradox of thrift (or paradox of saving) suggests that as individuals increase their saving, there is a reduction in equilibrium income so that saving is unchanged.

Especially during the times of recession, a rise in saving could restrain the economic recovery. Therefore, the Keynesian theory suggests increasing the spending in times of economic recessions, rather than increasing the saving. Yet, for the medium-run economic growth, individual saving is crucial as these savings are channeled into investment by extending credits to businesses and entrepreneurs to purchase capital, such as machinery and technology.

## DERIVATION OF THE IS CURVE

In the previous section Equation (2.26) suggests that whenever there is a change in interest rate, it affects the aggregate demand ( $Z$ ) through its impact on investment. An increase in the rate of interest rate results in a decrease in aggregate demand ( $Z$ ), while level of income is considered to be given. As pointed out earlier, autonomous expenditure ( $A$ ) is not affected by the increase in the rate of interest. Figure 2.15 depicts the effect of change in interest rate on aggregate demand curve ( $Z$ ). Assume that when the interest rate is  $i$ , the economy is initially at equilibrium at point  $E$ , with production equal to  $Y$ . An increase in the rate of interest rate to  $i$  leads to a fall in investment, which is translated to a decrease in  $(A - bi)$  as seen from Equation (2.26). When interest rate rises from  $i$  to  $i''$ , there is decrease in investment which is depicted as a fall in investment from  $I$  to  $I''$  in panel a of Figure 2.15. The fall in investment leads to a fall in aggregate demand, which is depicted by a downward shift of aggregate demand curve from  $Z(i)$  to  $Z(i'')$  in panel (b) of Figure 2.15, indicating that there is a fall in aggregate demand at the given level of output. At the initial equilibrium  $E$ , now, aggregate demand is less than the production, leading to an increase in inventories which may be a signal for producers to decrease production. Therefore, production decreases until equilibrium is restored at the new equilibrium point  $E''$  at the intersection of 45-degree line and the new aggregate demand curve ( $Z(i'')$ ). Accordingly, an increase in interest rate has a negative impact on equilibrium output, which leads to further reductions in consumption and investment through the

multiplier effect. Consequently, holding all else constant, the IS-curve shows these alternative combinations of interest rate and income level that clear the goods market. In this analysis, we must remember that all components of autonomous spending  $\bar{A}$  remain the same, and there are no changes in the parameters in the aggregate demand function, i.e.  $c$ ,  $t$ , and  $b$ , hence along a given IS-curve relationship, all autonomous spending components and the model parameters are the same, only interest rate and  $Y$  are changing.

That is, given some interest rate  $i$ , the goods market-clearing condition delivers the corresponding equilibrium income level. As such, as the interest rate changes, and hence as the aggregate demand changes through changes in investment demand, the equilibrium in the goods market would also change. We can then say that for every different interest rate, there is a different corresponding equilibrium income level that occurs in the goods market equilibrium. This relationship between interest rate and output can be represented directly as depicted in the lower panel of Figure 2.15, where the interest rate is on the vertical axis and output is on the horizontal axis. An increase in interest rate leads to a fall in investment (panel a), which further decreases income through the multiplier effect (panel b). Thus, the line depicting the interest rate and income combinations which keep the goods and services market in equilibrium is negatively sloped. The locus of all these alternative combinations of interest rate and equilibrium income level is the IS-curve (panel c).



attention

Interest rate is assumed to be exogenous, as it is determined outside the goods market. Income  $Y$  is determined in the goods market equilibrium.

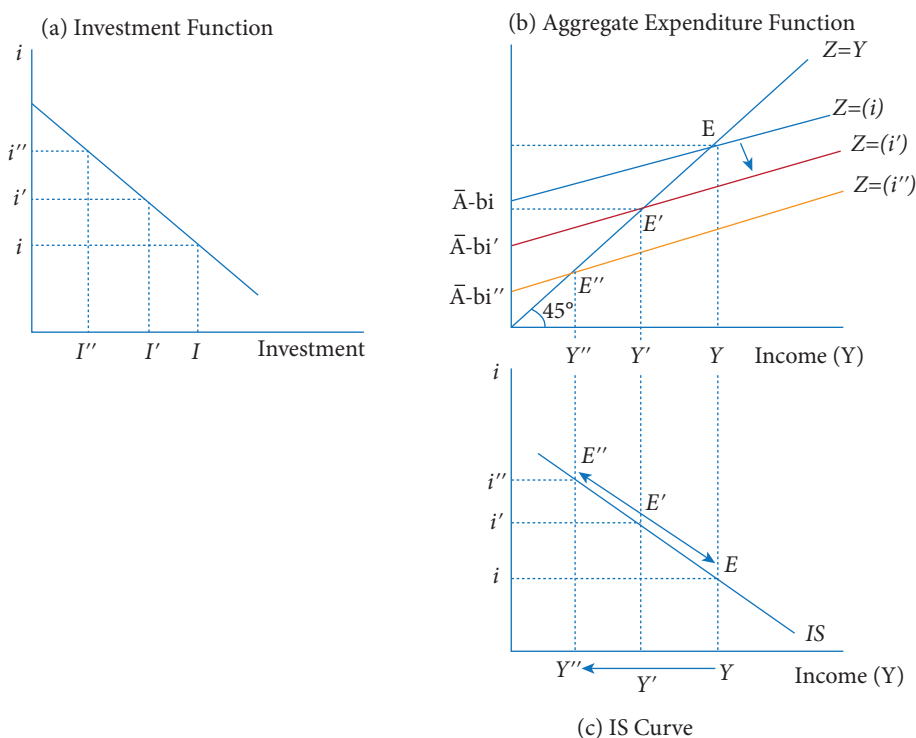


Figure 2.15 Derivation of the IS Curve

## Algebraic Expression of the IS Relationship

We can express the IS-curve relationship algebraically using the goods market-clearing condition:

$$Y = Z = \bar{A} - bi + c(1 - t)Y$$

$$Y = \bar{A} - bi + c(1 - t)Y$$

$$Y [1 - c(1 - t)] = \bar{A} - bi$$

$$\Rightarrow Y = \frac{\bar{A} - bi}{1 - c(1 - t)}$$

$$\text{Let } \frac{1}{1 - c(1 - t)}, \text{ then}$$

$$Y = \alpha (\bar{A} - bi) \quad (2.31)$$

Here, the parameter  $\alpha$  can be thought of as the simple autonomous spending multiplier, as the changes in the autonomous spending  $\bar{A}$  lead to changes in the equilibrium income level in the goods market by a multiple of  $\alpha$ , holding all else constant:

$$\frac{\Delta Y}{\Delta \bar{A}} = \alpha$$

We can write the IS function as

$$i = \frac{1}{b} \left( \bar{A} - \frac{Y}{\alpha} \right) \quad (2.32)$$

The position of the IS curve is determined by the autonomous factors (A). The slope of the IS curve is defined as the rate of change in income due to a change in interest rate. The negative slope of the IS-function is given by,

$$\frac{\Delta i}{\Delta Y} = -\frac{1}{b\alpha} < 0 \quad (2.32)$$

$$\frac{\Delta i}{\Delta Y} = \frac{1 - c(1 - t)}{b} < 0 \quad (2.33)$$

Where  $c(1-t)$  is the marginal propensity to consume out of disposable income, and  $b$  is the interest elasticity of investment. The slope being negative supports the fact that  $Y$  and  $i$  are negatively related. The investment demand sensitivity parameter  $b$  together with the autonomous spending multiplier  $\alpha$  determines how steep or flat the IS curve is. If  $b$  goes to zero (i.e. investment is interest-rate insensitive), the slope of the IS curve goes to minus infinity, and the IS curve is vertical. Note that the investment function is then defined as  $I = \bar{I}$ , i.e., it is also vertical. If investment does not depend on the interest rate, the IS curve is vertical, because now, as the interest rate falls, no component of aggregate demand increases. For every one unit decrease in the interest rate, the higher the investment sensitivity parameter  $b$ , the lower the slope of the IS curve is, and the higher the increase in the equilibrium income and output in the goods market will be, equilibrium as shown in Figure 2.16. The higher the marginal propensity to consume the flatter the IS curve, while an increase in the tax rate, reduces the disposable income and leads to a steeper IS curve. Thus an increase in the simple autonomous spending multiplier  $\alpha$  makes the IS curve flatter.

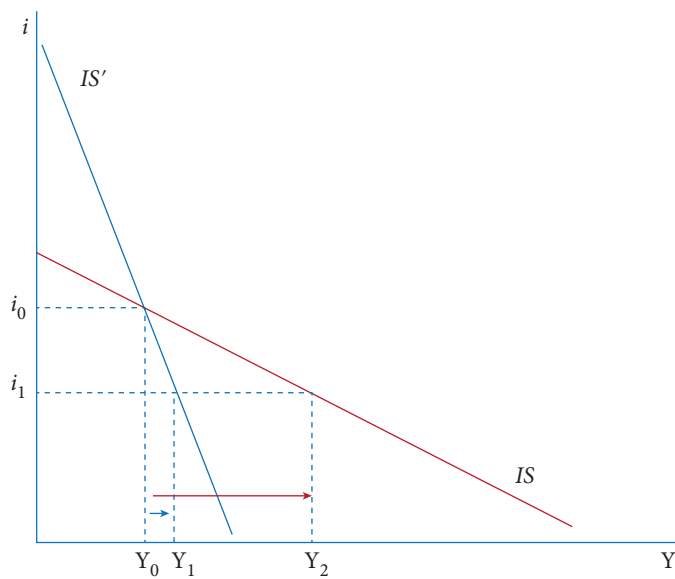


Figure 2.16 Slope of the IS Curve.



attention

The following factors determine the slope of the IS curve:

- The larger the marginal propensity to consume ( $c$ ), the flatter the IS curve.
- The larger the elasticity of investment demand with respect to interest rate ( $b$ ), the flatter the IS.
- The lower the income tax rate ( $t$ ), the flatter the IS.



your turn 2

Consider the following model of the economy:

$$C = C + cY_D \text{ (consumption)}$$

$$Y_D = Y - T + TR \text{ (disposable income)}$$

$$I = \bar{I} - b i \text{ (investment)}$$

$$G = G \text{ (government expenditure)}$$

$$TR = TR \text{ (government transfer payments)}$$

$$T = t Y \text{ (taxes)}$$

- What is the equation for the aggregate expenditure curve in this model?
- What is the equilibrium level of income?
- What is the aggregate expenditure multiplier in this model?
- What is the slope of the IS curve in this model?
- What are the factors determining the magnitude of the slope of the IS curve?



your turn 3

- Assume that investment does not depend on the interest rate. What will be the implication for the shape of the IS curve?
- Assume that marginal propensity to consume is zero. What will be the implication for the shape of the IS curve?

## SHIFTS IN THE IS CURVE

In the previous section, the IS curve relationship is derived for a given autonomous spending  $\bar{A}$ , and along with a given IS curve, the level of autonomous spending is the same. Accordingly, shifts in the IS curve (i.e. the change in the position of the curve) are caused by changes in the autonomous spending,  $\bar{A}$ , given a constant interest rate,  $i$ .

Recall that the aggregate demand is expressed as

$$Z = c_0 + cTR + c(1 - t)Y + \bar{I} - bi + G$$

$$Z = \bar{A} - bi + c(1 - t)Y \quad (2.23)$$

$$\text{where } \bar{A} \equiv c_0 + cTR + \bar{I} + G$$

Suppose that the government spending  $G$  increases once-and-for-all by  $\Delta G$ :

$$\Delta G > 0 \Rightarrow \Delta \bar{A} = \Delta G > 0$$

$$Z = c_0 + cTR + c(1 - t)Y + \bar{I} - bi + G + \Delta G$$

The equilibrium condition requires that

$$Y = Z$$

$$Y' = \alpha (\bar{A} - bi)$$

$$\text{Where } \bar{A} = c_0 + cTR + \bar{I} + G + \Delta G$$

The new equilibrium income is then

$$Y'^E = \alpha (\bar{A} - bi)$$

$$Y'^E = \frac{\bar{A} - bi}{1 - c(1 - t)}$$

Which implies that

$$\Delta Y = \alpha \Delta \bar{A} - \alpha b \Delta i$$

$$\text{Since } \Delta i = 0, \quad \Delta Y = \alpha \Delta \bar{A} = \alpha \Delta G.$$



Note that a change in the autonomous spending  $\bar{A}$  leads to a parallel shift in the aggregate demand function,  $Z$ , with no change in the interest rate. The interest rate is constant because we would like to assess the isolated impact of the change in autonomous expenditures on aggregate demand and therefore on equilibrium income. With the change in autonomous spending, the intercept of the aggregate demand function  $Z$  on the y-axis changes, and at every income level, the aggregate demand changes by the same magnitude as the change in autonomous spending. For example, as given in Figure 17, the once-and-for-all increase in government spending and therefore the upward shift in the aggregate demand function  $Z$  from  $Z$  to  $Z'$  leads to a disequilibrium in the goods market at the original equilibrium income and output level  $Y$ , and to re-establish equilibrium in the goods market, the equilibrium income, and output level increases to  $Y'$ . Hence, the initial interest rate  $i_0$  now corresponds to a new equilibrium income and output in the goods market,  $Y'$ . Notice that this new combination of interest rate and income level is no longer on the original IS curve, it is outside and to the right of the original IS curve. If we perform the same exercise as we did previously to construct the full IS-curve relationship (i.e., increase and decrease the interest rate and see how the equilibrium in the goods market changes), eventually we will obtain a completely new IS-curve relationship under the new government spending, but with the same slope as the original curve, since there are no changes in the spending multiplier  $\alpha$  and the parameter  $b$ . The magnitude of the shift in the IS curve will be exactly by  $\Delta \bar{A}$ , that is, we observe the full multiplier effect in the shift of the IS curve, as there is no change in the interest rate, and the shift in the IS curve is horizontal.

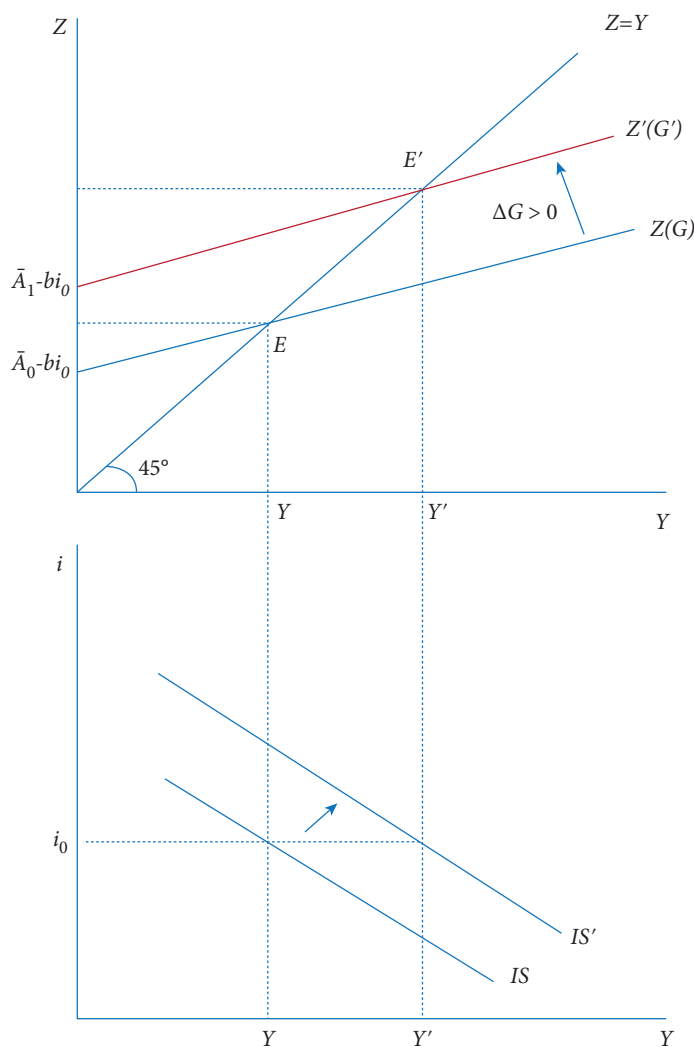


Figure 2.17 Shifts in the IS Curve.



attention

Changes in the interest rate lead to movements along a given IS curve, only! Changes in the interest rate do not cause shifts in the IS curve.



your turn 4

Consider the following model of the economy:

$$C = 85 + 0.75 Y_D$$

$$I = 100 - 10i$$

$$G = 500$$

$$T = 0.2Y$$

$$TR = 20$$

- Please derive the IS curve for the given model of the economy.
- Suppose that there is 20 units increase in autonomous consumption and derive the new IS curve.



your turn 5

**For each of the cases below, please explain the impact on the IS curve.**

- COVID- 19 pandemic has motivated a majority of people to create an emergency fund and increase their savings.
- Investor confidence in Europe has fallen because of the Ukraine – Russian war.

**L0 1** Define the components of aggregate demand

In a closed economy, aggregate demand is the sum of three components: consumption, investment, and government spending.

**L0 2** Explain the determinants of consumption, saving, and investment

The main driver of consumption and saving is disposable income. Moreover, expectations about future income and changes in wealth levels also affect consumption and saving. The main determinant of investment is the interest rate. The other determinants of investment are expected profitability, which in turn is shaped by expectations about future economic growth, the creation of new technologies, the price of key inputs, and tax incentives for investment.

**L0 3** Understand how the output is determined in the short run

Keynes's theory of the determination of equilibrium real GDP focuses on the relationship between aggregate income and expenditure. The income-expenditure model, or Keynesian cross diagram, shows how the level of aggregate demand varies with the level of economic output.

The short-run equilibrium in the diagram occurs where the aggregate expenditure line crosses the 45-degree line, which represents the set of points where aggregate expenditure in the economy is equal to output, or national income. If the current level of aggregate demand is greater than real GDP, inventories accumulate signaling producers to increase production. The increase in production continues until output equals aggregate demand.

#### L0 4 Derive the IS curve

Whenever the interest rate falls, there will be an increase in investment, which in turn causes an increase in the aggregate demand. The upward shift of the aggregate demand curve, therefore, leads to an increase in the equilibrium level of national income. The IS curve is defined as the locus of income and interest rate combinations, which ensure goods market equilibrium. Since a lower rate of interest is associated with a higher level of national income, and vice versa, the IS curve slopes downward.

#### L0 5 Evaluate the determinants of the slope of the IS curve

The slope of the IS curve depends on:

- a. The interest elasticity of the investment demand curve, and
- b. The size of the aggregate spending multiplier,  $\frac{1}{1-c(1-t)}$ .

#### L0 6 Identify what causes the IS curve to shift

In a closed economy any change in the components of autonomous spending  $\bar{A}$ , which are autonomous consumption, autonomous investment and government spending, will lead to a shift in the IS curve.

1 Assume that the consumption function is of the form,  $C = 50 + 0.8Y$ . If income is ₦4000 then consumption is,-

- A. ₦3250
- B. ₦3000
- C. ₦3050
- D. ₦4000
- E. ₦4250

2 What will be the future value of ₦100 at 5 % rate of interest after 2 years?

- A. ₦110.00
- B. ₦110.25
- C. ₦90.00
- D. ₦90.75
- E. ₦110.75

3 The rate of discount (r) which equalizes the present value of the prospective yield of an asset with its supply price is known as -----.

Which of the following completes the sentence above?

- A. Prospective income
- B. Supply price
- C. Prospective yield
- D. Deposit rate
- E. Marginal Efficiency of Capital (MEC)

4 An increase in marginal propensity to consume will -----.

Which of the following completes the sentence above?

- A. Shift the aggregate demand function downwards
- B. Shift the aggregate demand function upwards
- C. Lead to the aggregate demand function becoming steeper
- D. Shift the savings function upwards
- E. Shift the savings function downwards

5 In the simple Keynesian model, stability of equilibrium exists, if -----.

Which of the following completes the sentence above?

- A. APS is less than one
- B. APC is less than one
- C. Consumption depends on income
- D. Investment is autonomous
- E. MPC is between zero and one

6 Which of the following is not true for the Keynesian cross model?

- A. In a closed economy aggregate demand is composed of consumption, investment and government spending
- B. The higher the tax rate, the higher the multiplier
- C. The equilibrium output is determined by the aggregate demand
- D. The higher the marginal propensity to consume the higher the multiplier
- E. An increase in government spending positively affects output

7 For a closed economy with no government, if the saving function is defined as  $S = -500 + (0.20)Y$  and there is an increase in investment spending by 100, by how much will consumption increase?

- A. 300
- B. 400
- C. 500
- D. 600
- E. 700

8 Which of the following would **not** lead to a decrease in the government budget deficit?

- A. A decrease government spending
- B. An increase in the tax rate
- C. An increase real income
- D. An increase in government spending
- E. Both a and b

9 A reduction in savings at each level of disposable income -----.

Which of the following completes the sentence above?

- A. shifts the IS curve down
- B. shifts the IS curve up
- C. shifts the Z curve down
- D. the slope of IS increases
- E. since savings are not included in the expressions for the IS and Z curve, a reduction in savings will not affect IS

10 Every other thing equal, an increase in the risk of investment return would cause the IS curve to -----.

Which of the following completes the sentence above?

- A. remain unchanged
- B. shift down and to the left
- C. shift up and to the right
- D. remain unchanged if the risk is small
- E. the slope of aggregate expenditure curve decreases

|      |                                                                                               |       |                                                                                                                                       |
|------|-----------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| 1. A | If your answer is wrong, please review the “Consumption Function” section.                    | 6. B  | If your answer is wrong, please review the “The Aggregate Demand and Its Components and Determination of Equilibrium Output” section. |
| 2. B | If your answer is wrong, please review the “Investment Demand” section.                       | 7. C  | If your answer is wrong, please review the “Saving –Investment Equality” section.                                                     |
| 3. E | If your answer is wrong, please review the “Investment Demand” section.                       | 8. D  | If your answer is wrong, please review the “Government Spending” section.                                                             |
| 4. C | If your answer is wrong, please review the “The Aggregate Demand and Its Components” section. | 9. B  | If your answer is wrong, please review the “Shifts in the IS Curve” section.                                                          |
| 5. E | If your answer is wrong, please review the “Determination of Equilibrium Output” section.     | 10. B | If your answer is wrong, please review the “Shifts in the IS Curve” section.                                                          |

Assume the following consumption function for a closed economy:

$$C = 20 + 0.75 \times YD$$

$$T = 40$$

$$G = 30$$

$$I = 30$$

- What is the marginal propensity to consume?
- What is the short-run equilibrium value of  $Y$  in the economy?
- What is the short-run equilibrium value of consumption in the economy?
- What is the short-run equilibrium value of inventory investment in the economy?
- Suppose investment increases by 10. How much would the short-run equilibrium value of GDP ( $Y$ ) change?

a)  $mpc = 0.75$

b)  $Z = 20 + 0.75(Y - 40) + 30 + 30$

$$Z = 50 + 0.75Y$$

The equilibrium condition requires  $Z = Y$

$$Y = 50 + 0.75Y$$

$$50 = 0.25Y$$

$$Y^e = 200$$

c)  $C = 20 + 0.75(200 - 40)$

$$C = 140$$

d)  $Y$  is always equal to  $Z + \text{Inventory Investment}$ . In the short run equilibrium  $Y = Z$ . Hence

Inventory Investment is zero in the short run equilibrium.

e) The multiplier is  $\frac{1}{1-c}$  since  $t=0$ , which is taxes do not depend on income

level. Rather, taxes are lump-sum, which is independent from income level.

$$\text{Then } \frac{1}{1-c} = \frac{1}{1-0.75} = 4$$

Thus, when there is a 10 units increase in investment, the equilibrium income increases by 40. So,

the new equilibrium income is 240.

$$Z = 20 + 0.75(Y - 40) + 40 + 30$$

$$Z = 20 + 0.75Y - 30 + 40 + 30$$

$$Z = 60 + 0.75Y$$

$$Y = Z$$

$$Y = 60 + 0.75Y$$

$$0.25Y = 60$$

$$Y^e = 240$$

your turn 1

Consider the following model of the economy:

$C = C + cY_D$  (consumption)

$Y_D = Y - T + TR$  (disposable income)

$I = \bar{I} - b \times i$  (investment)

$G = G$  (government expenditure)

$TR = TR$  (government transfer payments)

$T = t \times Y$  (taxes)

- What is the equation for the aggregate expenditure curve in this model?
- What is the equilibrium level of income?
- What is the aggregate expenditure multiplier in this model?
- What is the slope of the IS curve in this model?
- What are the factors determining the magnitude of the slope of the IS curve?

a) First, we must obtain the aggregate demand function:

$$Z = C + I + G$$

$$Z = C + c Y_D + \bar{I} - b i + G$$

$$Z = C + c (Y - t Y + TR) + \bar{I} - b i + G$$

$$Z = C + I + G + c TR + c (1 - t) Y + \bar{I} - b i$$

$$Z = C + c TR + \bar{I} + G + c (1 - t) Y - b i$$

b) In equilibrium  $Y = Z$ , therefore

$$Y = C + I + c TR + \bar{I} + c (1 - t) Y - b i$$

We can rewrite this equation as a functional relationship between  $Y$  and the interest rate  $i$ .

Let  $C + c TR + \bar{I} + G = A_0$  the level of autonomous spending

$$Y = A_0 + c(1-t)Y - bi$$

$$[1 - c(1-t)]Y = A_0 - b i$$

This is the algebraic expression of the relation between  $(i, Y)$ , which represents equilibrium in the final goods market.

your turn 2

$$Y^e = \frac{1}{1 - c(1-t)} [A_0 - b \times i]$$

c) What is the aggregate expenditure multiplier in this model?

$$\alpha_A = \frac{1}{1 - c(1-t)}$$

d) Solve equation (2.24) for  $i$  then

$$[1 - c(1-t)]Y = A_0 - b i$$

$$i = \frac{1}{b} A_0 - \frac{1}{b} [1 - c(1-t)]Y$$

$$\text{slope IS} = -\frac{1 - c(1-t)}{b} < 0 \text{ which is the IS curve}$$

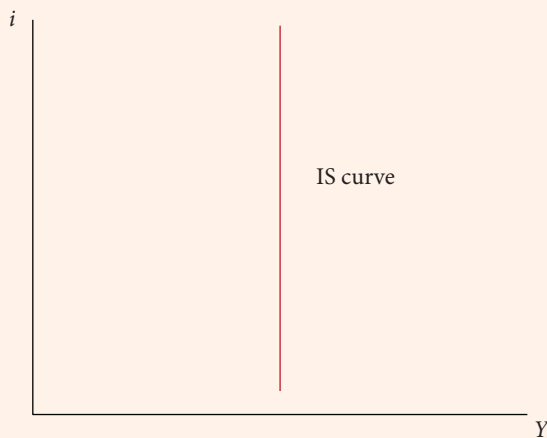
The slope of the IS curve may be flat or steep again depending on the sensitivity of investment to the interest rate (i.e., the value of  $b$ ). The IS curve is steep (slope is a large negative number) when investment is insensitive to changes in the interest rate ( $b$  is small). For a given change in the interest rate, there is only a small change in investment and income. The IS curve is flat (slope is close to zero) when a small change in interest rate leads to a large change in investment ( $b$  is large), which leads to a large change in national income.



- a. Assume that investment does not depend on the interest rate. What will be the implication for the shape of the IS curve?
- b. Assume that marginal propensity to consume is zero. What will be the implication for the shape of the IS curve?

your turn 3

- a. The IS curve represents the relationship between the interest rate and the level of income that arises from equilibrium in the market for goods and services. That is, it describes the combinations of income and the interest rate that satisfy the equation  $Y = C(Y-T) + I(i) + G$ . If investment does not depend on the interest rate, then nothing in the IS equation depends on the interest rate; income must adjust to ensure that the quantity of goods produced,  $Y$ , equals the quantity of goods demanded,  $C + I + G$ . Thus, the IS curve is vertical at this level.



- b. If the mpc is zero. This makes the IS curve steeper than it would otherwise be, but it does not cause it to be vertical. It makes the multiplier equal to 1, rather than larger than one, but this is enough for a fall in the interest rate that increases investment to still cause an increase in income.

Consider the following model of the economy:

$$C = 85 + 0.75Y_D$$

$$I = 100 - 10i$$

$$G = 500$$

$$T = 0.2Y$$

$$TR = 20$$

- Please derive the IS curve for the given model of the economy.
- Suppose that there is 20 units increase in autonomous consumption and derive the new IS curve.

your turn 4

- First, we must obtain the aggregate expenditure function:

$$Z = C + I + G$$

$$= (85 + 0.75Y_D) + (100 - 10i) + 500$$

$$\text{where } Y_D = Y - 0.2Y + 20 = 20 + 0.8Y$$

Substitute  $Y_D$  in aggregate demand equation.

$$Z = (85 + 0.75(20 + 0.8Y)) + (100 - 10i) + 500$$

$$Z = 700 + 0.6Y - 10i$$

In equilibrium,  $Y = Z$ :

$$Y = 700 + 0.6Y - 10i$$

$$0.4Y = 700 - 10i$$

$$Y = 1750 - 25i \quad \text{or} \quad i = 70 - 0.04Y$$

- The new aggregate expenditure function is

$$Z = C + I + G$$

$$= (105 + 0.75(20 + 0.8Y)) + (100 - 10i) + 500$$

The new aggregate demand equation is

$$Z = 720 + 0.6Y - 10i$$

In equilibrium,  $Y = Z$ . The new IS relation is

$$Y = 720 + 0.6Y - 10i$$

$$Y = 1800 - 25i \quad \text{or} \quad i = 72 - 0.04Y$$

As a result of an increase in the autonomous consumption, IS curve shifts up.

For each of the cases below, please explain the impact on the IS curve.

- a. COVID- 19 pandemic has motivated a majority of people to create an emergency fund and increase their savings.
- b. Investor confidence in Europe has fallen because of the Ukraine – Russian war.

your turn 5

For each of the cases below please explain the impact on the IS curve.

COVID- 19 pandemic has motivated a majority of people to create an emergency fund and increase their savings.

Investor confidence in Europe has fallen because of the Ukraine – Russian war.

At any given level of income, consumers now wish to save more and consume less. Because of this downward shift in the consumption function, the IS curve shifts inward.

Income, interest rates, and consumption all fall, while investment rises. Income falls because at every level of the interest rate, planned expenditure falls. The interest rate falls because the fall in income reduces demand for money; since the supply of money is unchanged, the interest rate must fall to restore money-market equilibrium.

Consumption falls both because of the shift in the consumption function and because income falls. Investment rises because of the lower interest rates and partially offsets the effect on output of the fall in consumption.

If consumer or business confidence drops, then consumption and investment spending decline. Because of this downward shift in the investment function, the IS curve shifts inward.

## References

- Becker, G. S. (1964). *Human capital: a theoretical and empirical analysis, with special reference to education*. The University of Chicago Press, Chicago, 3rd ed. edition, 1993. ISBN 0226041204.
- Becker, G. S. (1965). A Theory of the Allocation of Time. *The economic journal*, 75(299), 493-517. doi: 10.2307/2228949. URL <http://www.jstor.org/stable/2228949>.
- Keynes, J. M. (1930a). *A Treatise on Money, Vol. II: The Applied Theory of Money*. London: Macmillan.
- . (1930b). *Monetary Policy Alone Will Not End Depression*. The Nation, May 10.
- . (1932). A Note on the Long-Term Rate of Interest in Relation to the Conversion Scheme. *The Economic Journal*, 42, no. 167 (September): 415–23.
- . (1936). *The General Theory of Employment, Interest and Money*. London: Macmillan.
- Tsoufidis, L. (2008). Keynes on the marginal efficiency of capital and the great depression. Keynes on the Marginal Efficiency of Capital and the Great Depression. *History of Economic Ideas*, 2008, Vol. 16, No. 3 (2008), pp. 65-78.

# Chapter 3 Money Market

After completing this chapter, you will be able to;

## Learning Outcomes

- 1 Explain the money market equilibrium,
- 2 Understand the implementation of the monetary policy,
- 3 Derive the LM curve,
- 4 Evaluate the factors affecting the slope of the LM curve,
- 5 Identify factors that shift the LM curve.

### Chapter Outline

Introduction  
Financial Markets  
The Instruments of Monetary Policy  
Derivation of the LM Curve

### Key Terms

Demand for Money  
Equilibrium in the Money Market  
Interest Rate  
Monetary Policy  
LM Curve



## INTRODUCTION

In the previous chapter, we discussed the equilibrium in the goods and services market but did not refer to money or money markets, by implicitly assuming that transactions take place without any need for a medium of exchange. However, this is neither a realistic assumption, nor it is sufficient to understand economic activities. The money market is crucially important as money affects the level of output and income.

This chapter discusses the motives for holding money as well as the functions of money and introduces a simple model for the determination of interest rate. It is assumed that individuals can hold either money (cash-in-hand) or interest-bearing assets (bonds) and thus face a portfolio choice problem. A bond is a promise to pay an agreed amount of money to its holder at some future date. If an individual holds more bonds, she is expected to receive more interest earnings. While holding more money enables her to make her transactions easily as money is the most liquid asset. Accordingly, the wealth of an individual is composed of money held in different types of assets.

## FINANCIAL MARKETS

Financial markets can be defined as any platform where financial products, such as money, stocks, bonds, foreign currencies, and commodities, are traded. Buyers and sellers of various financial instruments meet in the financial markets, thus lowering the cost of transactions. The primary function of any financial market is to channel funds from savers to investors who are in need of funds. Prices in the financial market convey the available information to economic agents. Moreover, financial markets enable investors to allocate their funds across time, such as taking credit to have higher education as well as across different states of the economy, such as investing in stocks or bonds. Generally, central banks' monetary policy actions affect the target variable, interest rate, through the financial market.

### What is Money?

The term money has different uses in daily life compared to economic literature. We use money in our everyday lives quite often, generally to describe an economic activity, such as making money, earning money, spending money, or saving money. In daily life, having a lot of money generally amounts to having a certain amount of wealth. However, for an economist, money is an asset that is generally used as a medium of exchange that facilitates transactions and reduces transaction costs. It does not pay any interest. It also serves as a unit of account and as a store of value.

### What are Bonds?

Bonds are a promise to pay a certain amount in the future. It is a documentation of indebtedness that specifies the obligations of a borrower to a holder of the bond. Both governments and firms issue bonds to get a loan from the public. The value of a bond depends on its maturity, face value, and coupon payments. Maturity is the length of time until the bondholder is paid the fixed amount of money, which is the face value. A coupon payment is an occasional payment to the bondholder. If the bonds have one single payment at maturity, they are called discount bonds.

Individuals hold bonds because they pay positive interest,  $i$ , even though they cannot be used for transaction purposes. Buying and selling bonds actually involve transaction costs, such as calling your broker or going to the bank to realize these transactions. But for now, we will ignore these transaction costs. If the interest rate is high, people are then inclined to hold more bonds and thus decrease their money demand to buy more bonds in order to earn interest earnings.

Equilibrium in the bond market directly determines the prices of bonds, from which the nominal interest rate can be inferred. Suppose that the economy only has one type of government bond with a face value of ₦100 that matures in one year, suggesting that it pays ₦100 a year from now. Let's denote the price of the bond today as  $P_B$ . If an individual buys a bond today, the rate of return a year from now is:

$$i = \frac{₦100 - P_B ₦}{P_B ₦} \quad (3.1)$$

This formula can be rearranged to calculate the price of the bond given the interest rate:

$$P_B = \frac{100}{1 - i} \quad (3.2)$$

Equation (3.2) indicates that the bond price is equal to the present value of its future payment. It is evident that a rise in interest rates renders existing bonds less attractive and their value falls. Alternatively, whenever the price of bonds increases, the interest rate falls. As a result, the price of bonds and interest rates are inversely related.

## The Demand For Money

The use and holding of money have been one of the fundamental issues in monetary economics. The question of why people hold money that adds neither utility nor wealth has always been questioned. It can be argued that holding money depends on the expected price and interest changes, uncertainty, or liquidity services that money provides. Alternatively, one can approach the issue by looking at different motives for holding money and these motives will depend on the functions that money performs.

Keynes considered that people hold money due to the following motives:

- i) Transactions motive: Individuals need money for their current transactions of personal and business expenditures. Individuals hold transaction balances to facilitate transactions because payments and receipts are not perfectly synchronized.
- ii) Precautionary motive: a) People hold money to cover unforeseen expenses, as well as unanticipated opportunities to make profitable purchases.  
b) Individuals hold an asset the value of which is fixed in terms of money. Money balances kept as a precaution against the uncertainty of the timing of cash flows are known as precautionary balances.
- iii) Speculative motive: The individuals hold money to secure profit and avoid losses, according to their expectations about price and interest rate changes. People keep speculative balances as a safety net against the uncertainty of financial asset prices, particularly bond prices.

## Demand for Real Balances

When we hold money for transaction purposes, we are rather interested in the purchasing power of the money that we want to hold, rather than the actual, nominal amount of money that we want to hold. For example, suppose that you hold ₦100, and ₦100 buys 20 kg of apples, at ₦5 per kg. Let's say that the price of apples increases to ₦10 per kg from ₦5 per kg. Then, to buy the same 20 kg of apples, you need to hold ₦200 rather than ₦100. In nominal terms, you hold twice the amount of money, but in real terms, nothing has changed. In this sense, demand for real balances is represented in goods and services, not in monetary or nominal terms. Here, we are interested in the demand for real balances given the real income,  $Y$ , rather than the nominal income  $\$Y$ . The real money demand depends positively on the real income.

The amount of money that an individual demands is known as her nominal demand. However, the real demand for money is expressed in terms of the quantity of things that money can be used to purchase. The demand for money that has been adjusted for inflation is referred to as the real demand for money.

People keep money, which pays no interest, primarily for the liquidity it provides in transactions to purchase goods and services. Thus, the quantity of the financial transactions expected in the near future drives the demand for money. The lost interest earnings on bonds that the person could have invested represent the cost of retaining money. The cost of holding money is the foregone interest earnings on bonds that the individual could have acquired. Holding money costs more when there is an increase in interest rates. The amount of monetary holdings is therefore determined by the trade-off between the demand for liquidity, resulting from transactions, and the desire to make interest income. If there is an increase in an individual's transaction following an increase in income, then the demand for monetary holdings increases, mainly to smooth out the difference between the income stream and the payments for goods and services (transactions motive for holding money). Alternatively, if the interest rate increases, the individual will be more likely to buy bonds, by reducing their monetary holdings to earn interest income (the speculative motive for holding money). Whenever the price of goods increases, the individual will require more monetary balances to realize the same level of transactions. Hence, we express the demand for money (also called "the liquidity demand") as a positive function of income  $Y$  and a negative function of the interest rate as follows

$$M^d = \$Y L(i) \quad (3.3)$$

Equation (3.3) shows that the money demand depends on national income and interest rates.  $\$Y$  denotes nominal income and it can be regarded as a proxy for the flow of transactions.

Higher transactions take place when income rises, hence, people need to keep more cash balances to accommodate the growing volume of transactions. When actual income rises, so does the demand for money. The interest that could have been acquired if the money had been used to buy bonds instead, is the opportunity cost of retaining any amount of money. When people prefer to keep monetary balances rather than other assets, they must forgo a financial return, which is represented by the interest rate. Hence, the interest rate is considered to be the opportunity cost of holding cash. Due to the higher cost of holding cash reserves when the interest rate rises, people would naturally want to maintain fewer monetary assets compared to interest-bearing assets. That is to say, the money demand is inversely related to the interest rate.

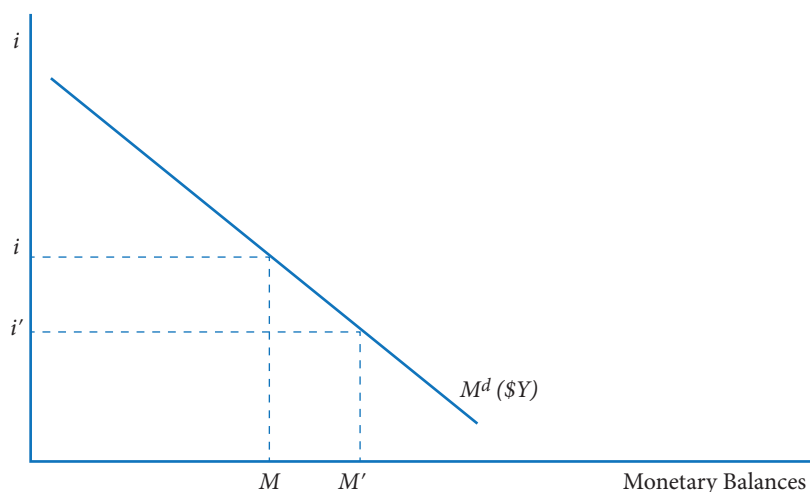


Figure 3.1 Demand for Monetary Balances.



Figure 3.1 depicts the demand for money relationship implied by Equation (3.3), where the horizontal axis represents money balances and the vertical axis represents the interest rate. The money demand curve displays the amount of money that is required at each interest rate, all other things being unchanged. The quantity of money demand increases when there is a decrease in the interest rate. The slope of the money demand curve is the interest rate elasticity of money demand.

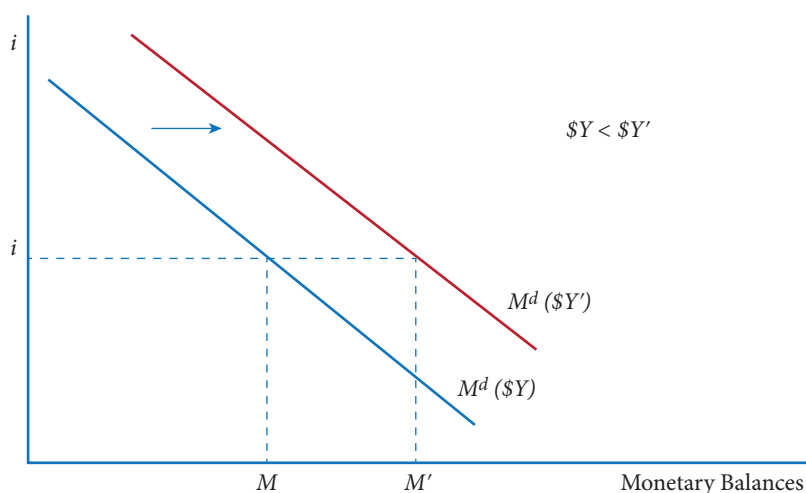


Figure 3.2 Increase in Income.

The effect of an increase in income on money demand is shown in Figure 3.2. For a given level of nominal income ( $\$Y$ ), the initial money demand curve is  $M^d(\$Y)$ . If there is an increase in nominal income to ( $\$Y'$ ), the demand for money increases, as seen in the shift from  $M^d(\$Y)$  to  $M^d(\$Y')$ . Because individuals want to hold more money to facilitate their increased transactions at a higher level of income. Thus, any change in income (real or nominal) acts as a shift factor for demand for money.



**Financial Innovation:** Technological developments in the banking and financial sector affect the demand for money. These developments are called financial innovations and include the following:

- Increased usage of the internet for transactions where electronic payment methods are employed,
- Usage of credit and debit cards in transactions,
- Online banking,
- Mobile banking services,
- Automatic transfers among various types of deposits.



**Currency Substitution vs Dollarization:** Currency substitution occurs when residents of one country use foreign currency to finance their transactions along with the domestic currency.

If foreign currency is used not only for transactions purposes, but also speculative and precautionary purposes, and replaces the domestic money, then, it is called dollarization. It is a form of currency substitution where the foreign currency fulfills all the functions of the domestic money.

## Supply of Money

The money supply is the total amount of money available in an economy at a particular point in time. The money supply in this chapter is defined as currency, paper money, and coins that nonbank public holds in addition to the demand deposits in commercial banks. They are the most liquid assets in an economy earning no interest, and they are generally accepted as means of exchange. This definition can be regarded as the most widely used monetary aggregate definition and corresponds to M1 in the literature. The broader monetary aggregate definition M2 is obtained by adding demand deposits to the M1 definition. Time deposits are not considered to be liquid, and in general, they cannot be used as a means of exchange. However, with the global financial development, commercial banks offer hybrid deposit options combining the properties of demand and time deposits, which can earn interest, but at the same time enable holders to withdraw or deposit money at any time they wish. These developments blurred the distinction between the narrow and broad definitions of monetary aggregate.



attention

Central Bank of Türkiye – Monetary Definitions  
 M1: Defined as currency in circulation, plus ₺ and foreign currency demand deposits held by the non-bank general public in commercial banks.  
 M2 = M1 plus ₺ and foreign currency savings deposits.  
 M3 = M2 plus funds received from repurchasing agreements, money market funds, and debt securities issued.

We also need to define the quantity of money in real terms. The nominal quantity of money is the face value of the money, and the real quantity of money is the face value divided by the price level:

The real quantity of money = Nominal quantity of money/Price level.

$$m = \frac{M}{P} \quad (3.4)$$

The monetary authority, generally the central bank, determines the *nominal quantity* of the money supply.

$$M^S = M \quad (3.5)$$

Equation (3.5) indicates that the nominal money supply does not depend on interest rates. Therefore, when drawn in the interest rate and real monetary balances dimension, the money supply curve is vertical (Figure 3.3).

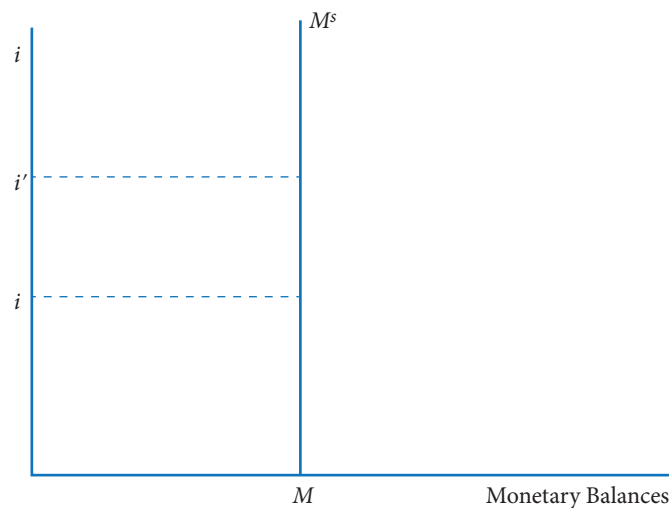


Figure 3.3 Money Supply.

## Equilibrium in the Money Market

The money market equilibrium is achieved when the demand for money equals the supply of money, as shown in Figure 3.4. Given the income level, the market equilibrium interest rate is  $i$  at equilibrium point E. At any other interest rate, there is a disequilibrium in the money market. Suppose the interest rate is  $i'$ , where the money demand  $M^{d'}$  is greater than the money supply  $M^s$ . In order to meet the excess demand for money, individuals will sell the bonds they have in their portfolios. Then bond supply in the market increases, leading to a fall in bond prices.

As we have discussed in the previous sections, there is a negative relationship between bond prices and interest rates. A fall in bond prices leads to a rise in interest rates. As interest rates rise, the opportunity cost of holding cash (monetary balances) increases, prompting a decrease in speculative demand for money, which is reflected by a movement along the money demand curve from point A towards equilibrium point E, restoring the equilibrium in the money market. Similarly, for any interest rate above the equilibrium interest rate, such as  $i''$ , there is an excess supply of money. Individuals would like to buy bonds with the excess monetary holdings that they have. The demand for bonds increases, driving the bond prices up, thereby leading to a reduction in the interest rate. The fall in the interest rates lowers the opportunity cost of holding money. Hence, there is an increase in the speculative demand for money, which is reflected by a movement along the money demand curve from point B towards equilibrium point E, restoring the equilibrium in the money market. Thus, for any given level of income  $Y$  and supply of monetary balances  $M^s$ , the money market equilibrium condition Equation (3.6) gives the interest rates that clear the market.

$$M^s = \$YL(i) \quad (3.6)$$

Suppose that the money market is in equilibrium at point E with interest rate  $i$  and nominal income level  $\$Y$  (Figure 3.5). When there is an increase in the income level, the demand for money curve shifts to the right, as individuals would like to hold more cash balances to assist their transactions at the new level of income. The money market is not in equilibrium at the initial level of interest rate  $i$ . Because at point B on the new money demand curve, there is an excess demand for money. In order to hold more cash balances, individuals sell their bonds. So, there is an increase in bond supply, which drives bond prices down

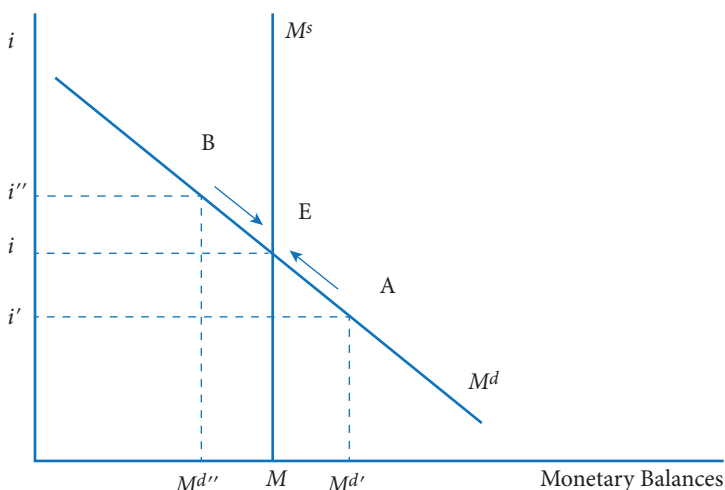


Figure 3.4 Equilibrium in the Money Market.

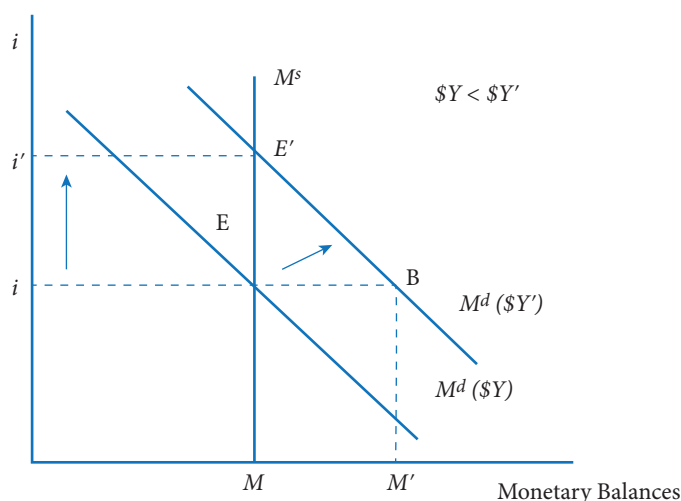


Figure 3.5 The Effect of an Increase in Income.

and interest rates up. The increase in interest rates leads to a fall in the demand for money along  $BE'$ . The new money market equilibrium is achieved at a higher interest rate  $i'$ . Thus, the equilibrium interest rate rises in response to an increase in money demand. The income elasticity of money demand determines the magnitude of the shift in the money demand curve. The higher the income elasticity of money demand, the greater the shift in the money demand curve is in response to an increase in income.

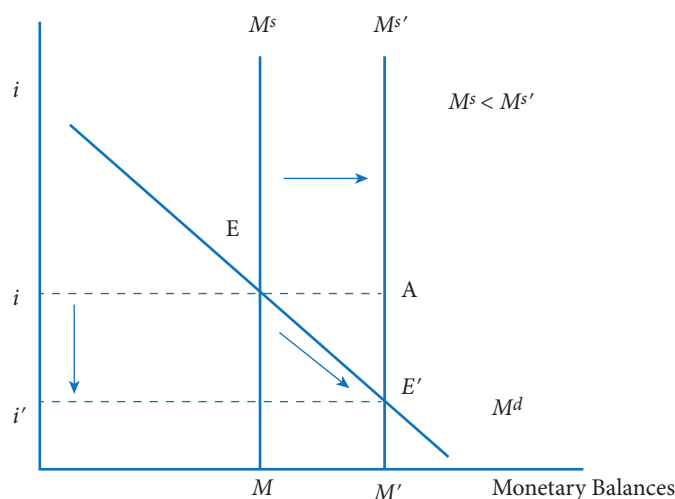


Figure 3.6 The Effect of an Increase in Money Supply.

Figure 3.6 depicts the effect of an increase in money supply on the interest rate. Assume that the money market is in equilibrium at point E with equilibrium interest rate  $i$  and equilibrium income level  $\$Y$ . When the central bank increases the money supply from  $M^s$  to  $M^{s'}$ , the money supply curve shifts to the right. At the initial level of equilibrium (E), there is an excess supply of money, which can be represented by  $|EA|$ . There are more monetary balances than the individuals are willing to hold, implying that the money market is not in equilibrium at the initial interest rate,  $i$ . Individuals would like to buy bonds to earn interest earnings instead of holding excess cash in their portfolios. Then, there is an increase in demand for bonds leading to an increase in bond prices, which in turn drives interest rates down, from  $i$  to  $i'$ . There is an increase in money demand as the interest rate falls, and equilibrium is restored at point  $E'$ , where the quantity demanded just equals the quantity supplied. Hence, the equilibrium in the money market is restored through a reduction in interest rates, which is achieved in the bond market.

In Figure 3.6, the central bank employs an expansionary monetary policy and buys bonds from the public. Individuals agree to sell bonds from their portfolios only if the central bank offers a satisfactory bond price. Thus, there is an increase in bond prices. Recall from Equation (3.2) that when there is an increase in bond prices, the rate of return to the bond (interest rate) falls. In the case of a contractionary monetary policy, the central bank sells bonds to the public in the bond market. The supply of bonds increases by driving the bond prices down, and hence, the interest rate increases.

Note that the central bank may increase the money supply to decrease the interest rate from  $i$  to  $i'$ , as depicted in Figure 3.6. But in a similar fashion, the central bank may choose to lower the interest rates from  $i$  to  $i'$  to adjust the money supply. Generally, central banks target a short-term interest rate, that is a policy interest rate, and adjust the money supply accordingly. The change in the policy interest rate affects other interest rates of mortgage loans, commercial loans, and deposit accounts. It also acts as a signal for consumers and policymakers about the stance of the economic activity, and thus affects consumption and investment decisions.



## your turn 1

The following information is given for an economy.

Assume that the demand function is given as follows:  $M^d = \$Y(0.6 - i)$

Nominal Income:  $\$Y = 1000$

Money Supply:  $M^s = 200$

- Calculate the money demand when the interest rate is 2% and when  $i = 10\%$ . Compare the magnitudes of the money demand for each case. Explain the reason for the difference.
- Calculate the price of a bond that promises to pay ₺10 in a year for interest rates being 2% and 10%, respectively. Please interpret it.
- Calculate the equilibrium interest rate in the money market.
- Assume that the central bank buys ₺100 worth of bonds from the public. Calculate the new equilibrium level of interest rate. Illustrate your results graphically.

## THE INSTRUMENTS OF MONETARY POLICY

The central bank laws of the countries specify certain objectives for central banks to attain. Among them, the most common objectives are to achieve price stability, ensure economic growth, promote financial stability, and stimulate high employment. The primary objective of the Central Bank of Türkiye is to achieve and maintain price stability. However, central banks do not have the tools or means to directly achieve these objectives. But they employ several instruments, which can affect the availability (money supply), and cost of money (interest rate), to achieve these objectives. The central bank can affect the money supply by making open market operations, in addition to setting reserve requirement ratio and discount rate.

The central bank can change the monetary balances in the economy by employing open market operations, which entails buying and selling securities, i.e. government treasury bonds, to commercial banks. When the central bank buys bonds, it generally pays with newly created money so that commercial banks' reserves increase, which may enable banks to extend credit to the public. When, on the contrary, the central bank sells bonds, commercial banks' reserves decrease, thereby reducing their ability to lend to the public.

Commercial banks are required to hold a fraction of their total demand-deposit liabilities at the central bank, called minimum or required reserves. Any reserves in excess of required reserves are called excess reserves. An increase in the required reserve ratio, say for example from 10% to 20%, leads to a decrease in balances held by banks that could otherwise be loaned to the public.

If a commercial bank does not have enough reserves, it may borrow from other banks as well as from the central bank, which is the lender of last resort. The central bank can extend loans to commercial banks at a discount rate, generally for a short period. Since discount rates are generally higher than the market interest rates, commercial banks resort to borrowing from the central bank only if they cannot secure any short-term loans from other commercial banks. When a commercial bank borrows from the central bank, a deposit is created at the central bank in the amount of borrowed reserves in the commercial bank's name. Therefore, any increase in required reserve ratios or the discount rate translates into a decrease in the money supply.



## your turn 2

Assume that the money market is initially in equilibrium. What will be the impact of an increase in income on the money market? If the central bank would like to keep the initial interest rate, what kind of policies should the central bank implement? Please explain your reasoning by using graphs.

## The Mechanism of Monetary Expansion

In order to better understand the effects of an expansionary monetary policy, shown in Figure 3.6, recall the monetary policy tools that the central bank can employ. The buying and selling of bonds on the bond market are known as “open market activities.” The central bank purchases bonds to increase the money supply or sells bonds to decrease the money supply. When the central bank increases the money supply by purchasing bonds, it pays for them by creating money that is coming from outside the banking system. Hence, the money supply increases by more if, for example, there is an increase in deposits in the banking system. The assets of the central bank are the bonds it holds, while the money stock in the economy is its liability (Table 3.1). Whenever the central bank utilizes open market operations, there will be an equal change in its assets and liabilities. If, for example, the central bank purchases ₦40 million worth of bonds, both the amount of bonds (assets) and the money in the economy (liabilities) increase by ₦40 million.

Table 3.1 The Balance Sheet of the Central Bank.

| Assets                            | Liabilities      |
|-----------------------------------|------------------|
| Bonds                             | Money (Currency) |
| Advances to banks                 | Deposits         |
| Foreign securities and currencies |                  |

| Assets                                    | Liabilities                             |
|-------------------------------------------|-----------------------------------------|
| Change in bond holdings:<br>+ ₦40 million | Change in money stock:<br>+ ₦40 million |

Consider the balance sheet of Hittite Bank in Table 3.2. Panel (a) shows that initially, Hittite Bank has ₦600 million in assets consisting of reserves, bonds, and loans, and ₦500 million in liabilities in the form of deposits, with a net worth of ₦100 million. The impact of an expansionary monetary policy can be traced in panel (b). The central bank purchases ₦40 million in bonds from Hittite Bank. Then bond holdings of Hittite Bank fall by ₦40 million while its reserves increase by ₦40 million. Assume that Hittite Bank prefers to keep reserves at ₦50 million. Thus, Hittite Bank extends its loans by an additional ₦40 million, in panel (c). There is no change in the net worth of Hittite Bank. The open market operation by the central bank increases the money supply as Hittite Bank extends loans, instead of holding government bonds.

Table 3.2 The Balance Sheet for Hittite Bank.

| Assets                         |     | Liabilities |     |
|--------------------------------|-----|-------------|-----|
| Reserves                       | 50  | Deposits    | 500 |
| Bonds                          | 150 |             |     |
| Loans                          | 400 | Net Worth   | 100 |
| (a) The original balance sheet |     |             |     |

| Assets                          |            | Liabilities |     |
|---------------------------------|------------|-------------|-----|
| Reserves                        | 50+40=90   | Deposits    | 500 |
| Bonds                           | 150-40=110 |             |     |
| Loans                           | 400        | Net Worth   | 100 |
| (b) The central bank buys bonds |            |             |     |

| Assets                               |            | Liabilities |     |
|--------------------------------------|------------|-------------|-----|
| Reserves                             | 90-40=50   | Deposits    | 500 |
| Bonds                                | 110        |             |     |
| Loans                                | 400+40=440 | Net Worth   | 100 |
| (c)Hitit Bank makes additional loans |            |             |     |

### Who Determines the Money Supply?

The money supply is determined by the actions of four actors, which are the central bank, commercial banks, depositors, and borrowers, respectively. Recall the balance sheet of the central bank depicted in Table 3.1. The assets of the central bank are government securities (bonds) and loans, generally to commercial banks, whereas the monetary liabilities of the central bank consist of notes in circulation and deposits of other financial institutions. The commercial banks hold deposits with the central bank for precautionary motives such as desired reserves to meet short-term liquidity requirements, or for regulatory requirements such as required reserves.

The sum of commercial banks' deposits with the central bank (R) and currency in circulation (CU) make up the monetary base or high-powered money (MB).

$$MB = CU + R \quad (3.7)$$

The central bank can affect the money supply by controlling the monetary base. The central bank has at least three options to control the monetary base: open market operations, extending credit to commercial banks, and issuing new currency.

Let  $C \equiv \frac{CU}{D}$  denote the currency to deposit ratio and  $r \equiv \frac{R}{D}$  reserves to deposit ratio, where  $0 < c, r < 1$ .

Then monetary base can be rewritten as follows:

$$MB = (c + r)D \quad (3.8)$$

The narrow monetary aggregate is defined as the sum of currency in circulation (CU) and demand deposits (D) and can be represented as follows:

$$M = CU + D = (1 + c)D \quad (3.9)$$

By substituting D from Equation (3.8) to Equation (3.9), we obtain Equation (3.10).

$$M = \frac{1+c}{r+c} MB \quad (3.10)$$

where  $\frac{1+c}{r+c}$  is the money multiplier which is greater than one, implying that one unit increase in monetary base leads to an increase in the money supply that is greater than one unit. Besides, the magnitudes of the currency-deposit ratio,  $c$ , and reserve-deposit ratio,  $r$ , determine the magnitude of the money supply given the monetary base. The higher the two ratios, the lower the money supply is.

## DERIVATION OF THE LM CURVE

In the previous section, we have shown that money market equilibrium occurs for some interest rate  $i$  when the supply of money is equal to the demand for money for a given nominal income level  $\$Y$ :

$$M = \$Y L(i) \quad (3.6)$$

Here, on the left-hand side of Equation (3.6),  $M$  is the nominal stock of money, and on the right-hand side is the demand for money at some nominal income level  $\$Y$  and the market-clearing interest rate  $i$ . The money market-clearing condition requires that at some equilibrium interest rate, the nominal quantity of money supplied equals the nominal quantity of money demanded. In this part of the chapter, we derive the LM-curve relationship which is the locus of alternative combinations of interest rate and income level  $(i, Y)$  that clears the money market.

In order to obtain real values, we divide both sides of the Equation (3.6) by the price level ( $P$ ).

$$\frac{M}{P} = Y L(i) \quad (3.11)$$

Equation (3.11) implies that the real money supply should be equal to the real money demand to achieve equilibrium in the money market.

The left-hand side of Figure 3.7 depicts the money market equilibrium for a given level of income ( $Y$ ). For example, when  $Y = Y$ , the equilibrium real interest rate is  $i$ . The right-hand side of the graph illustrates the LM curve, where the real interest rate is measured on the vertical axis and real income (GDP) on the horizontal axis.

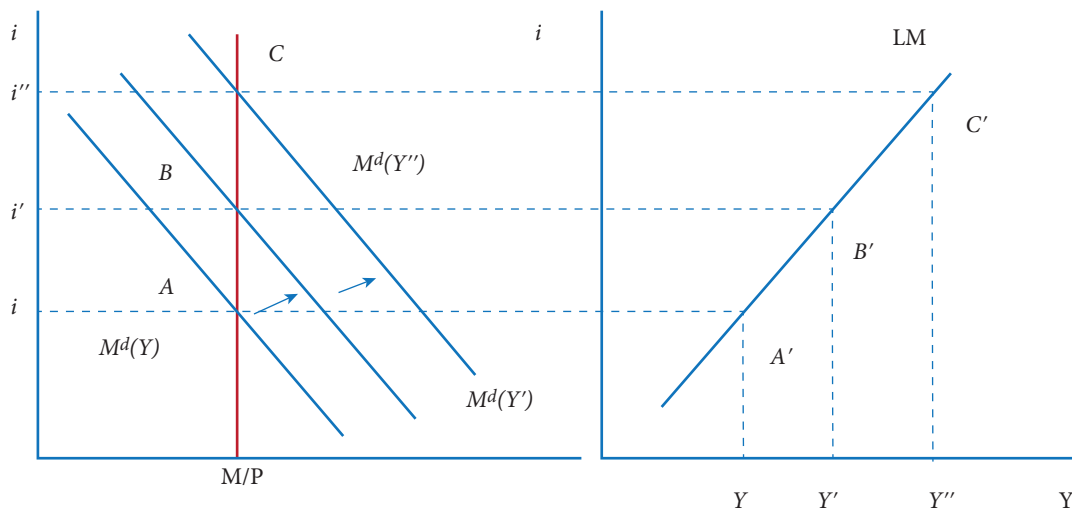


Figure 3.7 Derivation of the LM Curve.

Suppose that initially, the money market is in equilibrium at point A with equilibrium interest rate and income  $(i, Y)$  for some given real money supply  $\frac{M}{P}$ . Now, suppose that income level increases from  $Y$  to  $Y'$ . Along with the increase in income level, people's transactions demand for money also increases, which shifts the real money demand function from  $M^d(Y)$  to  $M^d(Y')$ . With this increase in the demand for real balances, the demand for money exceeds the supply of money at the original equilibrium interest rate,  $i$ . In other words, the real money supply in the economy cannot meet the people's demand for real balances



that they would like to hold for transactions purposes at the original equilibrium interest rate. Therefore, people sell their bonds and liquidate them into money to satisfy their demand for money, leading to a fall in bond prices. Thus, the interest rate increases. As long as there is an excess demand for money, interest rates will continue to rise. The new equilibrium will be established in the money market at a higher interest rate, where the new demand for real balances equals the real money supply, which is constant. Accordingly, in the money market equilibrium, a higher income level corresponds now to a higher interest rate, leading to a new equilibrium at a higher interest rate  $i'$  at point B. On the contrary, if there is a fall in income level, there will be a drop in the demand for real balances at the original equilibrium interest rate, and there will be an excess supply of money in the money market. With this excess supply of money, people will tend to purchase bonds (because there is an excess supply of money that they do not want to hold for transactions), which raises the price of bonds, and reduces the interest rate. As such, now, a lower income level corresponds to a lower interest rate in the money market equilibrium. This shows a positive relationship between the income level and the interest rate in the money market equilibrium.

LM curve is a locus of income and interest rate combinations that keep the money market in equilibrium, where money demand is equal to the money supply. The LM curve slopes upward when drawn on a graph with  $i$  on the vertical axis and  $Y$  on the horizontal axis.

### Algebraic Expression of the LM Relationship

The demand for real money balances depends on the level of real income and interest rate. The demand for real money balances increases with the rise in the level of income and decreases with the rise in the rate of interest.

The money demand function can be given in a specific functional form shown below:

$$M^d = k * Y - h * i \quad (3.12)$$

where  $k, h > 0$ .

Equation (3.12) shows that the real money demand is a function of the real income ( $Y$ ) and interest rate ( $i$ ). Parameter  $k$  represents how much demand for real money balances increases when the level of income rises. Parameter  $h$  shows how much demand for real money balances decreases when the rate of interest rises. A higher output level indicates greater production of goods and services, leading to increased transactions (more sales and more spending) in the economy. Individuals would then like to have more cash balances to assist their transactions. Hence,  $k$  is positive. When the interest rate increases, on the other hand, individuals need to make a portfolio choice decision: in what form would they want to hold their wealth? Although money is the most liquid asset it does not earn any interest. Bonds, however, are not liquid but earn interest. Therefore, the opportunity cost of holding cash increases whenever interest rates rise. Individuals may then decrease their cash holdings, and buy bonds to earn interest income. Therefore, a rise in interest rates results in a decrease in money demand ( $-h$ ).

The equilibrium in the money market is established where demand for real money balances equals the supply of real money balances and is given by  $M^s = M^d$ .

$$\frac{M}{P} = Y L(i) \quad (3.11)$$

Money supply ( $M$ ) is determined by the central bank. We also assume the price level ( $P$ ) to remain constant.

Substituting the demand for money function expressed in Equation (3.12) in Equation (3.11) gives

$$\frac{M}{P} = k * Y - h * i \quad (3.13)$$

Rearranging gives

$$h * i = -\frac{M}{P} + k * Y \quad (3.14)$$

Solving the above equation for interest rate,  $i$ , we obtain the expression for the LM curve:

$$i = -\frac{1}{h} \frac{M}{P} + \frac{k}{h} * Y \quad (3.15)$$

Equation (3.15) explains the LM relation and provides the equilibrium rate of interest for every given level of real income ( $Y$ ) and real money balances ( $\frac{M}{P}$ ). As a result, given a fixed value of real money balances ( $M/P$ ), the LM curve describes money market equilibrium for a range of income and interest rate values. We obtain a rate of interest for different values of income. The LM curve slopes upward because  $\frac{k}{h} > 0$ . In other words, given the supply of real money balances, a higher income level necessitates a higher interest rate for the money market to be in equilibrium. Since real money balances have a negative coefficient, an increase (decrease) in real money balances causes the LM curve to shift to the right (left).

### The Slope of the LM Curve

We will obtain the slope of the LM curve by taking the partial derivative of the LM curve in Equation (3.15) with respect to income ( $Y$ ):

$$\frac{\Delta i}{\Delta Y} = \frac{k}{h} > 0 \quad (3.16).$$

Equation (3.16) indicates that the slope of the LM curve is determined by the income elasticity of demand for money ( $k$ ), and the interest rate elasticity of demand for money ( $h$ ). The LM curve will be steeper if the income elasticity of money demand is higher (measured by  $k$ ) and the interest elasticity of money demand is lower (measured by  $h$ ). The larger  $k$  and the smaller  $h$ , the more impact  $\Delta Y$  will have on the interest rate,  $i$ , considering a given change in income.

If  $Y$  increases while the money supply ( $M^S$ ) remains fixed, a rise in interest rate  $i$  is required to maintain supply/demand balance. The magnitude of the increase in  $i$  to maintain equilibrium in the money market depends on the interest elasticity of demand for money ( $h$ ). If the demand for money responds strongly to changes in interest rate ( $i$ ) (big  $h$ ), then a small rise in interest rate would be sufficient, suggesting that LM will be relatively flatter. If the response is weak, a big change in interest rate is needed, and the LM slope is steeper. In the extreme case of a money demand totally unresponsive to the interest rate, the LM curve will be vertical.



your turn 3

If the demand for money does not depend on income, what would be the implications for the slope of the LM curve? How would a change in the money supply affect the equilibrium interest rate and income in such a case?

### Shifts in the LM Curve

The LM curve shifts in response to changes in money supply and changes in money demand. The impact of an increase in money supply on the LM curve is depicted in Figure 3.8. Suppose that the initial equilibrium in the money market is at point E with the equilibrium interest rate and income ( $i, Y$ ). Assume that there is an increase in the nominal money supply, leading to an excess supply of money at

the initial interest rate  $i$ , ( $|EA|$ ). Since individuals do not want to use these excess monetary balances for transactionary purposes, they would like to buy bonds to earn interest earnings. Hence, the price of bonds tends to increase, and with the negative relationship between the bond prices and interest rates, the interest rate tends to fall. This purchase of bonds continues until there is no excess supply of money in the money markets. With this change, a new equilibrium is established in the money markets, with the income level  $Y$  and the new lower interest rate  $i'$ . Notice that this corresponds to a new relationship between interest rate and the income level, hence this relationship is represented with a new  $LM$  function,  $LM'$ .

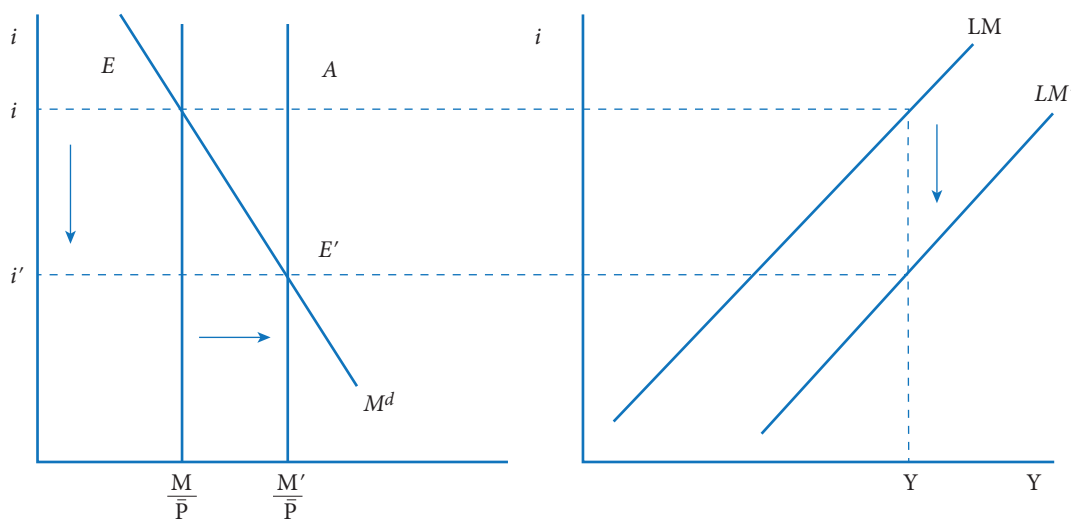


Figure 3.8 Expansionary Monetary Policy.

The impact of a contractionary monetary policy on the  $LM$  curve is shown in Figure 3.11. The central bank reduces the nominal money supply from  $M$  to  $M'$ . At the initial equilibrium interest rate  $i$ , now there is an excess demand for money ( $|EA|$ ). Now that people sell bonds to cover their excess demand for money, interest rate rises as bond prices fall. A new equilibrium is established in the money market with income level  $Y_0$  and the new interest rate  $i'$ , which lies above and to the left of the original  $LM$  curve. Thus  $LM$  curve shifts up or to the left.

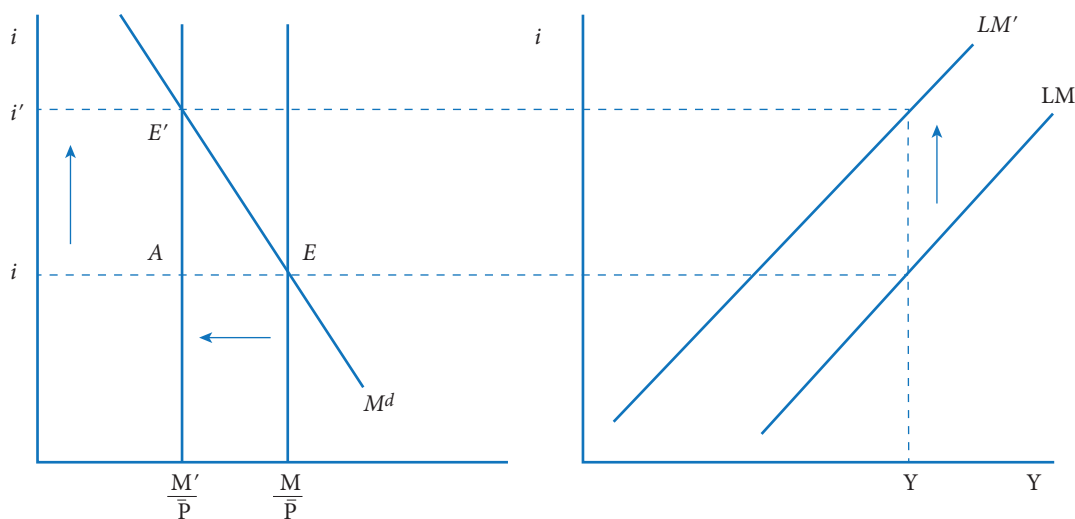


Figure 3.9 Contractionary Monetary Policy.

In addition to the changes in money supply, factors affecting the money demand function also lead to a shift in the LM curve. Suppose that the money market is in equilibrium at point E and there is an increase in income level from  $Y$  to  $Y'$ , while the money supply is constant (Figure 3.10). An increase in income leads to an increase in the demand for money, as shown in Figure 3.12. At the initial interest rate  $i$ , now, there is an excess demand for money ( $|EA|$ ). As we have seen in the previous section, an excess demand for money leads to an increase in the supply of bonds as individuals would like to have more cash to assist their transactions, driving the interest rates up to  $i'$  and equilibrium is restored at point  $E'$  with a new interest rate  $i'$  and income level  $Y'$  which corresponds to a new LM relationship  $LM'$ . Hence, whenever there is an increase in money demand, the LM curve shifts up or to the left. Similarly, when there is a decrease in the money demand, given a constant money stock, the LM curve shifts down or to the right.

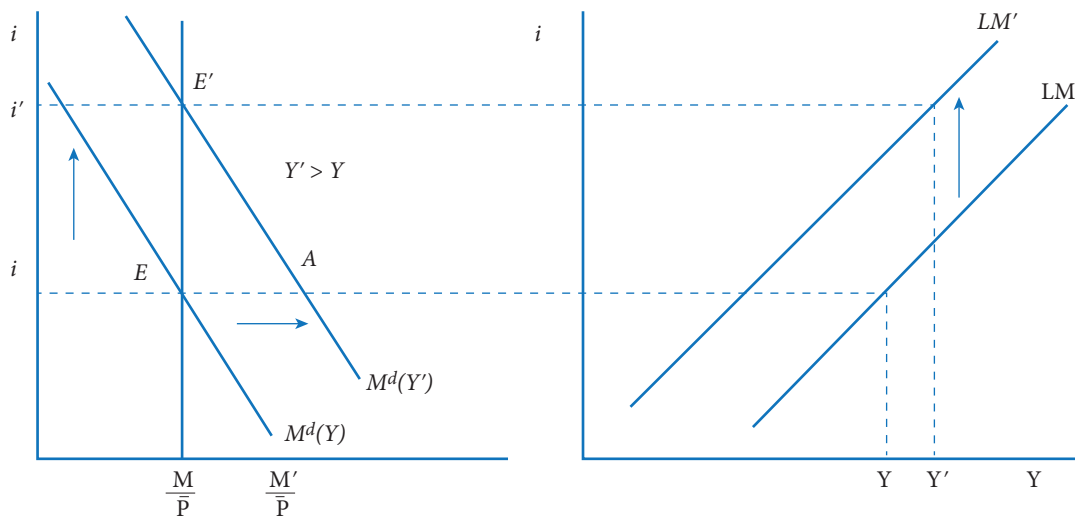


Figure 3.10 An Increase in the Money Demand.



#### your turn 4

Please derive the LM curve, using the information regarding the money demand and money supply below.

$$\left(\frac{M}{P}\right)^d = 2Y - 500i$$

$$\left(\frac{M}{P}\right)^s = 1500$$



#### your turn 5

There are reports that there has been an increase in cash demand because of the recent coronavirus outbreak. Please discuss its implications for the money market equilibrium and the LM curve.

## LO 1

Explain the money market equilibrium.

The demand for money depends positively on national income and negatively on interest rates. As there is an increase in the level of income, individuals need more cash balances to facilitate their transaction, leading to an increase in the demand for money. The interest rate is considered to be the opportunity cost of holding cash. When there is an increase in the interest rate, people would naturally want to maintain fewer monetary assets compared to interest-bearing assets, resulting in a decrease in money demand.

The money supply is the total amount of money available in an economy at a particular point in time. The monetary authority, generally the central bank, determines the nominal quantity of the money supply.

The equilibrium in the money market is achieved when the demand for money equals the supply of money.

## LO 2

Understand the implementation of the monetary policy.

The central bank laws of the countries specify certain objectives for central banks to attain, such as achieving price stability, ensuring economic growth, promoting financial stability, and stimulating high employment. Although central banks do not have the tools or means to directly achieve these objectives, they employ several instruments, which can affect the availability (money supply), and cost of money (interest rate), to achieve these objectives. The central bank can affect the money supply by making open market operations, in addition to setting reserve requirement ratio and discount rate.

The buying and selling of bonds on the bond market are known as “open market activities.” The central bank purchases bonds to increase the money supply or sells bonds to decrease the money supply. When the central bank buys bonds, following an expansionary monetary policy, it increases money supply by buying bonds, driving bond prices up and hence decreasing the interest rate.

## LO 3

Derive the LM curve.

The money market equilibrium occurs for some interest rate  $i$  when the supply of money is equal to the demand for money for a given nominal income level. When there is an increase in income, demand for money increases, leading to an increase in the equilibrium interest rate. The new equilibrium will be established in the money market at a higher interest rate, where the new demand for real balances equals the real money supply, which is constant. This shows a positive relationship between the income level and the interest rate in the money market equilibrium. LM curve depicts the positive relationship between the income level and the interest rate in the money market.

## LO 4

Evaluate the factors affecting the slope of the LM curve.

The slope of the LM curve is obtained by taking the partial derivative of the LM curve with respect to income. The slope of the LM curve is determined by the income elasticity of demand for money ( $k$ ) and the interest rate elasticity of demand for money ( $h$ ). The LM curve will be steeper if the income elasticity of money demand is higher (measured by  $k$ ) and the interest elasticity of money demand is lower (measured by  $h$ ). The larger  $k$  and the smaller  $h$ , a change in income will have more impact on the interest rate,  $i$ , considering a given change in income.

## LO 5

Identify factors that shift the LM curve.

The LM curve shifts in response to changes in money supply and changes in money demand. When there is an increase in the nominal money supply, the price of bonds increases, and with the negative relationship between the bond prices and interest rates, the interest rate tends to fall. With this change, a new equilibrium is established in the money markets, with the new lower interest rate. This corresponds to a new relationship between interest rate and the income level, hence this relationship is represented with a new LM function. Thus, the LM curve shifts to the right. Similarly when there is a decrease in money supply, LM curve shifts to the left.

When there is an increase in income while the money supply is constant there is an increase in the demand for money, driving the interest rates up. The new equilibrium is restored with a new higher interest rate and income level which corresponds to a new LM relationship. Hence, whenever there is an increase in money demand, the LM curve shifts up or to the left. Similarly, when there is a decrease in the money demand, given a constant money stock, the LM curve shifts down or to the right.

1 The \_\_\_\_ demand for money arises from the need to hold money as a medium of exchange. This demand for money is a function of \_\_\_\_.

Which of the following completes the sentence above?

- A. transaction; national income
- B. speculative; interest rates
- C. precautionary; national income
- D. transaction; interest rates
- E. precautionary; interest rates

2 The demand for money curve slopes \_\_\_\_ because at lower interest rate -----.

Which of the following completes the sentence above?

- A. upward; the opportunity cost of holding money is higher
- B. downward; the opportunity cost of holding money is higher
- C. upward; the opportunity cost of holding money is lower
- D. downward; the opportunity cost of holding money is lower
- E. upward; the opportunity cost of holding money is constant

3 If there is excess demand for money at the current interest rate, -----.

Which of the following completes the sentence above?

- A. the price of bonds rise
- B. the goods and service market is in equilibrium
- C. the price of bonds fall
- D. the interest rate fall
- E. the speculative demand for money falls

4 Which of the following cannot be considered as an objective of the central bank in its conduct of monetary policy -----.

Which of the following completes the sentence above?

- A. economic growth
- B. price stability
- C. high employment
- D. promotion of financial stability
- E. to reduce income inequality

5 In an economy where individuals do not hold currency, the money multiplier -----.

Which of the following completes the sentence above?

- A. is determined only by the currency-deposit ratio
- B. is determined only by the reserve-deposit ratio
- C. is determined by both the currency-deposit ratio and the reserve-deposit ratio
- D. is zero
- E. cannot be determined

6 Which of the following is likely to occur if the central bank buys bonds from the public?

- A. the monetary base increases
- B. the money supply decreases
- C. the interest rate increases
- D. the monetary base decreases
- E. the bond prices fall

7 Suppose that the Central Bank announces the required reserve ratio as 10% and Hittite Bank holds ₺300 of ₺5000 deposits as reserves. In this situation, Hittite Bank has ----- reserve of ----- ₺.

Which of the following completes the sentence above?

- A. excess, 150
- B. insufficient, 200
- C. insufficient, 150
- D. excess, 200
- E. excess, 250

8 As a result of an increase in income, one would expect all, but -----.

Which of the following completes the sentence above?

- A. An increase in the demand for money
- B. A decrease in bond prices
- C. An increase in interest rates
- D. An upward shift of the LM curve
- E. A downward shift of the LM curve

9 Which of the following is true if the money demand is not sensitive to the interest rate -----.

Which of the following completes the sentence above?

- A. The LM curve is horizontal
- B. The IS curve is steeper
- C. The LM curve is vertical
- D. The IS curve is flatter
- E. The LM curve is flatter

10 Which of the following will cause a shift in the LM curve to the right?

- A. An increase in tax rate
- B. An increase in money supply
- C. A decrease in money supply
- D. An increase in interest rate
- E. A decrease in money demand



1. A

If your answer is wrong, please review the “The demand for money” section.

2. D

If your answer is wrong, please review the “The demand for money” section.

3. C

If your answer is wrong, please review the “Supply of money” section.

4. E

If your answer is wrong, please review the “Instruments of monetary policy” section.

5. B

If your answer is wrong, please review the “Who determines the money supply?” section.

6. A

If your answer is wrong, please review the “The mechanism of monetary expansion” section.

7. B

If your answer is wrong, please review the “Instruments of monetary policy” section.

8. E

If your answer is wrong, please review the “Derivation of the LM curve” section.

9. C

If your answer is wrong, please review the “The slope of the LM curve” section.

10. B

If your answer is wrong, please review the “Shifts in the LM curve” section.

The following information is given for an economy.

Assume that the demand function is given as follows:  $M^d = \$Y(0.6 - i)$

Nominal Income:  $\$Y = 1000$

Money Supply:  $M^s = 200$

- Calculate the money demand when the interest rate is 2% and when  $i = 10\%$ . Compare the magnitudes of the money demand for each case. Explain the reason for the difference.
- Calculate the price of a bond that promises to pay ₦10 in a year for interest rates being 2% and 10%, respectively. Please interpret it.
- Calculate the equilibrium interest rate in the money market.
- Assume that the central bank buys ₦100 worth of bonds from the public. Calculate the new equilibrium level of interest rate. Illustrate your results graphically.

### your turn 1

a.  $M^d = 1000 * (0.6 - 0.02) = 1000 * 0.58 = 580$

$M^{d'} = 1000 * (0.6 - 0.1) = 1000 * 0.5 = 500$

As there is a rise in interest rate, the opportunity cost of holding money increases. People tend to hold more bonds instead of money.

- b. Recall from Equation (3.1)

$$i = \frac{\text{Face Value ₦} - P_B \text{ ₦}}{P_B \text{ ₦}}$$

For  $i = 0.02 \Rightarrow 0.02 = \frac{10 - P_B}{P_B}$

Then  $P_B = \text{₦}9.80$

For  $i = 10 \Rightarrow 0.10 = \frac{10 - P_B}{P_B}$

Then  $P_B = \text{₦}9.09$

Thus the price of the bond decreases if the interest rate rises.

c.  $M^d = \$Y(0.6 - i)$

Money Supply:  $M^s = 200$

$200 = 1000 * (0.6 - i)$

$200 = 600 - 1000 * i$

$400 = 1000 * i$

Then  $i^e = 0.4$

$i = 40\%$

- d. The money supply has increased by \$100. Then the equilibrium condition is

$M^d = \$Y(0.6 - i)$

Money Supply:  $M^s = 300$

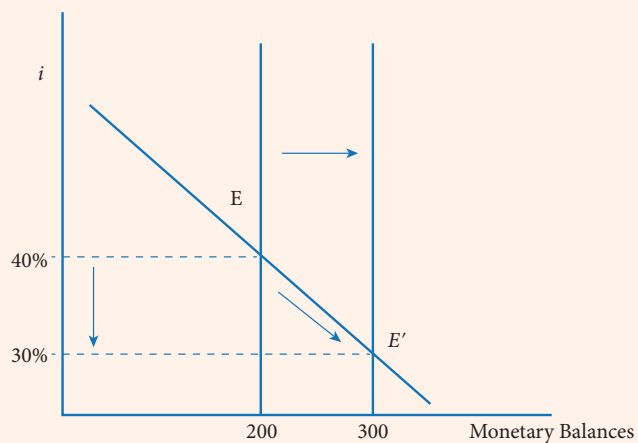
$300 = 1000 * (0.6 - i)$

$300 = 600 - 1000 * i$

$300 = 1000 * i$

Then  $i^e = 0.3$

$i = 30\%$



Assume that the money market is initially in equilibrium. What will be the impact of an increase in income on the money market? If the central bank would like to keep the initial interest rate, what kind of policies should the central bank implement? Please explain your reasoning, by using graphs.

your turn 2

An increase in income leads to an increase in the money demand which is shown as an upward shift of the money demand curve from  $M^d$  to  $M^{d'}$  (See Figure 3.5). The equilibrium interest rate will increase from  $i$  to  $i'$ . If the central bank would like to keep the interest rate at  $i$  after the increase in the money demand, it should have an expansionary monetary policy and increase the money supply.

If the demand for money does not depend on income, what would be the implications for the slope of the LM curve? How would a change in the money supply affect the equilibrium interest rate and income in such a case?

your turn 3

If the income elasticity of money demand is zero, the LM equation can be represented as  $M/P = L(i)$ , indicating that there is only one level of the interest rate at which the money market is in equilibrium for any given level of real monetary balances. Thus, the LM curve is horizontal. An increase in the money supply causes the interest rate to fall, so the LM curve shifts down. Thus, monetary policy is effective.

Please derive the LM curve, using the information regarding the money demand and money supply below.

$$\left(\frac{M}{P}\right)^d = 2Y - 500i$$

$$\left(\frac{M}{P}\right)^s = 1500$$

your turn 4

$$1500 = 2Y - 500i$$

$$i = 0.004Y - 3$$

There are reports that there has been an increase in cash demand because of the recent coronavirus outbreak. Please discuss its implications for the money market equilibrium and the LM curve.

your turn 5

Since there is an increase in demand for cash balances (demand for money), the money demand curve shifts to the right, driving the interest rate up. Given that the money supply is constant, at any given level of income, a higher interest rate is required to equilibrate the money market. Hence, the LM curve shifts up.

## ■ References

Keynes, J. M. (1923). *A Tract on Monetary Reform*. London: Macmillan.

Keynes, J. M. (1964). *The General Theory of Employment Interest and Money*. London, Harcourt Brace and Company (originally published 1936).

Keynes, J. M. (1971). "A Treatise on Money" (2 vols). *Collected Writings*, Vols. V & VI, Ed. Donald Moggridge, London: Macmillan (originally published 1930).

# Chapter 4

## Equilibrium in the Goods And Money Markets

After completing this chapter, you will be able to;

### Learning Outcomes

- 1 Establish simultaneous equilibrium in the goods and money markets and explain the meaning of the simultaneous equilibrium
- 2 Understand how changes in fiscal policy affect the general equilibrium and the components of aggregate expenditure
- 3 Understand how changes in monetary policy affect the general equilibrium and the components of aggregate expenditure
- 4 Assess the effectiveness of fiscal and monetary policy changes on income and output
- 5 Understand how the government may use policy mixes in order to meet policy goals

### Chapter Outline

Introduction  
Simultaneous (General) Equilibrium in the Goods and Money Markets  
Changes in the General Equilibrium in Goods and Money Markets  
Monetary and Fiscal Policy Mixes  
Special Cases

### Key Terms

General Equilibrium in Goods And Money Markets  
Stable Equilibrium  
Crowding Out Effect  
Monetary Transmission Mechanism  
Monetary Accommodation  
Liquidity Trap  
Velocity of Money  
The Interest Rate Rule



## INTRODUCTION

In previous chapters, we examined the equilibrium in goods and money markets separately. Now, we introduce the interaction between the goods and the money markets in a closed economy, and examine how simultaneous equilibrium in both markets is determined. In this framework, we study how interest rates and output and income are determined in the goods and money markets simultaneously in the short-run. By “short-run”, we imply the time frame during which demand-side policies (i.e., government’s monetary and fiscal policies) could have an effect on output and income in an economy. In that sense, our analysis will be a Keynesian analysis in essence where the economy is assumed to be always running under unemployment (or, below full employment) and where the demand-side policies are meant to stimulate the income and output in the economy without raising the production cost and prices.

As introduced in Chapter 2 and Chapter 3, this chapter also resorts to the IS-LM analysis which was first introduced by Sir John Hicks in the late 1930’s. The IS-LM model, which formalized the interaction of goods and money markets, was the main contribution by John Maynard Keynes in his groundbreaking book *The Theory of Employment, Interest, and Money*. In addition to understanding the interaction between goods and money markets, we will also study the impact of policy changes on the economy’s equilibrium in the short-run. In doing so, we will discuss the effectiveness of each policy action under alternative cases. Additionally, we will also examine the “special cases” in which the economy may find itself, and the policy options available to the government under these special circumstances.

In this chapter, we develop the basic **IS-LM model** for a closed economy. The open economy case will be studied in Chapter 7.

## SIMULTANEOUS (GENERAL) EQUILIBRIUM IN THE GOODS AND MONEY MARKETS

Recall from previous chapters that the locus of alternative equilibria in the goods market is characterized by the IS-curve relationship and the locus of alternative equilibria in the money market is characterized by the LM-curve relationship. Putting the IS and LM curves together, we are able to find the interest rate and output pair where both markets are in equilibrium simultaneously. Figure 4.1 plots the IS and the LM curves simultaneously on one single graph and at some pair ( $i^{EQ}$ ,  $Y^{EQ}$ ), the supply of goods is equal to the demand for goods (goods market is in equilibrium) and the real money demand is equal to the real money supply (money market is in equilibrium). At the equilibrium point E, the interest rate is such that people hold the available real money stock for transactions purposes to purchase final goods, and the demand for final goods is equal to the supply of final goods (or, the GDP). Recall that the IS curve is downward sloping and the LM curve is upward sloping, and there is a unique equilibrium point, point E, at the intersection of these two curves.

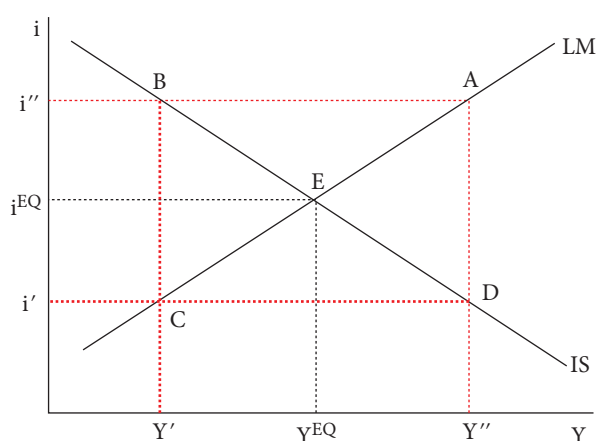


Figure 4.1 General equilibrium in goods and money markets.

In Figure 4.1, point E depicts the realization of simultaneous equilibrium or the general equilibrium in both goods and money markets. As shown, the unique point E satisfies the equilibrium conditions in both goods and money markets, and any other point on the ( $Y$ ,  $i$ )-plane than point E fails to satisfy the conditions of simultaneous equilibrium in both markets. Accordingly, at points A and C, the money market is in equilibrium, but the goods market is not in equilibrium whereas at points B and D, the goods

market is in equilibrium, but the money market is not in equilibrium. At point A, given the interest rate  $i''$ , the goods market reaches equilibrium at  $Y' < Y''$ , hence there is an excess supply of goods. At point B, given the output level,  $Y'$ , the money market reaches equilibrium at interest rate at  $i' < i''$ , hence there is an excess supply of money. At Point C, given the interest rate  $i'$ , the goods market reaches equilibrium at  $Y'' > Y'$ , thus there is excess demand for goods; at Point D, given the output level  $Y''$ , the money market reaches equilibrium at  $i'' > i'$ , hence there is an excess demand for money.

Any other points on the  $(Y, i)$ -plane than those on the IS and LM curves are points of disequilibrium in both markets, as depicted in Figure 4.2. On the points in Zone I (to the right of IS-curve and the left of LM-curve), there is an excess supply of goods in the goods market and an excess supply of money in the money market; on the points in Zone II (to the right of IS-curve and the right of LM-curve), there is an excess supply of goods in the goods market and an excess demand for money in the money market; on the points in Zone III (to the left of IS-curve and the right of LM-curve), there is an excess demand for goods in the goods market and an excess demand for money in the money market; finally, on the points in Zone IV (to the left of IS-curve and the left of LM-curve), there is an excess demand for goods in the goods market and an excess supply of money in the money market.

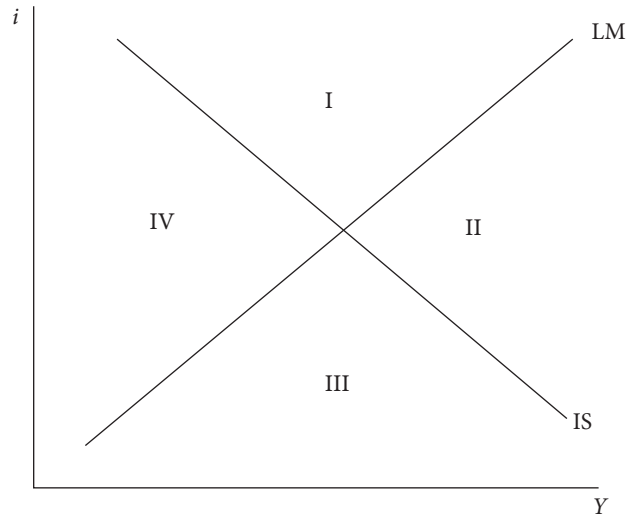


Figure 4.2 Points of disequilibria in goods and money markets.

Using the IS and LM functions, we can find the algebraic expression of the IS-LM equilibrium. We have a system of two equations in IS and LM with two unknowns,  $i$  and  $Y$ :

$$\begin{aligned} IS : Y &= \alpha(\bar{A} - bi) \\ LM : i &= \frac{1}{h} \left( kY - \frac{\bar{M}}{P} \right) \end{aligned}$$

We plug  $i$  from LM function into IS function and solve for the equilibrium  $Y$ :

$$Y = \alpha \left( \bar{A} - \frac{b}{h} kY + \frac{b}{h} \frac{\bar{M}}{P} \right) \Rightarrow Y^{EQ} = \frac{\alpha \bar{A} + \frac{b}{h} \frac{\bar{M}}{P}}{1 + \alpha \frac{b}{h} k}$$

Then, using the LM function, we plug in  $Y^{EQ}$  for  $Y$  and we obtain the equilibrium interest rate,

$$i^{EQ} = \frac{1}{h} \left( kY^{EQ} - \frac{\bar{M}}{P} \right)$$

At  $(Y^{EQ}, i^{EQ})$ , both markets are simultaneously in equilibrium. As can be seen from these expressions, equilibrium is dependent on the exogenous factors  $\bar{A}, \frac{\bar{M}}{P}$  (given by exogenous behavior and government policy) and the exogenous parameters of the economy,  $\alpha, b, h, k$ . Hence, as we will show below, if there is a change in any one of these exogenous factors, equilibrium will change as a result.



✓ **The IS-LM Model** was first formulated in a 1937 article by Sir John Hicks, a Nobel laureate, as a graphical representation of the ideas set forth in the groundbreaking book by J.M. Keynes “*The General Theory of Employment, Interest, and Money*” which was published in 1936. The IS-LM Model was later extended by Alvin Hansen, and has been the most influential macroeconomic model from the late 1930’s to 1970’s. Although at times it loses relevance in economic theory as it describes only a short-run model of an economy, the IS-LM Model is still popular in undergraduate textbooks of introductory and intermediate macroeconomics for pedagogical purposes.

## CHANGES IN THE GENERAL EQUILIBRIUM IN THE GOODS AND MONEY MARKETS

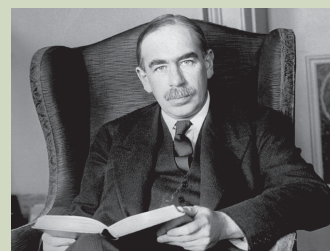
Recall that this is a short-run model, hence a change in demand will affect equilibrium output,  $Y$ . Changes in equilibrium output may occur whenever there is an exogenous change in demand. This change in demand may be due to changes in any component of autonomous spending or government policy, that is, changes in demand can stem from fiscal or monetary policy changes by the government, or may be directly caused by changes in autonomous consumption or investment demand. Below we examine the changes in the demand side of the economy by first looking at the changes in the goods market and then those in the money market.



### Further Reading

#### John Maynard KEYNES (1883-1946)

John Maynard Keynes was one of the most influential economists of the 20<sup>th</sup> century. His ideas have fundamentally shaped and changed how we understand the macroeconomy and economic policies of governments. His ideas became prominent during the Great Depression of the 1930s, when he challenged the neoclassical view that free markets eventually lead to full employment, as long as prices and wages are flexible. According to Keynes, the level of aggregate economic activity was determined by aggregate demand in an economy, and recognizing that there is wage and price stickiness in the short-run, insufficient demand could cause extended periods of recession. Keynes proposed that active use of demand-side policies, i.e. monetary and fiscal policies by the government, could relieve some of the negative effects of such recessions. He presented these ideas in his groundbreaking work published in 1936, *The General Theory of Employment, Interest and Money*.



**Source:** [https://www.investopedia.com/terms/j/john\\_maynard\\_keynes.asp](https://www.investopedia.com/terms/j/john_maynard_keynes.asp)



## Goods Market Effects

Changes in the goods market may stem from a change in any one of the components of aggregate expenditure: Consumption, investment, or government spending. These changes will affect the goods market equilibrium, hence directly alter the IS-curve relationship, and thus indirectly impact the money market equilibrium and the general equilibrium of the economy. Autonomous or behavioral changes in consumption and investment demand, as well as fiscal policy changes (such as changes in taxes, transfers, or government spending), will directly impact the components of aggregate expenditure. Changes in consumption may be due to changes in autonomous consumption and/or changes in disposable income due to changes in net taxes (taxes minus transfers), and changes in investment demand can be due to changes in the autonomous component of investment demand, and finally, an exogenous change in government spending will immediately alter aggregate expenditure.

## Expansionary Fiscal Policy

Suppose that there is an increase in autonomous expenditures  $\bar{A}$  due to expansionary fiscal policy, which can be through an increase in government spending,  $G$ , or a decrease in net taxes,  $T$ , which leads to an increase in the disposable income. The immediate effect of this expansionary fiscal policy will be on the goods market equilibrium and therefore, with the expansionary fiscal policy (let's say an increase in  $G$  from  $G_0$  to  $G_1$ , or  $\Delta G = G_1 - G_0$ ), there will be an immediate increase in aggregate demand in the goods market, at the given interest rate. Suppose we denote the initial aggregate demand by  $Z_0$ ,

$$Z_0 = C(Y_d) + I(i) + G_0 = c_0 + c(Y - T) + I(i) + G_0 = c_0 + cTR + c(1 - t)Y + \bar{I} - bi + G_0 = \bar{A}_0 - bi + c(1 - t)Y$$

where  $T = tY - TR$ ;  $I(i) = \bar{I} - bi$ ;  $\bar{A}_0 \equiv c_0 + cTR + \bar{I} + G_0$ . Now let's say that government spending increases from  $G_0$  to  $G_1$ , then aggregate demand becomes  $Z_1$ ,

$$Z_1 = c_0 + c(Y - T) + I(i) + G_1 = \bar{A}_1 - bi + c(1 - t)Y$$

holding all else the same and  $\bar{A}_1 \equiv c_0 + cTR + \bar{I} + G_1$ . Therefore, the constant term in the  $Z$  function changes autonomously by  $\Delta G$ .

Recall that in the goods market equilibrium, the IS-curve is given by

$$Y = \alpha (\bar{A} - bi)$$

where  $\alpha = \frac{1}{1 - c(1 - t)}$ .

Consequently, holding the interest rate constant, the magnitude of the shift in the IS-curve is by the multiplier,  $\alpha$ , times the magnitude of the change in autonomous spending:

$$\Delta Y = \alpha \Delta \bar{A} = \alpha \Delta G$$

At the given interest rate  $i_0$ , the increase in  $G$  increases the aggregate demand, and increases the equilibrium income in the goods market; as shown in Figure 4.3, this change in  $G$  shifts the IS-curve horizontally to the right by the magnitude  $\alpha\Delta\bar{A}$ , or by the full multiplier effect. As the IS-curve shifts to the right and at the initial interest rate  $i_0$ , the money market is no longer in equilibrium (the point  $A'$  falls to the right of the LM-curve).



attention

A change in the interest rate causes a movement along the IS-curve, not a shift in the IS-curve. Only autonomous changes (such as a change in government spending, net taxes, autonomous consumption, and autonomous investment) cause a shift in the IS-curve.

From this point on, the process of establishing a new simultaneous equilibrium in both markets is initiated. As shown in Figure 4.4, the increase in income and output in the goods market equilibrium at the given interest rate (from point  $A$  to point  $A'$ ) subsequently increases money demand as people now would want to hold more money for carrying out a higher volume of transactions; In the money market, the increase in money demand and the resulting excess demand for money raises the interest rate to  $i'$  at point  $B$ . At this high interest rate at point  $B$ , investment demand in the goods market falls, reduces aggregate demand, leads to an excess supply of goods, and then reduces equilibrium income and output, which is no longer an equilibrium in the money market with an excess supply of money (point  $B'$  in Figure 4.4). This cycle of establishing equilibrium in one market and creating disequilibrium in the other market (with an excess demand or an excess supply) continues until both markets find their equilibria simultaneously at point  $E$ . The relative shapes of IS and LM curves (one negatively sloped, the other positively sloped) ensure that the equilibrium is stable, and once it is disturbed, it is possible to reestablish a new equilibrium.

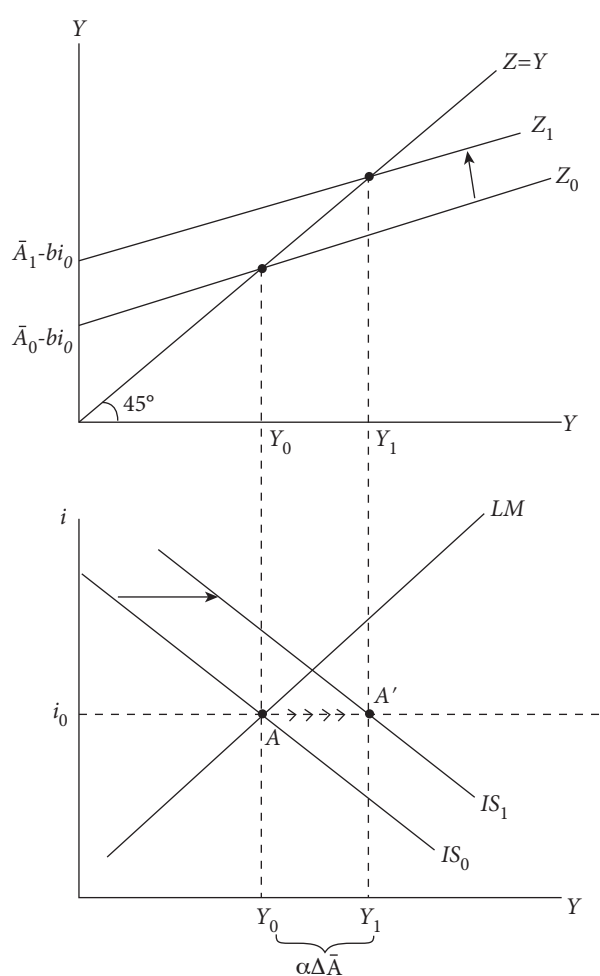


Figure 4.3 An increase in autonomous expenditures in the goods market.

**A stable equilibrium** exists if a model or a system tends to converge back to equilibrium if it is disturbed or shocked exogenously.

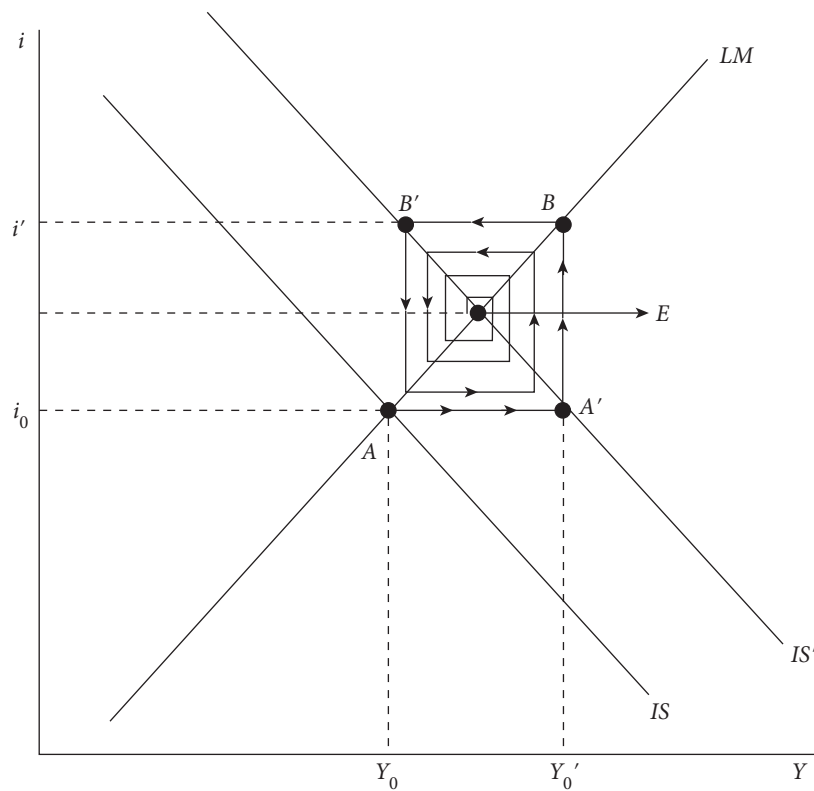


Figure 4.4 Establishing a new equilibrium in the IS-LM model.

More specifically, the increase in government spending creates a **crowding out effect** on private spending. An increase in government spending  $G$  leads to an increase in the interest rate and therefore discourages private investment spending. Before the interest rate effect, the increase in output in response to an increase in  $G$  is by the full multiplier effect (from  $A$  to  $A'$  in Figure 4.5), but with the increase in the interest rate and hence the decrease in investment demand, the increase in the output (from  $Y_0$  to  $Y_1$ ) is by less than the full multiplier effect (from  $Y_0$  to  $Y_0'$ ) in the final equilibrium. In this case, we say that an increase in government spending crowds out private spending. Now in the new equilibrium, investment demand is less than what it used to be in the initial equilibrium.

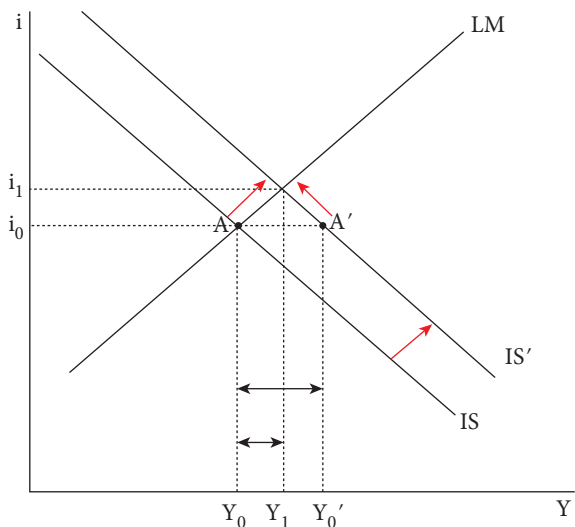


Figure 4.5 Expansionary fiscal policy.

**Crowding out effect** takes place when an increase in government spending negatively affects private spending. In practice, this usually takes place when the government increases borrowing in order to finance increased spending, which prompts an increase in interest rates that eventually reduces private spending such as investments. An increase in the interest rate increases the opportunity cost of borrowing by businesses and hence discourages them from engaging in new investments of physical capital.

In Figure 4.6, we present a detailed examination of this fiscal policy change: In panel (a), the increase in autonomous spending from  $A$  to  $\bar{A}$ , leads to an upward shift in aggregate demand function  $Z$  in the goods market, at the given interest rate  $i_0$ . This upward shift in aggregate demand (from  $Z_0$  to  $Z'_0$ ) leads to a new higher equilibrium income and output in the goods market. With this higher income, there will be a higher transactions or liquidity demand for money, and thus the money demand tends to increase in the money market from  $M^d(Y_0)$  to  $M^d(Y'_0)$  (Panel b). At the initial equilibrium interest rate, there is now an excess demand for money. This excess demand for money drives the interest rate up (this is the movement up along the LM curve from point  $A$  towards point  $E$ ) in panel (c). As interest rate tends to increase in the money market, this will lead to a decrease in investment demand in the goods market, leading to a downward shift in the aggregate demand function, downwards from  $Z'_0$ . This downward shift of the aggregate demand is characterized as an upward movement along the new IS curve from point  $A'$  towards point  $E$ . With this fall in income, the money demand function also moves somewhat backwards from  $M^d(Y'_0)$ , until a new equilibrium in both goods and money markets is established simultaneously at  $(Y_1, i_1)$ .

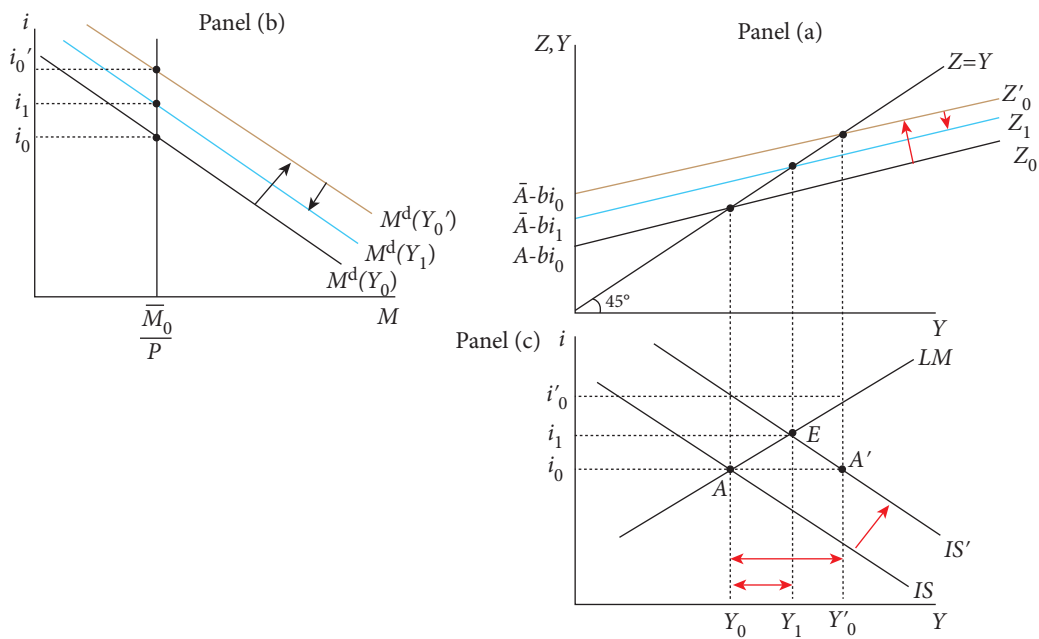


Figure 4.6 A detailed examination of the impact of expansionary fiscal policy.



#### your turn 1

Access the TurkSTAT website (<https://www.tuik.gov.tr/>) and evaluate the composition of GDP in Türkiye annually from 1998 to 2020 using the National Accounts database. Do you observe a compositional change in GDP in terms of the shares of consumption, government spending and investment over the last 22 years?

### Contractionary Fiscal Policy

Suppose now that the government wishes to reduce the budget deficit, and to accomplish this objective, the government decreases government spending  $G$ , or increases net taxes  $T$ . Decreasing government spending or increasing net taxes are examples of contractionary fiscal policy. As a result of contractionary fiscal policy, aggregate expenditure in the goods market falls, leading to a fall in equilibrium income in the goods market, at the initially given interest rate. With the fall in income in the goods market, demand for money also decreases in the money market, which leads to a decrease in interest rate in money market equilibrium, a downward movement along the LM-curve. The fall in the interest rate in turn leads to an increase in investment and aggregate demand in the goods market, which tends to increase the equilibrium income, causing a downward movement along the new IS-curve,  $IS'$ . The simultaneous movements downward along the LM and downward along the new IS eventually establish a new equilibrium at  $(Y_1, i_1)$ .

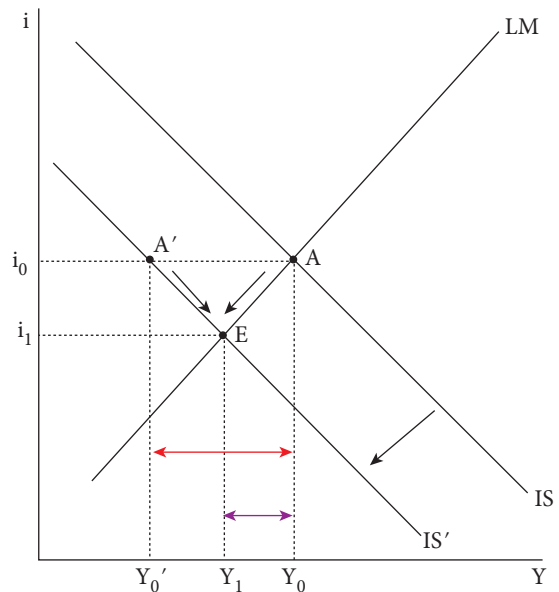


Figure 4.7 Contractionary fiscal policy.

### Effectiveness of Fiscal Policy

The effectiveness of fiscal policy is assessed by the magnitude of the impact of policy changes on output,  $Y$ . Let's suppose that there is an increase in government spending,  $G$ , by  $\Delta G$ . The magnitude of the change in  $Y$  in response to a given change in  $G$  depends on the slope of the LM-curve, and also on the magnitude of the fiscal multiplier,  $\alpha$ .

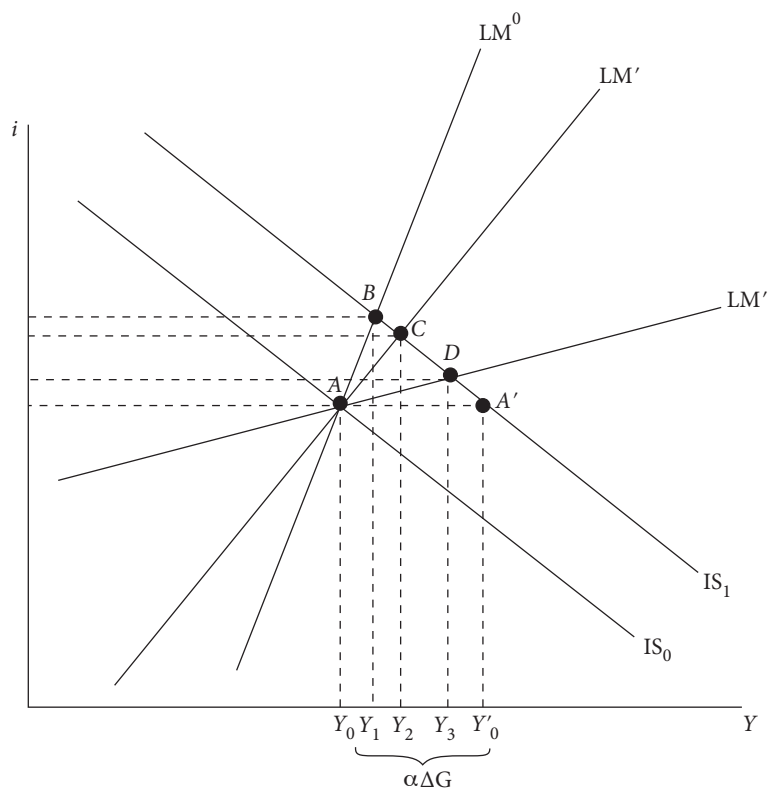


Figure 4.8 Effectiveness of fiscal policy.

The slope of the LM-curve is given by  $k/h$ , where  $k$  is the sensitivity of money demand to changes in  $Y$  (this is about the magnitude of the shift in money demand curve in response to a change in  $Y$ ),  $h$  is the sensitivity of money demand to changes in interest rate (this is about the slope of the money demand). Hence, the higher  $k$ , the higher the slope of the LM-curve; the lower the  $h$ , the higher the slope of the LM-curve. As such, for a given change in government spending, the first impact is in the goods market, leading to a new equilibrium in the goods market with a higher income level (let's say for a given  $\Delta G$ , the new equilibrium in the goods market is at point  $A'$  on the new IS-curve, as given in Figure 4.8). Now in the money market, if  $k$  is high, the change in money demand will be high (a large shift in the money demand function), leading to a large increase in interest rate in the money market equilibrium. This large increase in interest rate will prompt a large drop in investments, holding all else the same. This is the large crowding out effect of this large increase in interest rate. Therefore, compared to a small  $k$  (leading to a flatter LM-curve with a smaller slope) where the increase in money demand is relatively small for a given change in equilibrium income and hence creates a small change in interest rate, the large  $k$  creates a large crowding out effect on income and output, and hence the ultimate increase in income and output is relatively small, implying a small effect of the fiscal policy.

Similarly, when  $h$  is low, the slope of the money demand curve is high, and to maintain equilibrium in the money market, a given change in  $Y$  requires a large increase in the interest rate, which also implies a high slope for the LM-curve. As explained above, a large increase in the interest rate brings about a large crowding out effect in private investments and hence renders the given fiscal policy change relatively ineffective in raising output.

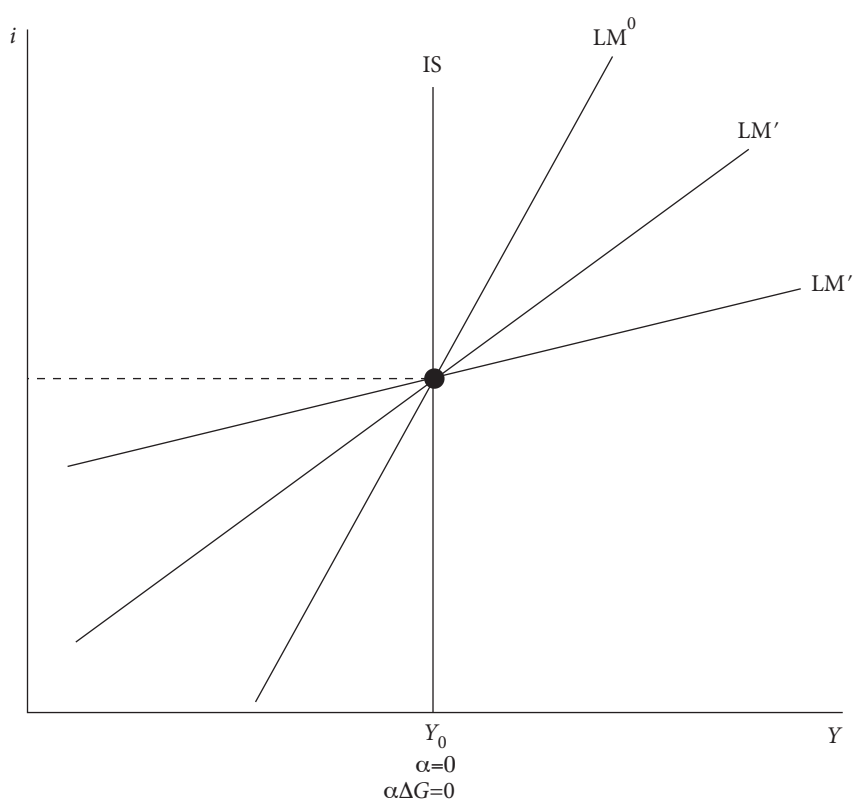


Figure 4.9 Fiscal policy is fully ineffective when the multiplier is zero.

Regardless of the slope of the LM-curve, if the goods market multiplier  $\alpha$  is equal to zero, no matter how much the government applies fiscal policy change, there will be no response in income and output, and the IS-curve is vertical (Figure 4.9). When the fiscal multiplier is equal to zero, there will be no shift in

the IS-curve, hence fiscal policy will be fully ineffective in this case. Also, if the parameter  $b$  goes to infinity, the IS-curve is horizontal, and a change in autonomous spending will not change the position of IS, no matter how much government policy fiscal change is applied, IS will not change its position.

### Money Market Effects

The government may also resort to monetary policy changes to impact income and output in this short-run model of an economy. The government uses monetary policy to impact the interest rate, which in turn affects real activity through changes in investment demand and hence aggregate demand. The changes in money supply can be accomplished through open market operations, changes in the required reserve ratio, or changes in the discount rate. Such changes in money supply evoke the monetary transmission mechanism, and how effective the monetary policy is determined by how effectively this mechanism works.

### Expansionary Monetary Policy

Consider the following function for the LM-curve:

$$i = \frac{1}{h} \left( kY - \frac{\bar{M}}{P} \right)$$

Suppose that the central bank changes the money supply by the magnitude  $\Delta \bar{M}$ , holding all else constant. The magnitude of the shift in the LM-curve in response to the change in nominal money supply by  $\Delta \bar{M}$  is given by the vertical distance from A to A' in Figure 4.10 (when  $\Delta Y = 0$ , as given by the change in the equilibrium interest rate in the money market):

$$\Delta i = -\frac{1}{h} \Delta \left( \frac{\bar{M}}{P} \right)$$

Consider an increase in nominal money supply,  $\bar{M}$  (which may be accomplished by an open market purchase, a fall in the discount rate, or a fall in the required reserve ratio). In the money market, with the excess supply of money, the interest rate tends to decrease. This new equilibrium in the money market is on the new LM-curve,  $LM'$  (a rightward shift in the LM-curve in Figure 4.10). In the goods market, with the fall in interest rate, an increase in investment demand is prompted. The increase in investment demand increases aggregate expenditure and hence in goods market equilibrium, there will be an increase in income and output,  $Y$  (at the new lower interest rate,  $Y$  rises in goods market equilibrium) towards point B in Figure 4.10. This upward tendency in income stimulates an increase in money demand, therefore in the money market, the interest rate tends to increase from where it first fell. Along with the tendency of an increase in interest rate, investment demand now falls, and aggregate expenditure falls, hence this leads to a fall in equilibrium income in the goods market. This increase in the interest rate is represented by an upward movement along the new LM-curve from point A', and the

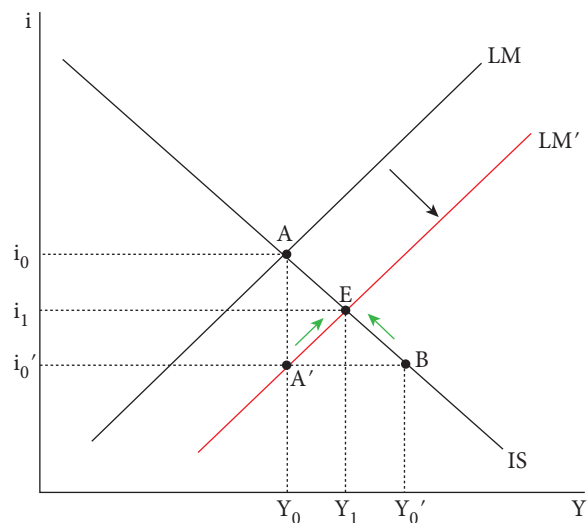


Figure 4.10 Expansionary monetary policy.

decrease in income is represented by an upward movement along the IS-curve from point B. The upward movement along IS and LM curves stops when a simultaneous equilibrium in both markets is accomplished at point E. This process which is initiated by a monetary policy change is called the “**monetary transmission mechanism**”.

**Monetary transmission mechanism:** Monetary policy changes are intended to affect real economic activity. Changes in the money market eventually affect the equilibrium in the goods market. The monetary transmission mechanism is the process by which changes in monetary policy influence asset prices, interest rates, aggregate demand, and finally the overall economic activity. The traditional monetary transmission mechanism works through the interest rate channel to affect investment demand, aggregate demand, and finally the level of economic activity.

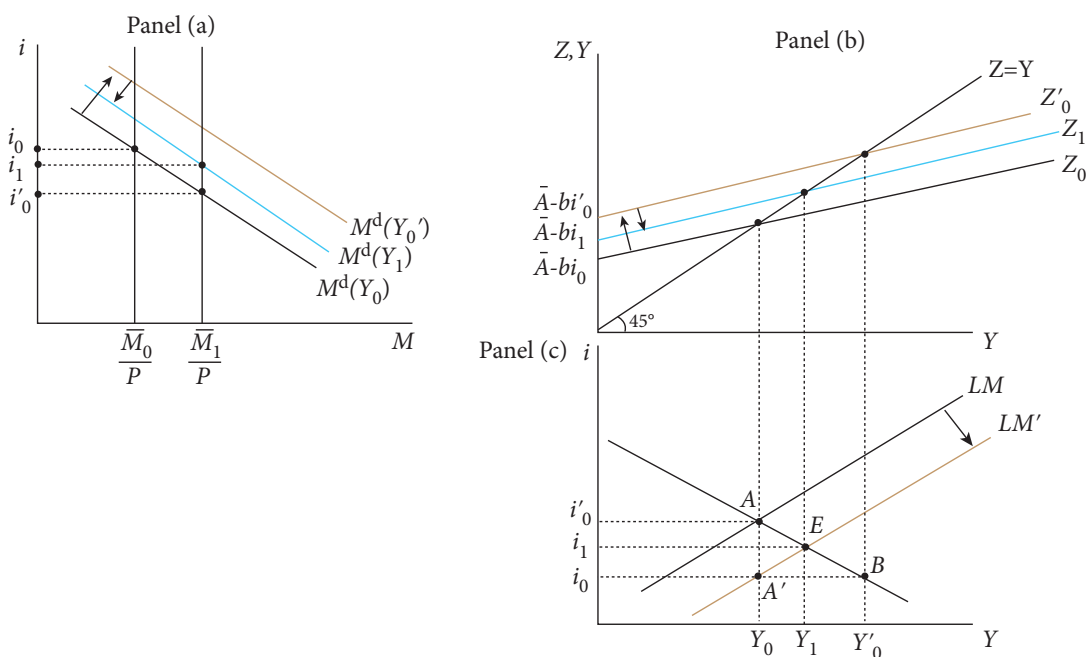


Figure 4.11 A detailed examination of the impact of expansionary monetary policy.

In Figure 4.11 above, we describe how the monetary transmission mechanism works. As given in Panel (a), first there is an increase in the nominal money supply, from  $\bar{M}_0$  to  $\bar{M}_1$ . This increase in the nominal money supply leads to an excess supply of money at the given interest rate, and hence tends to reduce the interest rate in the money market equilibrium at the given income level (notice the rightward shift of the LM-curve in Panel (c) at the initially given income level). But now, the decrease in the interest rate induces new investment demand, increases aggregate demand from  $Z_0$  to  $Z'_0$  and thus increases equilibrium income in the goods market as given in Panel (b). The increase in income induces new money demand, shifts the money demand function rightwards, and hence tends to increase the interest rate from where it first fell with the initial money supply shock. With the increase in interest rate, investment is discouraged, the aggregate demand starts to fall from  $Z'_0$  towards  $Z_1$ . Eventually, as shown in Panel (c), both the goods and money markets will establish simultaneous equilibrium at  $(Y_1, i_1)$ .



attention

A change in the income level causes a movement along the LM-curve, not a shift in the LM-curve. Only changes in real money supply can cause a shift in the LM-curve.



### Contractionary Monetary Policy

The monetary authority may also implement contractionary monetary policy to reduce the nominal money supply with the objective of slowing the economy down, which can be accomplished by an open market sale, an increase in discount rate, or an increase in required reserve ratio. With an exogenous fall in the nominal money supply, there will be an excess demand for money in the money market, and interest rate increases as a result (this is the immediate impact in the money market) and shifts the LM-curve to  $LM'$  in Figure 4.12 (the new equilibrium in the money market is at point  $A'$ ). With the increase in interest rate, investment demand falls and aggregate demand also falls in the goods market. A new equilibrium in the goods market is reached at a lower income and output level (on the IS-curve at point B in Figure 4.12). But at this new lower income level, money demand falls and there occurs an excess supply of money in the money market. Hence, as long as there is an excess supply of money with low money demand, the interest rate tends to fall (the downward movement along the  $LM'$ -curve from point  $A'$  towards point E), and as the interest rate falls, investment demand increases and aggregate demand increases, again a downward movement along the IS-curve (from point B to point E). Both markets will eventually be in simultaneous equilibrium at point E.

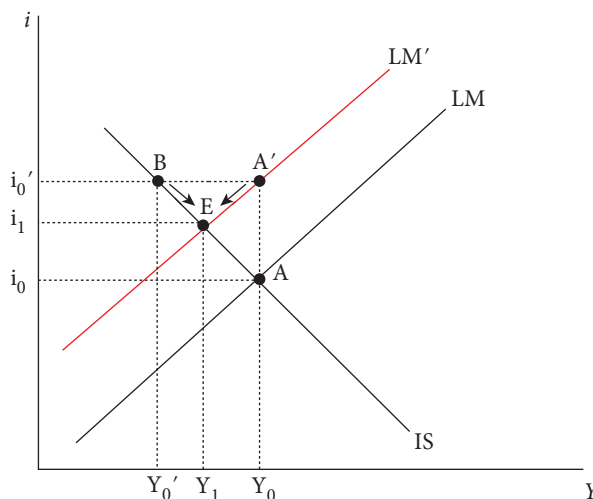


Figure 4.12 Contractionary monetary policy.

### Effectiveness of Monetary Policy

First and foremost, the effectiveness of a given monetary policy change (leading to an increase or a decrease in the nominal money supply) depends on the slope of the IS-curve: The flatter the IS-curve, the more effective monetary policy is in terms of affecting income and output.

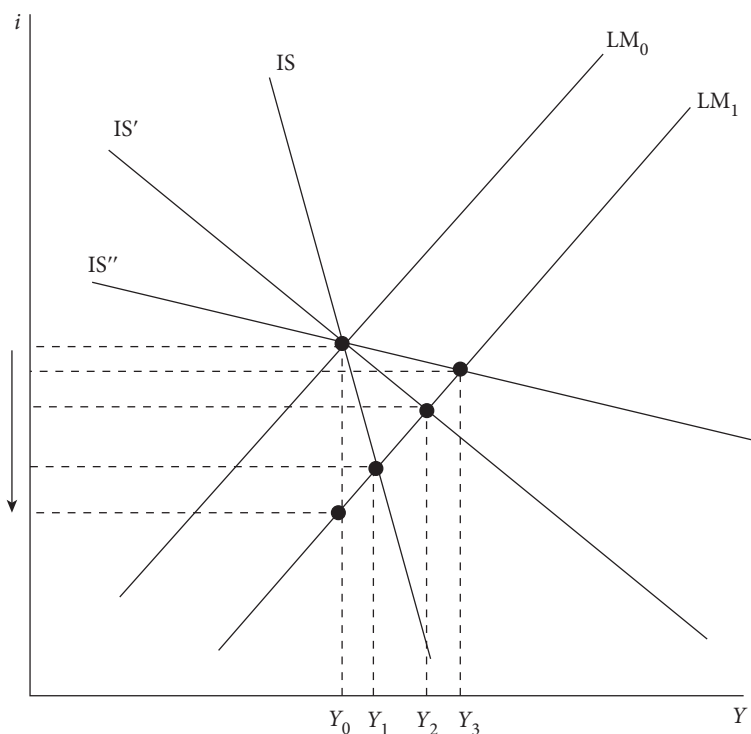


Figure 4.13 Effectiveness of monetary policy.

Let's say that for a given magnitude of a change in nominal money supply, the LM-curve shifts from  $LM_0$  to  $LM_1$  (Figure 4.13). With the implementation of expansionary monetary policy, the interest rate tends to fall in the money market equilibrium. How the goods market equilibrium reacts to this fall in the interest rate in the money market determines the effectiveness of the given change in monetary policy. For the given fall in the interest rate, if investment demand is very sensitive to changes in the interest rate, the response in investment demand will be large, and therefore, the investment demand will increase by a lot, and aggregate demand will increase by a lot, and hence the change in equilibrium income and output will be large. The sensitivity of investment demand to changes in interest rate is given by the parameter  $b$  in the investment demand function, which also determines the slope of the IS-curve:

$$i = \frac{1}{b} \left( \bar{A} - \frac{Y}{\alpha} \right)$$

Recall from Chapter 2 that the negative slope of the IS-curve is given by,

$$\frac{\Delta i}{\Delta Y} = -\frac{1}{b\alpha}$$

Hence for a large  $b$  parameter, the slope of the IS-curve will be small, and therefore the IS-curve will be relatively flat (as in  $IS''$  in Figure 4.13). Reversely, if the investment demand is not very responsive to changes in the interest rate and the  $b$  parameter is small (the slope of the IS-curve is large and the IS-curve is steep), there will not be a large response in the goods market to changes in the interest rate, and hence the equilibrium income and output will not change by too much. Therefore, for a given increase (decrease) in money supply, how much the output increases (decreases) depends on the sensitivity of investments to changes in interest rate in the money market.

Secondly, whether monetary policy is effective or not also depends on the shape of the LM curve.

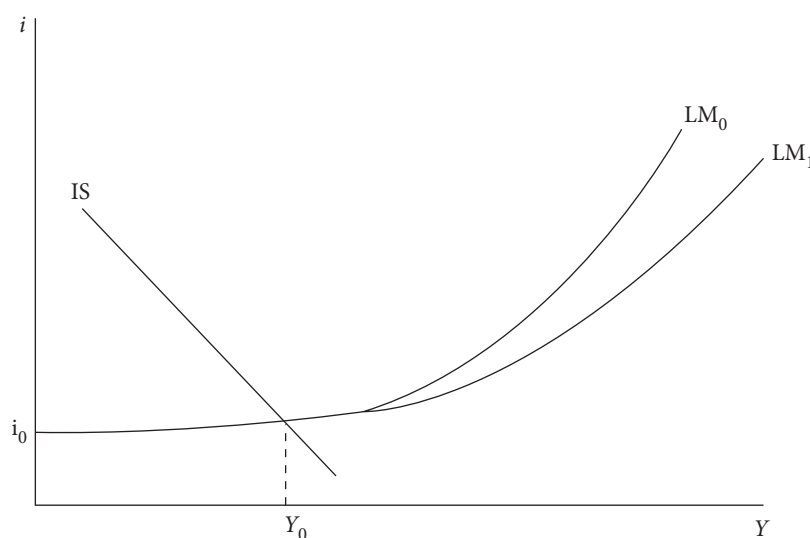


Figure 4.14 Ineffectiveness of monetary policy when the LM-curve is flat.

When the LM curve has a completely flat section ( $b \rightarrow -\infty$ ) then any change in the money supply will not be able to stimulate any change in the interest rate (no movement in the flat section of the LM-curve), and therefore, if the initial equilibrium is located in this flat section of LM-curve, there will be no change in the equilibrium output in the economy (Figure 4.14). This is the special case of the “Liquidity Trap” in monetary policy, which will be discussed in detail below under the section “Special Cases”.

### The LM Relation and the Interest Rate Rule

So far, we have derived the LM-curve (i.e., relationship between  $Y$  and  $i$  in the money market equilibrium) for an exogenously given money supply, and we have shown that the LM-curve will shift whenever there are exogenous changes in the money supply (when central bank implements monetary policy changes). However, in real world situations, central banks think in terms of targeting the interest rate, and adjusting the money supply to the changes in economic activity to maintain the targeted interest rate. In that sense, money supply in fact is endogenous, and responds to economic activity level. Hence, we may derive the LM function under an alternative assumption that the central bank sets the interest rate and adjusts the money supply to meet the targeted interest rate.

Consider the initial money market equilibrium with money supply  $M_0$  in Figure 4.15 Panel (a). Suppose that the targeted interest rate by the government is  $i_0^*$ , and the central bank sets the money supply as  $M_0$  to accommodate for real money demand at income level  $Y_0$ . As such, the equilibrium in the money market is at point A, which corresponds to point A on the  $LM_0$  curve in Panel (b).

Now suppose the level of economic activity increases from  $Y_0$  to  $Y_1$ . If the policymaker keeps the targeted interest rate at  $i_0^*$ , then the central bank must adjust the money supply to meet the increase in real money demand. If the interest rate target is kept constant at  $i_0^*$ , then the new equilibrium in the money market is at point C. In this case, the LM curve is flat and the corresponding point on  $LM_0$  is point C.

As an alternative, let's say that the government changes targeted interest rates along with the level of economic activity and does not adjust the money supply. This requires a radical change in the targeted interest rate from  $i_0^*$  to  $i_1^*$ , the equilibrium in the money market is at point B, which corresponds to point B on the upward sloping  $LM_1$  curve. On the other hand, the policymaker may decide to accommodate for some of the increase in money demand and raise the money supply somewhat, but not to keep the initial interest rate target. The target may increase to  $i_2^*$  while money supply increases to  $M_2$ , given by the equilibrium point D in Panel (a). In this case, the corresponding  $LM_2$  curve will be flatter than the  $LM_1$  curve. Accordingly, the slope of the LM-curve now depends on the willingness of the policymaker to adjust the targeted interest rate and hence the money supply in response to changes in income level.

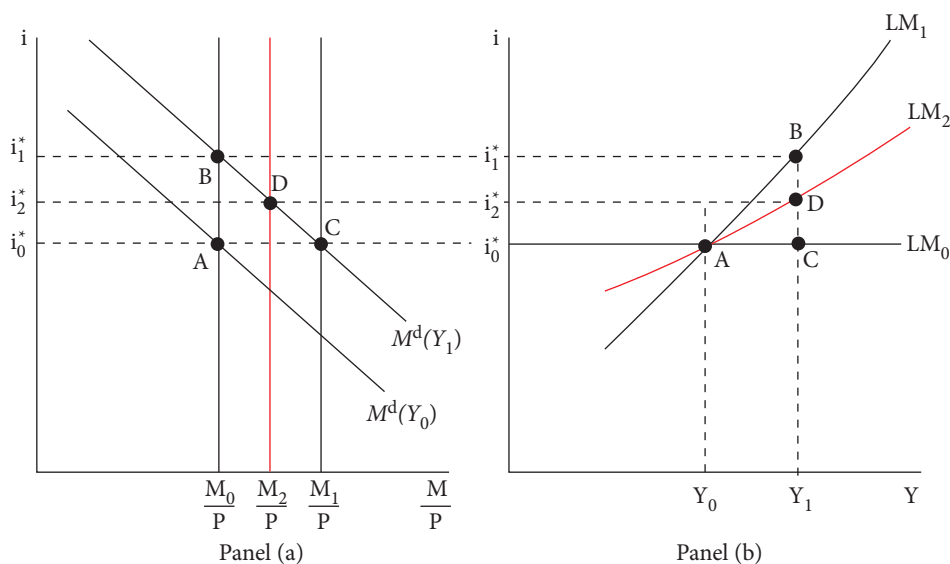


Figure 4.15 The Interest rate rule and the LM-curve.

If the central bank follows an **interest rate rule** (i.e., targets the interest rate rather than the money supply), the LM-curve that we derive describes the relationship between the level of economic activity and targeted the interest rate, where the central bank lets the money supply adjust as needed.

The slope of the LM-curve then depends on how much the central bank lets the targeted interest rate to change in response to an increase in income and thus money demand.

## MONETARY AND FISCAL POLICY MIXES

In the real world, policy makers use fiscal and monetary policies together to create the desired effect on the interest rate and income. The government may target the interest rate and/or target the income level. Depending on the goal, a combination of fiscal and monetary policies, whether in the same direction or opposite directions may be used.

The first example of a policy mix is “accommodative monetary policy”. Suppose that the government wants to boost aggregate demand, but does not want the interest rate to go up as a result of the increase in demand. Let’s say that the government increases government spending or decreases taxes to keep aggregate demand high. This expansionary fiscal policy will tend to increase interest rates and lead to a crowding out effect on private spending. To prevent an increase in the interest rate and the resulting crowding out effect, the central bank increases the money supply. This action by the central bank will result in a full multiplier effect of the fiscal policy on income (Figure 4.16).

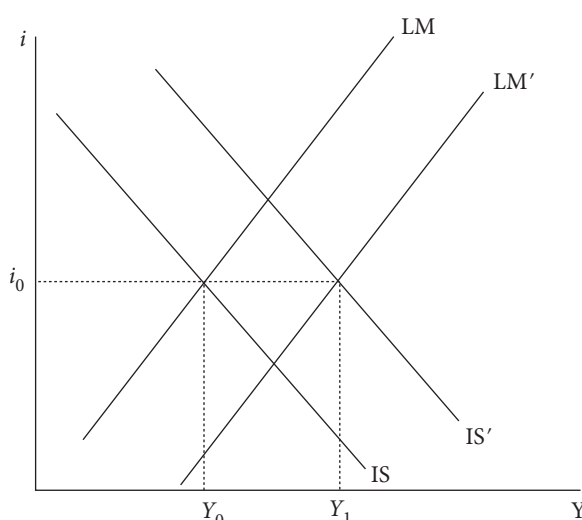


Figure 4.16 Simultaneous expansionary monetary and fiscal policies.

In real world examples, when the government wants to increase government spending, it will resort to issuing new government bonds to finance new spending. When the central bank conducts an open market purchase to buy these government bonds, money supply will increase. As such, the government will accomplish the goal of stimulating income and output while keeping the interest rates constant or at the targeted level.

Another example is when the government wants to cut down the budget deficit, by reducing government spending or raising taxes. However, this action will lead to a fall in income and output. To prevent a recession, the central bank boosts the money supply and reduces interest rates to keep demand high (Figure 4.17 Panel a). This is another example of accommodative monetary policy. As a result, the budget deficit is reduced and there is no fall in income and output, and if interest rates fall just enough, there may also be an increase in income and output as a result of accommodative monetary policy (this is the policy mix that was implemented in the early 1990s by the Clinton Administration and Fed Chairman Alan Greenspan to reduce budget deficits and at the same time prevent a recession in the US economy).

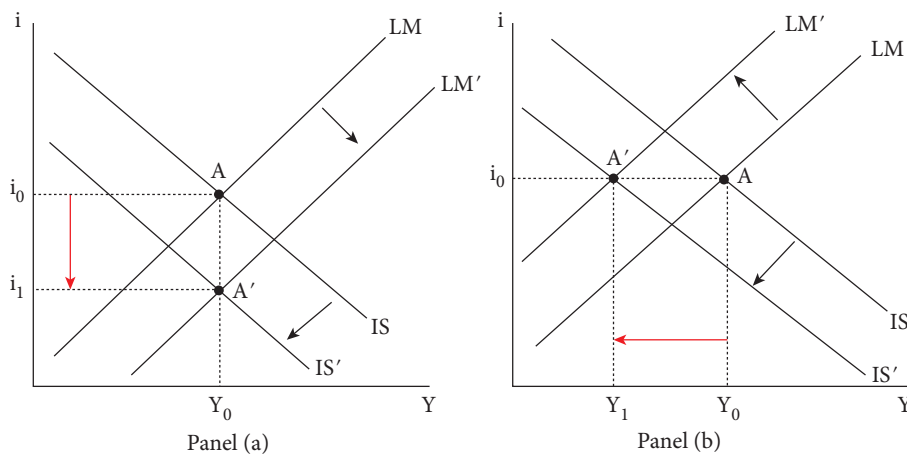


Figure 4.17 Contractionary fiscal policy.

Another example may be where there exist inflationary pressures in the economy, and hence the government wants to cool down the economy by reducing or scaling back the aggregate expenditures. The government then implements a contractionary fiscal policy. But, the fall in interest rate as a result of contractionary fiscal policy may further boost aggregate demand, hence implements contractionary monetary policy to keep interest rates at the original level (Figure 4.17 Panel b). The outcome is the full multiplier effect of contractionary fiscal policy on income and output.

The last example of a policy mix is when expansionary fiscal policy and contractionary monetary policy are implemented together (Figure 4.18). This policy mix can be implemented when the government raises government spending, but does not want the economy to be overstimulated over the current GDP level. Here, with the increase in the interest rate, we observe that private spending is completely crowded out by an increase in government spending.

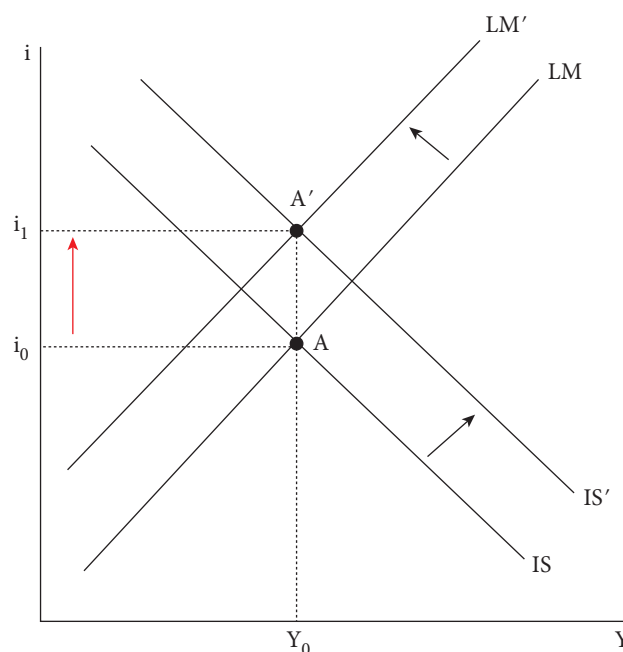


Figure 4.18 Simultaneous expansionary fiscal policy and contractionary monetary policy.



## your turn 2

Consider the following economy with the following goods market relations:

$$C = 600 + 0.5Y^d$$

$$T = 0.20Y$$

$$I = 1000 - 30i$$

$$G = 500$$

and the following money demand function:

$$\frac{M^d}{P} = 0.6Y - 30i$$

where  $C$  is consumption,  $Y^d$  is disposable income,  $T$  is net taxes,  $Y$  is income,  $I$  is investment,  $G$  is government spending, and  $i$  is the interest rate. The price level is fixed  $P = 1$  and the nominal money stock supplied by the central bank is  $M^s = 600$ .

- Derive the IS and LM curve relationships. What is the equilibrium value of income? What are the equilibrium values of net taxes, private consumption, and private investment?
- Suppose that the government would like to increase the level of income to  $Y = 2500$ . Find out the required change in government expenditures that will allow the government to attain its income target. What happens to the budget deficit? Private savings? Private investment? Calculate.
- Show the effect of the policy you suggested in part b on  $(Y, i)$ -space using IS-LM framework. Make sure to label your graphs properly, be precise in describing the movement from the original equilibrium to the new one.
- Now assume that we are still in the equilibrium you found in part b. The government would like to make sure that the private investment level stays the same as in part a, by this fiscal policy action. Propose a monetary policy change that will give this result and describe it using the IS-LM framework.

## SPECIAL CASES

The IS-LM Model that we have described above assumes that agents are well-behaved in their money market choices: Agents optimally hold both money and interest-bearing bonds as part of their wealth, and their demand for money is negatively related to the interest rate on bonds as the interest rate is the opportunity cost of holding money. However, there may be extreme cases where the interest rate is so low that the opportunity cost of holding money is close to zero, or where agents hold money only for transactions purposes, and they do have the choice of holding bonds. In these extreme cases, policy choices for the government may be limited: Monetary policy will not be effective if the opportunity cost of holding money is close to zero, and fiscal policy will not be effective if people choose to hold money only for transaction purposes. Below, we examine these special cases as the “*liquidity trap*” and the “*Quantity Theory of Money*”.

### The Liquidity Trap

An economy is said to be in a “*liquidity trap*” when the interest rate is so low that people would rather hold money than buy or hold bonds. When the interest rate is low enough close to zero or equal to zero, it means that the opportunity cost of holding money is zero or close to zero, hence people do not bother to hold bonds. Recall the money demand function

$$M^d = kY - hi$$

When the economy is in a liquidity trap, for very low rates of interest,  $h \rightarrow -\infty$ , that is, at very low rates of interest, the slopes of the money demand curve and the LM-curve are zero, as shown in Figure 4.19. If the equilibrium of IS and LM is initially at this flat section of the LM-curve, then any attempt of the central bank to escape the trap by increasing the money supply would be futile. When the economy is in a liquidity trap, monetary policy to stimulate income will be fully ineffective, because the central bank cannot stimulate additional demand with a decrease in interest rates. Whatever increase in money supply there is, will be held by the public, and will not stimulate any demand for bonds, and hence does not change the price of bonds, and the interest rate.

On the other hand, as long as the economy is in a liquidity trap, any fiscal policy change will be fully effective on income and output, since the interest rate does not change in response to a fiscal policy change so that there is no crowding out effect on private expenditures. And the effect of fiscal policy will be by the full multiplier effect.

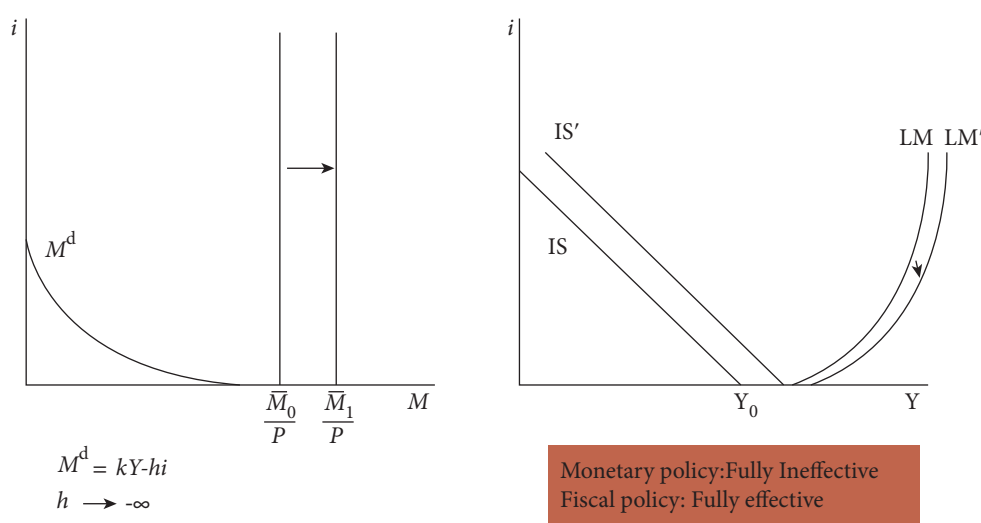


Figure 4.19 The Liquidity trap and the effectiveness of policy.

**Liquidity Trap:** As described in 1936 in “*The General Theory of Employment, Interest and Money*” by J. M. Keynes, liquidity trap is a situation in which “...after the rate of interest has fallen to a certain level, liquidity-preference may become virtually absolute in the sense that almost everyone prefers cash to holding a debt which yields a low rate of interest. In this event the monetary authority would have lost effective control over the rate of interest”. That is, in an economy in a liquidity trap, interest rates are extremely low and individuals prefer holding their money in perfectly liquid form rather than in the form of interest-bearing assets.



## Further Reading

### Liquidity Trap and the “Lost Decade” in Japan

After experiencing rapid growth in the 1980's, the Japanese economy entered a decade of low growth and deflation from 1991 to 2002. Between 1991 and 2002, Japanese annual GDP growth was only 0.6 percent on average. This period is called the “Lost Decade” in Japan, and this is also a time when short-term interest rates fell close to zero, below 1 percent. In his 1998 article, Paul Krugman (1998) claimed that the Japanese economy was in a liquidity trap during the 1990's:

*“...Over the past several years, Japanese money market rates have been consistently below 1 percent, and the Bank of Japan plausibly claims that it can do no more; yet the Japanese economy, which has been stagnant since 1991, is sliding deeper into recession. Since Japan is such an important economy, and its slump threatens to shatter the already fragile prospects for economic recovery in the rest of Asia, understanding what is going wrong there has become quite urgent. And there is also a deeper reason for concern: if this can happen to Japan, perhaps it can happen elsewhere. In short, it is time to reexamine the theory of liquidity traps, which has turned out not to be irrelevant after all.”*

**Source:** Krugman, P. R. (1998) “It’s Baaack: Japan’s Slump and the Return of the Liquidity Trap”, *Brookings Papers on Economic Activity* (2): 137-205.

## The Quantity Theory of Money

It may also be the case that people are fully unresponsive to changes in the interest rate in their demand for money, and people hold money only to satisfy their transactions demand to buy goods in the goods market. Regardless of what the interest rate is, people hold the same amount of money, as dictated by their volume of transactions, only. In this case,  $h = 0$  in the money demand function, hence money demand function becomes

$$M^d = kY$$

Here people hold money as a fraction of their income. In the equilibrium of the money market,

$$\frac{M}{P} = kY$$

$$\frac{M}{k} = PY$$

Here,  $1/k$  is the **velocity of money**. Velocity is the number of times one unit of currency is spent or changes hands to purchase goods and services per unit of time.

**Velocity of money:** It is the measure of how many times a unit of currency is used to purchase goods and services during a given period of time. It is measured as the ratio of the nominal GDP (or the nominal value of transactions) to the nominal money supply. If the velocity of money is rising with a constant money supply, it implies that the volume of transactions is also rising.



When  $h = 0$ , the LM-curve is vertical (Figure 4.20). In this case, fiscal policy changes are fully ineffective in changing income. Consider expansionary fiscal policy with an increase in  $G$ . The increase in  $G$  will fully crowd out private investments, and goods market equilibrium will be reestablished at a higher interest rate with the same level of income. In the money market, the interest rate does not matter for equilibrium, hence any rate of interest may satisfy equilibrium conditions in the money market.

The effectiveness of monetary policy in this environment depends on how the prices respond to the changes in the money supply. If the prices increase fully proportionally or one-to-one with the increase in the money supply, then there will be no change in the real money supply and the income level. But if the prices increase less than proportionally with the increase in the money supply, the real money supply will increase and the income must also increase to assure equilibrium in the money market. In that sense, the effectiveness of monetary policy depends on the degree of response in prices to the changes in the nominal money supply.

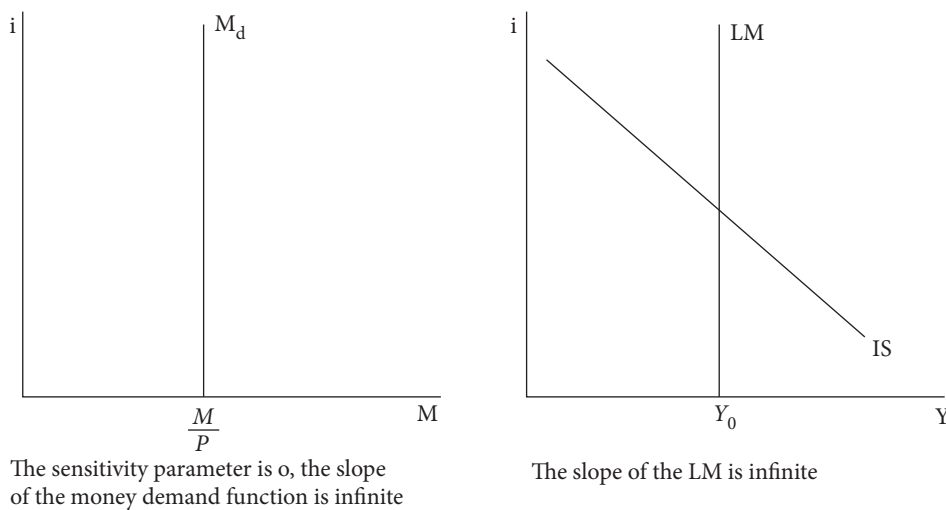


Figure 4.20 Vertical money demand and LM curves under Quantity Theory of Money.

**Quantity Theory of Money:** According to the Quantity Theory of Money, the general price level of goods and services is directly proportional to the amount of money in circulation, or the money supply. For example, if the money supply doubles, the general level of prices will also double. This theory was popularized by economists Anna Schwartz and Milton Friedman in their book *A Monetary History of the United States*, published in 1963.



## your turn 3

Based on the information in this chapter, state whether the following statements are true, false, or uncertain. Explain your answers briefly.

- a. The IS-curve is downward sloping because goods market equilibrium implies that a lower level of government spending leads to a lower level of output.
- b. If the government spending and taxes increase exactly by the same amount, the IS-curve does not shift.
- c. When investment demand is not very sensitive to changes in the interest rate, expansionary monetary policy is not very effective in stimulating output.
- d. A higher sensitivity of money demand to changes in income implies a higher effectiveness of fiscal policy.
- e. Expansionary fiscal policy coupled with expansionary monetary policy implies that one of the objectives of the government is to keep the interest rate unchanged.

## LO 1

Establish simultaneous equilibrium in the goods and money markets and explain the meaning of the simultaneous equilibrium

Simultaneous or general equilibrium in the goods and money markets in a closed economy occurs at the intersection of IS and LM curves at some interest rate and income pair. At the general equilibrium, the interest rate is such that people hold the available real money stock to purchase final goods, and the demand for final goods is equal to the supply of final goods or the GDP. The general equilibrium is unique and stable in the sense that there is no other possible combination of interest rate and income where both goods and money markets are in equilibrium, and that when one the equilibrium is disturbed with an exogenous shock, the economy tends to converge to an equilibrium, eventually.

## LO 2

Understand how changes in fiscal policy affect the general equilibrium and the components of aggregate expenditure

Fiscal policy changes, i.e. a fiscal expansion or a fiscal contraction, lead to changes in the level of income and the interest rate in the short-run equilibrium of an economy. Fiscal policy changes can be with a change in government spending and/or changes in net taxes. Both changes directly affect the goods market equilibrium, and indirectly affect the money market and thus the interest rate. Changes in the interest rate in turn cause changes in private spending such as investment, and hence lead further to changes in aggregate demand. In the final analysis, because of the change in the interest rate and the change in private spending, the change in the income is not one-to-one with the fiscal policy change: For example if the increase in government spending leads to an increase in the interest rate, some private spending will be crowded out as a result, and the increase in income will be by less than the increase in government spending.

## LO 3

Understand how changes in monetary policy affect the general equilibrium and the components of aggregate expenditure

Monetary policy changes first impact the money market and the equilibrium interest rate, which in turn affects the goods market equilibrium and the equilibrium income level. As such, the impact of monetary policy changes on economic activity occur only indirectly. How monetary policy changes affect economic activity is given by how the monetary transmission mechanism works in an economy. In typical economies, monetary transmission works through the interest rate channel, which affects the cost of borrowing and the opportunity cost of investment.

## LO 4

Assess the effectiveness of fiscal and monetary policy changes on income and output

The same fiscal or monetary policy implementation may create different outcomes in equilibrium depending on several factors: The parameter  $k$  (the sensitivity of money demand to changes in  $Y$ ), the parameter  $h$  (the sensitivity of money demand to changes in the interest rate), the multiplier  $\alpha$ , and the parameter  $b$  (the sensitivity of investment to changes in interest rate). Depending on these parameter values and the magnitude of the multiplier, a given fiscal or monetary policy change will have a different effect on economic activity. In extreme cases, fiscal or monetary policy changes will be fully ineffective, or fully effective on economic activity.

## LO 5

Understand how the government may use policy mixes in order to meet policy goals

To meet certain goals or objectives regarding the level of economic activity, governments may use fiscal and monetary policy together to create the desired effect. Depending on the goal, the government may use monetary and fiscal policies in the same direction (both expansionary or both contractionary), or in opposite directions (one expansionary, the other contractionary). These combinations are called policy mixes. One of the most notable policy mixes is called accommodative monetary policy, where the government carries out expansionary monetary policy along with expansionary fiscal policy to obtain the maximum benefit from fiscal policy change.

1 Which of the following is likely to occur in the goods and money markets if the central bank conducts an open market sale of government bonds?

- A. Money supply increases, interest rate decreases, output increases, money demand function shifts to the right, consumption increases, investment increases
- B. Money supply increases, interest rate increases, output decreases, money demand function shifts to the right, consumption decreases, investment increases
- C. Money supply decreases, interest rate increases, output decreases, money demand function shifts to the left, consumption decreases, investment decreases
- D. Money supply decreases, interest rate decreases, output increases, money demand function shifts to the right, consumption decreases, investment increases
- E. Money supply increases, interest rate increases, output increases, money demand function shifts to the left, consumption decreases, investment decreases

2 Which of the following is likely to occur as a result of a simultaneous fall in required reserve ratio and a fall in government spending?

- A. An increase in  $Y$  with ambiguous effects on the interest rate
- B. A reduction in  $Y$  with ambiguous effects on the interest rate
- C. An increase in interest rate with ambiguous effects on  $Y$
- D. A reduction in interest rate with ambiguous effects on  $Y$
- E. Ambiguous effects on both interest rate and income

For Questions 3, 4, 5 and 6, consider the following model of an economy. The following information currently belongs to a closed economy called Economica.

$$C = 80 + \frac{2}{3}Y^d$$

$$T = \left(20 + \frac{1}{4}Y\right) - 80$$

$$G = 230$$

$$I = 250 - 5i$$

$$M^d = 400 + \frac{1}{2}Y - 20i$$

$$M^s = 500$$

$$P = 1$$

Where  $Y$  is national income (GDP),  $C$  is consumption,  $Y^d$  is disposable income,  $T$  is net taxes,  $G$  is government spending,  $I$  is private investment,  $i$  is interest rate,  $M^d$  is real money demand,  $M^s$  is the money supply,  $P$  is the general level of prices.

3 For the model above, what are the IS and LM functions?

- A. IS:  $Y = 1200 - 10i$ ; LM:  $i = \frac{Y}{40} - 5$
- B. IS:  $Y = 1500 - 8i$ ; LM:  $i = 4Y - 50$
- C. IS:  $Y = 1200 - 10i$ ; LM:  $i = 40Y - 5$
- D. IS:  $Y = 120 - 100i$ ; LM:  $i = \frac{Y}{40} - 5$
- E. IS:  $Y = 150 - 100i$ ; LM:  $i = \frac{Y}{40} - 50$

4 What is the general equilibrium ( $Y^*$ ;  $i^*$ ) in this economy?

- A. (1,000; 20)
- B. (500; 20)
- C. (500; 10)
- D. (1200; 10)
- E. (1,000; 25)

5 Now suppose that the government decides to increase government spending from 230 to 330 by 100 units. After this increase in the government spending by 100 units, what is the new equilibrium in  $Y$  and  $i$ ?

- A. (1,160; 24)
- B. (1,000; 24)
- C. (1,160; 12)
- D. (1,500; 8)
- E. (2,000; 29)

6 After the increase in government spending, the Central Bank attempts to hold the interest rate constant at its original equilibrium value. In order to achieve this objective, the Central Bank implements open market operations. What must be the required direction of open market operations and what must be the change in money supply to keep interest rate at its original equilibrium value?

- A. Open market sale; increase money supply by 100 units
- B. Open market sale; decrease money supply by 100 units
- C. Open market purchase; increase money supply by 100 units
- D. Open market purchase; decrease money supply by 100 units
- E. This objective cannot be achieved with open market operations

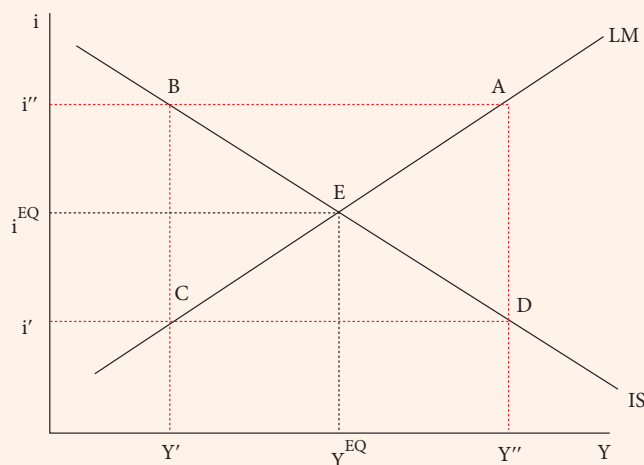
7 Which of the following statements is *false*?

- A. In an economy under liquidity trap, fiscal policy is fully effective
- B. In an economy under liquidity trap at low interest rates close to zero, expansionary monetary policy cannot stimulate the economy
- C. In an economy under liquidity trap, an increase in money supply would stimulate new investments
- D. When money demand does not respond to changes in the interest rate, fiscal policy is fully ineffective
- E. The less responsive investments are to changes in the interest rate, the less effective the monetary policy is

8 Which of the following statements is *true*?

- A. The LM curve is upward sloping because a higher level of money supply is needed to increase the output
- B. An increase in the interest rate will cause a reduction in investment and a leftward shift in the IS curve
- C. An increase in government spending causes a higher interest rate in the economy and shifts the LM curve upward to the left
- D. An increase in money supply does not shift the IS curve, it causes a movement along the given IS curve
- E. An increase in the price level has no impact on the IS-LM equilibrium

9 In the diagram below, which of the following information is correct about point A?



- A. Goods and money markets both do not clear
- B. Goods market clears, but there is excess supply of money in the money market
- C. Goods market clears, but there is excess demand for money in the money market
- D. Money market clears, but there is excess supply of goods in the goods market
- E. Money market clears, but there is excess demand for goods in the goods market

10 An open market sale of bonds by the central bank most likely leads to -----.

Which of the following completes the sentence above?

- A. an increase in real money supply, an increase in real money demand, a fall in interest rate, an increase in investment demand, and an increase in income
- B. a fall in real money supply, a fall in real money demand, an increase in the interest rate, a fall in investment demand, and a fall in income
- C. an increase in real money supply, a fall in real money demand, an increase in the interest rate, an increase in investment demand, and an increase in income
- D. a fall in real money supply, a fall in real money demand, a fall in the interest rate, an increase in investment demand, and an increase in income
- E. an increase in real money supply, a fall in real money demand, an increase in the interest rate, a fall in investment demand, and a fall in income

|      |                                                                                                                                             |       |                                                                                                            |
|------|---------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------|
| 1. C | If your answer is wrong, please review the “Money Market effects: Contractionary Monetary Policy” section.                                  | 6. C  | If your answer is wrong, please review the “Policy mixes” section.                                         |
| 2. D | If your answer is wrong, please review the “Goods Market Effects: Contractionary Fiscal Policy” section.                                    | 7. C  | If your answer is wrong, please review the “Effectiveness of Fiscal and Monetary Policies” section.        |
| 3. A | If your answer is wrong, please review the “General Equilibrium in Goods and Money Markets” section.                                        | 8. D  | If your answer is wrong, please review the “General Equilibrium in Goods and Money Markets” section.       |
| 4. A | If your answer is wrong, please review the “General Equilibrium in Goods and Money Markets” section.                                        | 9. D  | If your answer is wrong, please review the “General Equilibrium in Goods and Money Markets” section.       |
| 5. A | If your answer is wrong, please review the “Changes in General Equilibrium in Goods and Money Markets: Expansionary Fiscal Policy” section. | 10. B | If your answer is wrong, please review the “Money Market Effects: Contractionary Monetary Policy” section. |



Access the TurkSTAT website (<https://www.tuik.gov.tr/>) and evaluate the composition of GDP in Türkiye annually from 1998 to 2020 using the National Accounts database. Do you observe a compositional change in GDP in terms of the shares of consumption, government spending and investment over the last 22 years?

The composition of GDP in Türkiye using the expenditure approach from 1998 to 2020 from the TurkSTAT database is given in the table below. As given in the table, the share of consumption expenditures in aggregate expenditures has fallen over the years, while the shares of government spending and investment have risen. For the majority of the years, the NX share is negative, indicating a trade deficit.

|      | C    | G    | I    | Net Exports |
|------|------|------|------|-------------|
| 1998 | 64.2 | 10.6 | 23.9 | 1.0         |
| 1999 | 65.7 | 12.7 | 21.4 | -0.1        |
| 2000 | 66.6 | 11.9 | 23.7 | -2.6        |
| 2001 | 64.5 | 12.6 | 18.1 | 4.5         |
| 2002 | 63.5 | 12.8 | 21.1 | 2.2         |
| 2003 | 64.9 | 12.6 | 22.3 | -0.2        |
| 2004 | 63.9 | 12.3 | 25.0 | -1.6        |
| 2005 | 63.1 | 12.2 | 26.8 | -2.4        |
| 2006 | 61.4 | 12.9 | 29.4 | -4.0        |
| 2007 | 61.8 | 13.4 | 28.6 | -4.1        |
| 2008 | 60.8 | 13.6 | 28.8 | -3.4        |
| 2009 | 61.2 | 15.7 | 22.8 | 0.0         |
| 2010 | 62.4 | 14.9 | 26.7 | -4.3        |
| 2011 | 62.4 | 13.6 | 31.0 | -7.3        |
| 2012 | 61.6 | 14.1 | 28.1 | -4.1        |
| 2013 | 61.1 | 14.0 | 29.6 | -4.9        |
| 2014 | 60.1 | 14.0 | 28.9 | -3.4        |
| 2015 | 59.7 | 13.8 | 28.2 | -2.1        |
| 2016 | 59.1 | 14.7 | 28.0 | -2.1        |
| 2017 | 58.3 | 14.4 | 30.7 | -3.7        |
| 2018 | 55.8 | 14.7 | 29.4 | -0.2        |
| 2019 | 56.5 | 15.5 | 25.1 | 2.6         |
| 2020 | 56.4 | 15.2 | 31.9 | -3.8        |

your turn 1

Consider the following economy with the following goods market relations:

$$C = 600 + 0.5Y^d$$

$$T = 0.20Y$$

$$I = 1000 - 30i$$

$$G = 500$$

and the following money demand function:

$$\frac{M^d}{P} = 0.6Y - 30i$$

where  $C$  is consumption,  $Y^d$  is disposable income,  $T$  is net taxes,  $Y$  is income,  $I$  is investment,  $G$  is government spending, and  $i$  is the interest rate. The price level is fixed  $P = 1$  and the nominal money stock supplied by the central bank is  $M_s = 600$ .

- Derive the IS and LM curve relationships. What is the equilibrium value of income? What are the equilibrium values of net taxes, private consumption, and private investment?
- Suppose that the government would like to increase the level of income to  $Y = 2500$ . Find out the required change in government expenditures that will allow the government to attain its income target. What happens to the budget deficit? Private savings? Private investment? Calculate.
- Show the effect of the policy you suggested in part b on  $(Y, i)$ -space using IS-LM framework. Make sure to label your graphs properly, be precise in describing the movement from the original equilibrium to the new one.
- Now assume that we are still in the equilibrium you found in part b. The government would like to make sure that the private investment level stays the same as in part a, by this fiscal policy action. Propose a monetary policy change that will give this result and describe it using the IS-LM framework.

your turn 2

- IS curve relationship is  $Y = 3500 - 50i$ ; LM curve relationship is  $i = 0.020Y - 20$

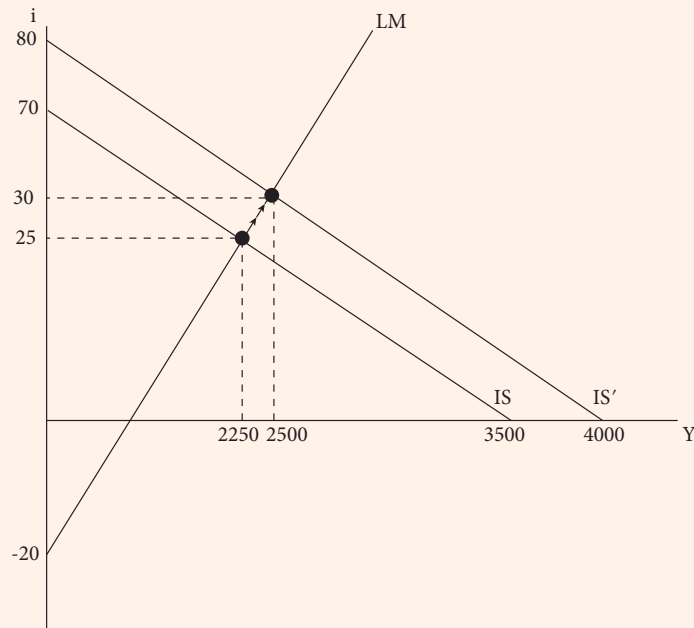
Equilibrium values:

$$Y = 2250; i = 25; T = 450; C = 1500; I = 250$$

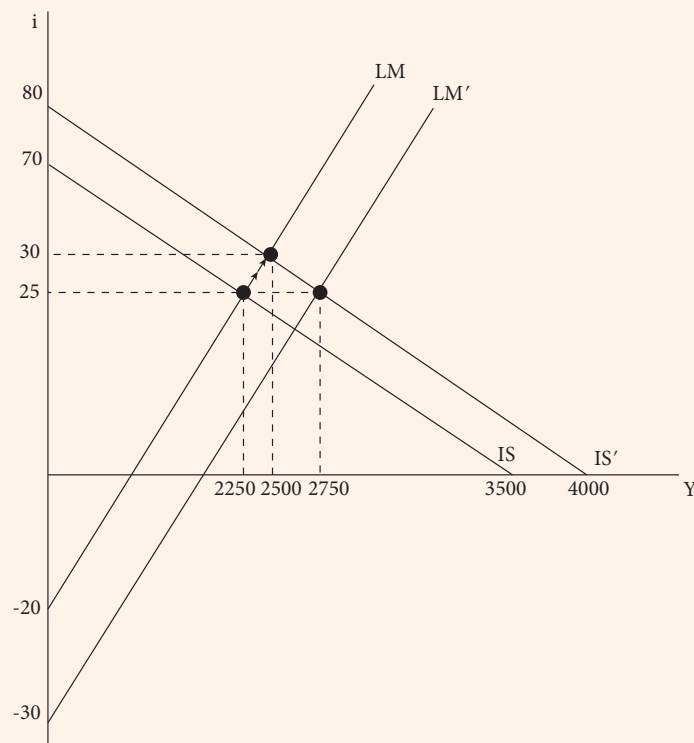
- At the new targeted income level, interest rate is 30 (move up along the LM function to find the interest rate at  $Y = 2500$ ). At the new equilibrium,  $C = 1600$ ,  $I = 100$ , then  $G = 800$ . The government spending must increase by 300 units. With the new  $G = 800$ , the new IS function becomes  $Y = 4000 - 50i$ . At the new equilibrium, the budget deficit is  $(T - G)$  300 units, private savings are  $(S = Y^d - C)$  400 units, and investment is  $I = 100$  units.

your turn 2

- c. In this new case, IS curve relationship is  $Y=4000-50i$ , LM curve relationship is the same as in part a.



- d. The government's policy is that the private investment stays the same as in part a, at  $I = 250$ . Since investment is only affected by the interest rate, it is sufficient to reestablish the original equilibrium interest rate at  $i = 25$ . To accomplish this, the government raises the nominal money supply by 300 units, from 600 to 900. As a result, the new equilibrium is  $(i^E, Y^E) = (25, 2750)$ . With this policy change, the LM curve relationship becomes  $i = 0.2Y - 30$ . The IS curve relationship is the same as we found in part b.



Based on the information in this chapter, state whether the following statements are true, false, or uncertain. Explain your answers briefly.

- a. The IS-curve is downward sloping because goods market equilibrium implies that a lower level of government spending leads to a lower level of output.
- b. If the government spending and taxes increase exactly by the same amount, the IS-curve does not shift.
- c. When investment demand is not very sensitive to changes in the interest rate, expansionary monetary policy is not very effective in stimulating output.
- d. A higher sensitivity of money demand to changes in income implies a higher effectiveness of fiscal policy.
- e. Expansionary fiscal policy coupled with expansionary monetary policy implies that one of the objectives of the government is to keep the interest rate unchanged.

your turn 3

- a. False
- b. False
- c. True
- d. False
- e. True

## References

- Blanchard, O. & Johnson, D. R. (2013). *Macroeconomics (Global Edition)*. 6th Ed., Essex: Pearson Education Limited.
- Krugman, P. R. (1998). It's Baaack: Japan's Slump and the Return of the Liquidity Trap. *Brookings Papers on Economic Activity* (2): 137-205.
- TurkSTAT website. <https://www.tuik.gov.tr>.

# Chapter 5 The Labor Market

After completing this chapter, you will be able to;

## Learning Outcomes

- 1 Recognise basic concepts of the labor market
- 2 Explain how the labor market works and the relationship between employment and wage
- 3 Understand why unemployment exists and explain how institutions, firms and the government affects the labor market
- 4 Discuss the relationship between unemployment and inflation taking into account the Philips curve and its evolution over time
- 5 Explain the relationship between unemployment and economic growth

## Chapter Outline

Basic Concepts of the Labor Market  
Movements in Employment and Unemployment  
Labor Market Equilibrium  
Existence of Unemployment  
The Phillips Curve and Natural Rate of Unemployment

## Key Terms

Labor force  
Labor Supply  
Labor Demand  
Labor Equilibrium  
Frictional  
Structural  
Cyclical  
Natural Rate of Unemployment  
Unemployment  
Inflation  
Phillips Curve  
Rational Expectations  
Okun's Law



## INTRODUCTION

If someone asks you how your economy is doing, you will most likely talk about the gross domestic product (GDP) of the country. However, GDP alone is not enough to describe the current state of the economy. The macroeconomy is like a chain, and each part of the chain is somehow connected to every other part. One of the most important pieces of this chain is the people who shape the labor market. In this chapter we will explain the definition of the terms of the labor market, changes of employment and unemployment in Türkiye, the labor supply and demand curves and their intersection first. Second, we will ask the question why there is unemployment and try to answer this question. Third, we will relate unemployment to inflation and look into history to explain the relationship between these two variables. Finally, we will look at the relationship between two other variables: Output and unemployment.

## BASIC CONCEPTS OF THE LABOR MARKET

Persons living in a country constitute the population of that country, but when it comes to the working-age population, the definition is different. The *working-age population* includes people who are 15 years old or older. In defining the basic concepts of the labor market, we will focus exclusively on the working-age population ( $P$ ).

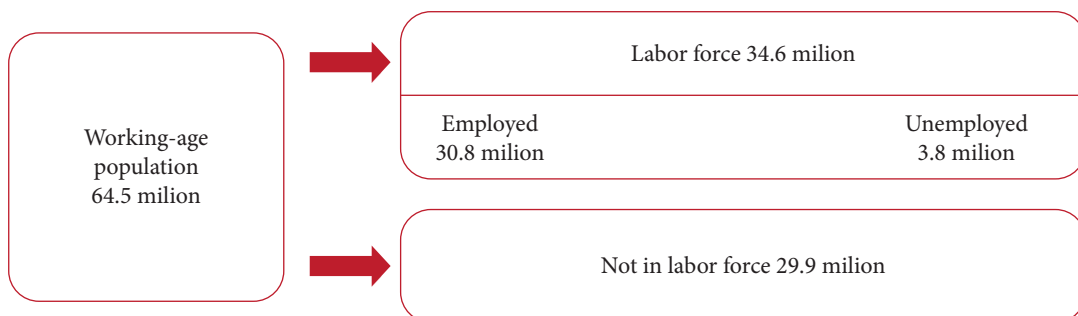


Population and working-age population are different.

A person who falls under the following categories is considered as *employed* ( $E$ ): Persons over a certain age who are in a paid work for at least one hour during the reference period or who have a job but are temporarily absent during the reference week for certain reasons, e.g. parental leave; Persons over a certain age who work for profit or family gain during the reference period. In the news we often hear the statistics about unemployment. Are you part of the unemployment? Is sitting at home without looking for a job enough to be considered unemployed? Actually, no. An *unemployed* person ( $U$ ) is one who is not employed during the reference period but has been *actively* looking for work in the last four weeks and is ready to start work within two weeks.

$$\text{Labor force (LF)} = \text{Employed (E)} + \text{Unemployed (U)} \quad (1)$$

There were 30.8 million employees and 3.8 million unemployed people in Türkiye in May 2022. The *labor force* ( $LF$ ) is the sum of people who have a job ( $E$ ) or are not employed but are actively looking for a job ( $U$ ). 34.6 million people were in the labor force in Türkiye in May 2022 (please see Diagram 5.1).



**Diagram 5.1** The structure of the working-age population in Türkiye in May 2022.

**Source:** Turkish Statistical Institute data, available at <https://data.tuik.gov.tr/>, accessed on July 18th, 2022.



The *employment rate* is the proportion of the working-age population ( $P$ ) that is employed:

$$\text{Employment rate} = \frac{E}{P} * 100\% \quad (2)$$

The *unemployment rate* is the percentage of unemployed people in the labor force ( $LF$ ):

$$\text{Unemployment rate} = \frac{U}{LF} * 100\% \quad (3)$$

*Labor force participation rate (LFPR)* is the proportion of working-age population ( $P$ ) that either works ( $E$ ) or looks for work ( $U$ ):

$$\text{Labor force participation rate} = \frac{E+U}{P} * 100\% \quad (4)$$

To better understand unemployment, we also need to know what the term “discouraged workers” means. Those who are not employed and give up looking for a job are discouraged workers. Some withdraw from the labor market during a recession and return when the market expands. Since official unemployment statistics do not include discouraged workers as unemployed when calculating the unemployment rate, published statistics may differ from actual statistics.



#### attention

As long as a person is looking for a job, s/he is unemployed. When that person stops looking for a job, s/he is **no longer** in the labor force.



#### your turn 1

According to the statistics of Turkish Statistical Institute, the number of employed women ( $E$ ) is 9.965.000 and the number of unemployed women ( $U$ ) is 1.598.000 in Türkiye in May 2022. The female population of working-age ( $P$ ) is 32.615.000 in Türkiye. Calculate female labor force participation rate ( $FLFPR$ ).



#### your turn 2

According to the statistics of Turkish Statistical Institute, the number of unemployed men ( $U$ ) is 2.187.000 in Türkiye in May 2022. The number of men who are in the labor force ( $LF$ ) is 23.061.000 in Türkiye. Calculate male unemployment rate.

## MOVEMENTS IN EMPLOYMENT AND UNEMPLOYMENT

The unemployment rate fluctuates depending on the state of the economy. During the periods of expansion, the unemployment rate is seen to decrease, while during the periods of recession, it increases. COVID-19, which began in early December 2019 and quickly spread to other countries, has negatively affected both the economy and social life since the day it broke out. Some industries had to suspend their operations for various reasons, such as travel restrictions and curfews imposed by governments. Supply chains were negatively affected, production was cut and unemployment increased (World Bank, 2020). With the spread of COVID-19, the global economy shrank by 5.2% in 2020, causing mass unemployment. This is the deepest recession since World War II (World Bank, 2020). Despite the fact that countries were pursuing different normalization plans, the recovery was not yet complete. Let's look at movements in labor force participation, employment and unemployment in Türkiye.

Figure 5.1 shows the labor force participation rate of women and men aged 15-64 in Türkiye between 1990 and 2019, with the overall participation rate fluctuating slightly between 50 and 60 per cent. During this period, the male labor force participation rate is always higher than that of women. The official statistics of the Turkish Institute of Statistics, which refer to persons aged 15 years and older, show that the labor force participation rate fell to 48 per cent in December 2020 and rose to 52 per cent in December 2021, clearly showing the impact of COVID -19 in 2020. In Figure 5.2, the ratio of employment to the working-age population in Türkiye shows a slight fluctuation between 1991 and 2021, as does the labor force participation rate. COVID-19

led to a decline in the employment rate in 2020 and the latest ratio in 2021 shows a recovery in the employment rate of both genders. As for the unemployment rate in Türkiye, shown in Figure 5.3, in contrast to the figures showing the ratio of employment to the working-age population and the labor force participation rate, there has been a significant increase in the unemployment rate. Between the years 2009 and 2021, the unemployment rate of women is always higher than that of men. The unemployment rate for women fell sharply between 2019 and 2020, while there was a slight decline for men. However, the decline has not remained stable and there is a sharp increase in the female unemployment rate between 2020 and 2021, which supports the report pointing to the disproportionate impact of COVID -19 on men and women (ILO, 2021).

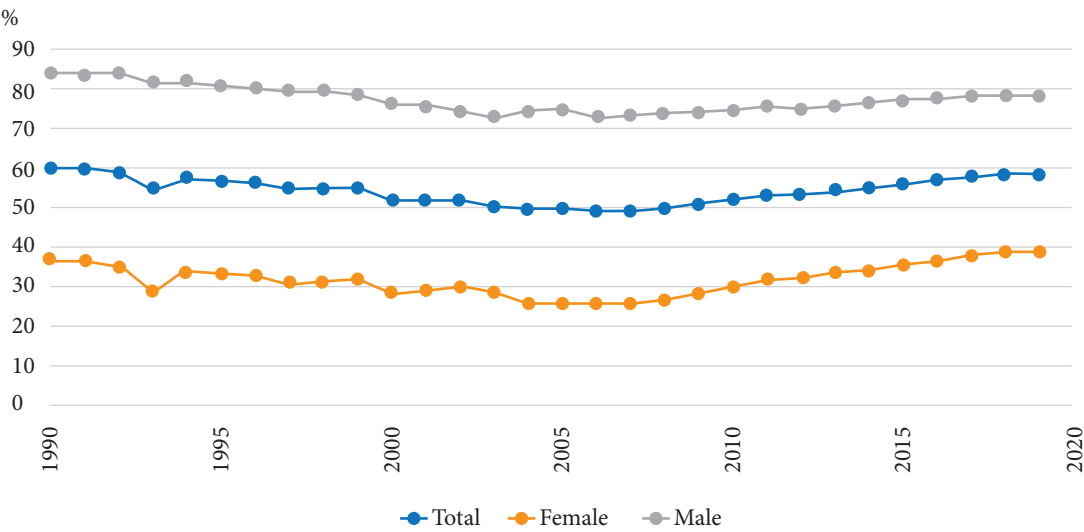


Figure 5.1 Labor force participation rate in Türkiye between 1990 and 2019.

Source: World Bank data, available at <https://data.worldbank.org/>, accessed on July 18<sup>th</sup>, 2022.

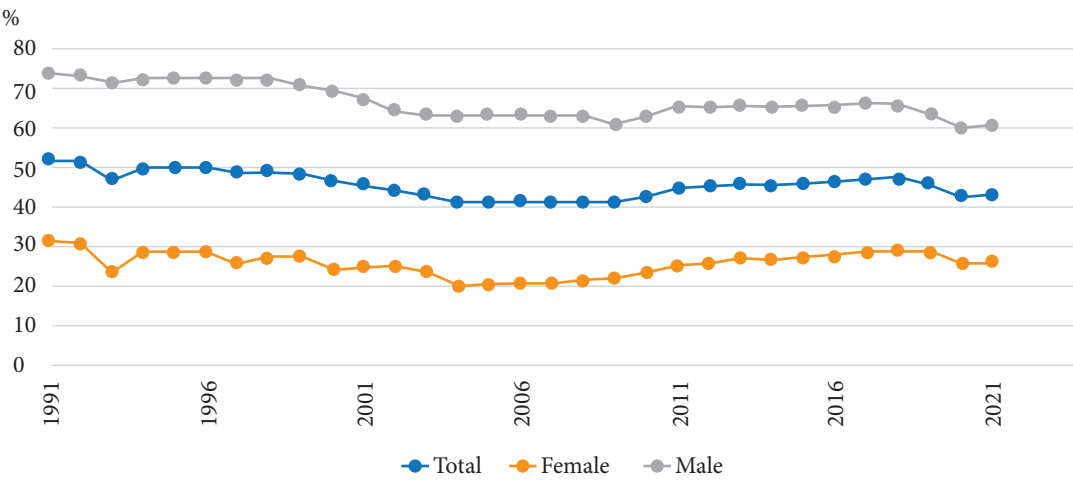


Figure 5.2 Employment to working-age population (+15) in Türkiye between 1991 and 2021.

Source: World Bank data, available at <https://data.worldbank.org/>, accessed on July 18<sup>th</sup>, 2022.



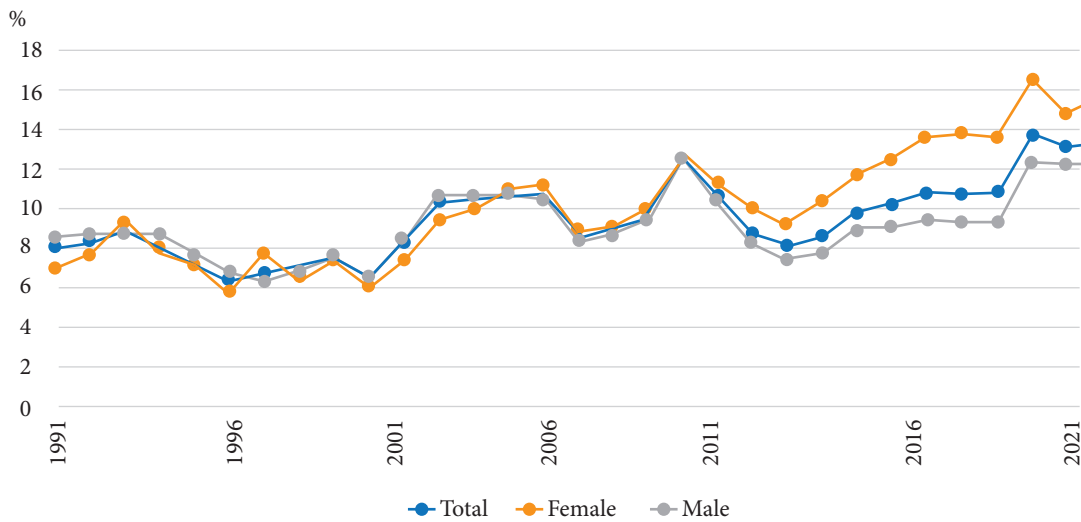


Figure 5.3 Unemployment rate in Türkiye between 1991 and 2021.

Source: World Bank data, available at <https://data.worldbank.org/>, accessed on July 18<sup>th</sup>, 2022.

Unemployment by education level in OECD (average) and Türkiye in 2019 illustrates that unemployment rate in Türkiye is higher than that in OECD (average) regardless of education level as shown in Figure 5.4. The unemployment rate of tertiary graduates is the lowest in both the OECD and Türkiye, while the least educated graduates (below upper secondary level) have the highest unemployment rate. The figure is a clear indication that higher education is more likely to help graduates fill job vacancies.

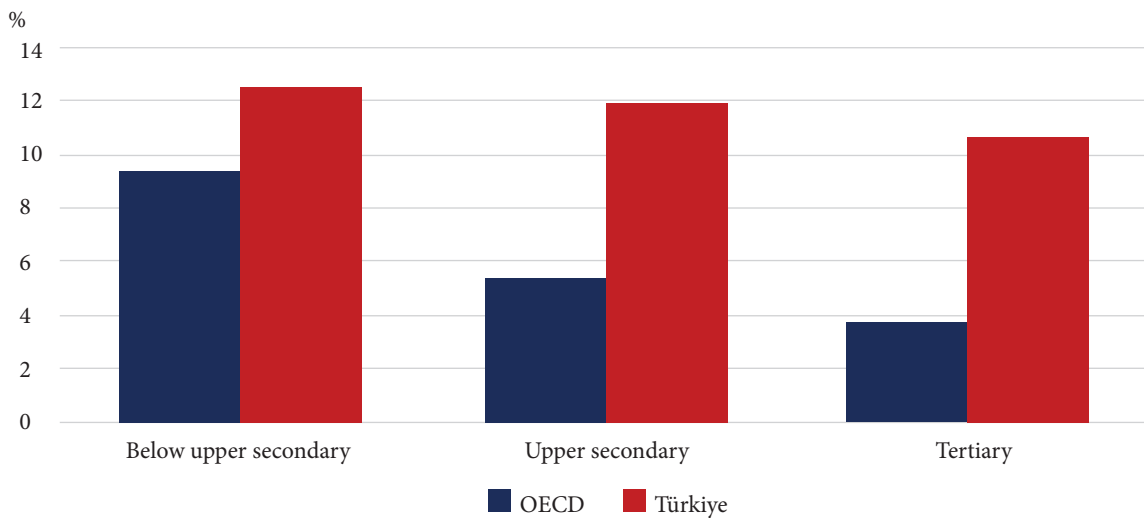


Figure 5.4 Unemployment rate by education level in OECD (average) and Türkiye in 2019.

Source: OECD data, available at <https://data.oecd.org/>, accessed on July 18<sup>th</sup>, 2022.

## LABOR MARKET EQUILIBRIUM

In this section we will derive labor supply and labor demand to understand how the labor market works. The labor market is where workers look for a job and firms look for an employee. In this market, labor is supplied by households and demanded by firms.

## Labor Demand

Wages paid to workers make up a large part of total costs that firms bear. How many workers do firms demand then? An unlimited number of workers? No. Firms demand labor until *the value of the marginal product of labor*, which is the revenue that firms gain by hiring additional workers, is equal to the wage that is being paid.

$$VMPL = w \quad (5)$$

Suppose that there is a nail art studio that offers the service for ₺150 (Turkish Lira) in Table 5.1. The wage paid to each artist is ₺900. The first artist produces 6 units and the marginal product of the first artist is 6. The output is 15 units after the studio hires the second artist. In other words, the second artist produces 9 additional units. The marginal products of the third and fourth artists are 8 and 6 respectively. When the studio hires the third artist, the value of the marginal product of the third artist is 1200RY, which exceeds the cost of hiring, ₺900. On the other hand, the value of the marginal product of the fourth artist is ₺900, which is equal to the wage paid, ₺900. When the studio hires the fifth artist, this artist produces 4 additional products, so the value of the marginal product of the fifth worker is ₺600, which is lower than the wage paid to this artist. Imagine that you own this studio. The revenue by hiring the fifth worker is only ₺600, but you have to pay the artist a wage of ₺900. Roughly speaking, a profit-maximizing studio would not hire the fifth artist.

**Table 5.1** The hypothetical example for calculating the value of the marginal product of labor.

| Number of nail artists employed | Price (₺) | Output (Units) | Marginal product of labor (Units) | Value of marginal product of labor (VMPL) (₺) | Wage (₺) |
|---------------------------------|-----------|----------------|-----------------------------------|-----------------------------------------------|----------|
| 1                               | 150       | 6              | 6                                 | 900                                           | 900      |
| 2                               | 150       | 15             | 9                                 | 1350                                          | 900      |
| 3                               | 150       | 23             | 8                                 | 1200                                          | 900      |
| 4                               | 150       | 29             | 6                                 | 900                                           | 900      |
| 5                               | 150       | 33             | 4                                 | 600                                           | 900      |
| 6                               | 150       | 36             | 3                                 | 450                                           | 900      |

As the number of workers increases, the value of the marginal product of each additional worker diminishes. Profit-maximizing firms hire up to the point where  $VMPL = w$ . When wages increase, firms demand a smaller number of workers. For example, if the wage rises to ₺1200, the firm hires only 3 artists instead of 4. As a result, the downward sloping part of the value of marginal product value of labor is the labor demand curve. The *labor demand curve* shows the relationship between the quantity of labor demanded and the wage. The value of marginal product of labor and the labor demand curve are shown by the Figure 5.5. A change in the wage affects the quantity of labor demanded. *Ceteris paribus*, the quantity of labor demanded moves along labor demand curve when the wage changes. If the wage rises, the quantity of labor demanded decreases, while a decrease in the wage increases the quantity of labor demanded.

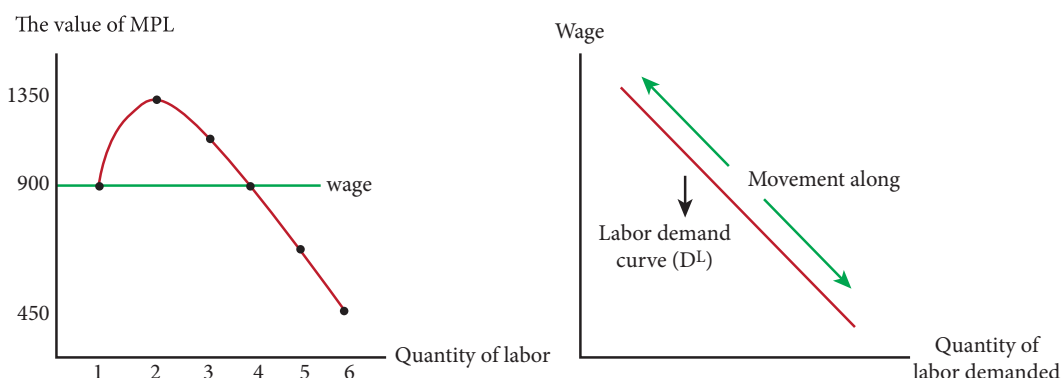


Figure 5.5 The value of the marginal product of labor (left) and the labor demand curve (right).

Any change in factors other than the wage, such as changes in the goods and services market, changes in productivity or changes in input markets, leads to a shift in the labor demand curve (please see Figure 5.6) (Acemoglu, Laibson and List, 2021). For example, artists in nail studios use a UV lamp and some special tools to apply gel nail polish to their clients. When the cost of these tools goes down, the studio owners buy more of them, increasing the marginal product of labor, which leads to a rightward shift in the labor demand curve at any given wage.

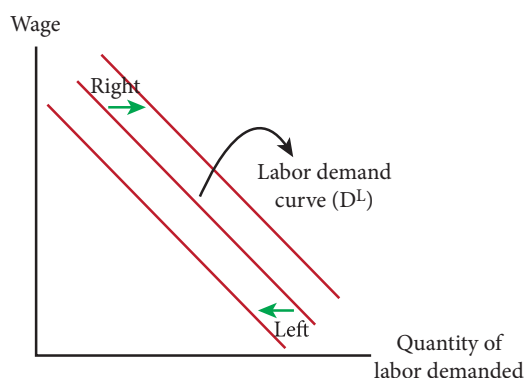


Figure 5.6 Shift in the labor demand curve.

## Labor Supply

Just as firms care about maximizing profits, individuals care about their utility. Utility is derived from consumption of goods and leisure. Consumption and leisure are limited by income and the 24 hours we all have in a day. If the wage in the market is high, do you choose to allocate more time to leisure? If we leave out some further details on this question, we can answer this question in the negative. When wages rise, so does the quantity of labor supplied because the cost of leisure is high. Accordingly, the *labor supply curve*, which indicates the relationship between the quantity of labor supplied and the wage, is upward sloping as shown on the left-hand side of Figure 5.7. *Ceteris paribus*, the quantity of labor supplied moves along the labor demand curve when the wage changes (please see the right-hand side of Figure 5.7).

Any change in factors other than the wage, such as changes in tastes and preferences, the use of household appliances, and the population such as immigration, leads to a shift in the labor supply curve (Acemoglu, Laibson and List, 2021; Mishkin, 2015). With an increasing number of foreigners, the labor supply curve shifts to the right.

According to the report of the T.R. Presidency of Migration Management of the Ministry of Interior (2017), 56,591 out of 461,217 foreigners who have a residence permit in Türkiye have a work permit in Türkiye in 2016. The foreigners come from Iraq, Georgia, China, Turkmenistan, Ukraine, Uzbekistan, India, Moldova, Azerbaijan and other countries.

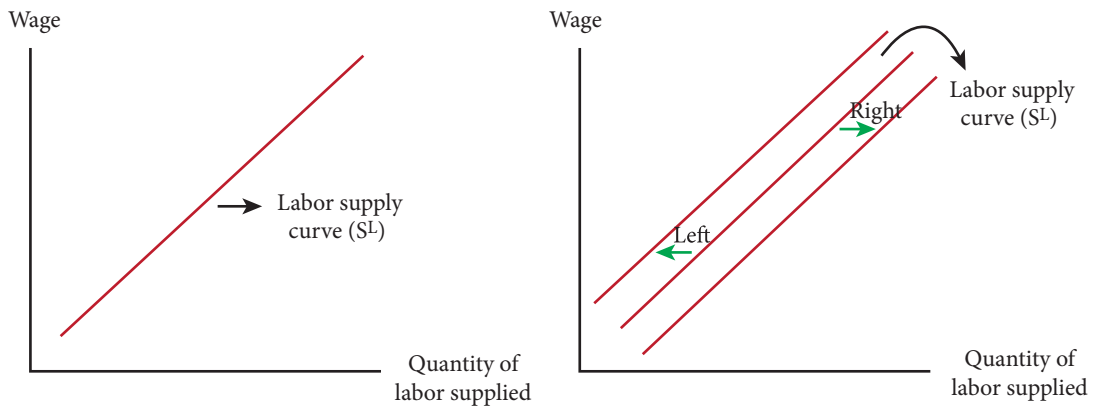


Figure 5.7 The labor supply curve (left) and shift in the labor supply curve (right)

### Equilibrium in the Labor Market

The point at which the labor supply and demand curves intersect shows the equilibrium wage ( $W^*$ ) and employment ( $L^*$ ). In the equilibrium, the quantity of labor supplied is equal to the quantity of labor demanded. In other words, all persons who supply their labor are employed by firms and remunerated at the equilibrium wage. Figure 5.8 shows the labor supply and demand curves in an economy. The labor supply curve is upward sloping and the labor demand curve is downward sloping. The two curves meet at the equilibrium point, where employment is  $L^*$  and wage is  $W^*$ . If the wage ( $W^1$ ) is higher than the equilibrium wage ( $W^*$ ), the quantity of labor supplied ( $L^2$ ) is higher than the quantity of labor demanded ( $L^1$ ). This exerts pressure to lower the wage. If, on the other hand, the wage ( $W^2$ ) is lower than the equilibrium wage ( $W^*$ ), the quantity of labor demanded ( $L^2$ ) is greater than the quantity of labor supplied ( $L^1$ ), so that pressure is exerted to increase the wage.

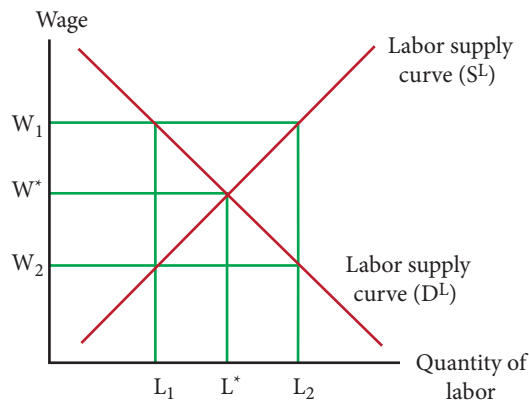


Figure 5.8 Equilibrium in the labor market



#### your turn 3

Margarine used to be used in most of our households. The latest evidence shows that margarine contains high levels of trans fats and trans fats clog the arteries. As word has spread in society about the hazardous effects of using margarines, the demand for margarine decreases. Use a graph to show the effect of the decrease in demand for margarine on employment and wage in the labor market.



#### your turn 4

The study by Coen-Pirani, Leon, Lugauer (2010) provides evidence that having a dryer, a freezer and a washing machine at home makes women's tasks easier in the United States. In other words, the appliances given women more free time. Use a graph to show the effect of the use of household appliances on women's employment and wage in the labor market.

## EXISTENCE OF UNEMPLOYMENT

Assuming that the market works well, why is there a problem in reality known as unemployment? Due to the nature of labor markets and other reasons, unemployment is inevitable. The unemployment rate falls during periods of expansion and rises during periods of recession, but never goes to zero. We will discuss the reasons in this section.

### Frictional Unemployment and Job Search

The labor market is quite dynamic. There are some workers who are either laid off or quit their jobs. Many new graduates are entering the market and others who are already employed are looking for a new job. Firms' demand for labor also changes over time. Growing firms need more workers while shrinking firms lead to layoffs. *Frictional unemployment* occurs because workers spend time finding a job while at the same time firms spend time looking for a suitable worker for that job. What will you do after you graduate from the university? You will rent a house, consume food, dress fancy and buy movie tickets. So you will have to earn your own money, which means you will need a job. In the period between your graduation and finding a new job, you will be a part of the frictional unemployment.

Fortunately, frictional unemployment lasts only a short time and is a sign that the economy is in good health. To explain why this is so, we need to ask ourselves two questions: Do you accept the first job offer that does not meet your expectations, or does a firm hire the first applicant who is not suitable for the job? No. We assume that both sides, the employee and the employer, have all the information on vacancies, qualifications, job package, etc. In reality, they lack information. Both sides keep looking because a bad match between the worker and the firm hurts the economy. The worker strives to find the best match and firms do the same. Since *job search* is time-consuming, official institutions and recruitment agencies can reduce the time spent on job search. On the other hand, government programs, such as unemployment insurance, can increase the time spent looking for a job. *Unemployment insurance* aims to help the unemployed with the costs they incur after becoming unemployed, which leads them to reject job offers and look for another well-paid job.



## Further Reading

After the abolition of the Institution of Providing Jobs and Employees (İPJE) (İşçi ve İş Bulma Kurumu in Turkish), founded in 1946, the Turkish Employment Agency (İŞKUR in Turkish) was established in October 2000. The agency's task is to provide workers with suitable jobs, taking into account their qualities, and to help employers find suitable employees for work. To date (July 2022), 782.102 people have found a job through the Turkish Employment Agency (İŞKUR).



**Diagram:** Picture from the homepage of the Turkish Employment Agency (İŞKUR).

**Source:** Turkish Employment Agency (İŞKUR).

The Turkish Employment Agency (İŞKUR) pays unemployment benefits to the unemployed who have registered with the Turkish Employment Agency (İŞKUR) after termination of their employment contract. The benefit is paid to persons who meet the eligibility requirements. The amount and duration of the benefit is calculated according to how many days the employee was insured before the termination of the employment contract.

## Structural Unemployment and Wage Rigidity

Structural unemployment is a nuisance for an economy. *Structural unemployment* results from a serious mismatch between the skills that workers have and those that companies expect from them. There are some specific skills that are prerequisite for being hired by an industry. Some industries terminate contracts and the workers who work for them become unemployed. The skills they have may not be enough to be hired by another industry. For example, the industry you work for stops operating and you become unemployed. The skills you acquired during your time in that industry are useless for other industries.

Apart from the fact that the qualifications do not match, it is difficult for a worker who does not have even basic skills to find a job compared to a worker who has some skills that are sufficient to get a job (Mishkin, 2015). It is unlikely that this person will find a job in a short time. Unlike frictional unemployment, structural unemployment does not last short and is not voluntary. Educating people can help to improve some skills and reduce the number of the structurally unemployed, but it is undeniable that education also takes time. In addition to the above reasons, structural unemployment also arises due to *wage rigidity*, a situation where the wage is higher than the equilibrium wage. Higher wage attracts many and so the quantity of labor supplied exceeds the quantity of labor demanded. Although there are many reasons for wage rigidity, the most common reasons for wage rigidity can be listed here as follows: *Collective bargaining and unions, efficiency wage, minimum wage law*.

## Collective Bargaining and Union

*Collective bargaining* is negotiation between unions and employers. *Unions* aim to improve working conditions and set higher wage than market wage for their members through collective bargaining. The higher wage set by unions lead firms to a lower demand for labor, so that higher unemployment is observed.



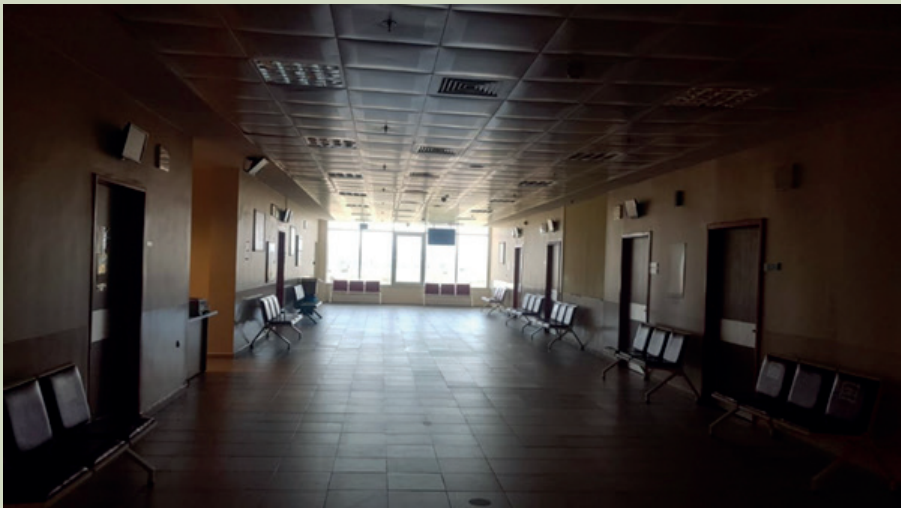
## Further Reading

Türkiye is one of the countries with the lowest union density among OECD countries. As shown in Table 5.2, the percentage of unionized workers is lower than in the OECD between 2000 and 2019. Union density decreased from 12.5 to 7.3 between 2000 and 2010 and increased again in the following years.

**Table 5.2** Trade union density in OECD(total) and Türkiye

| Years | OECD | Türkiye |
|-------|------|---------|
| 2000  | 20.9 | 12.5    |
| 2005  | 19   | 10.3    |
| 2010  | 17.8 | 7.3     |
| 2015  | 16.5 | 8       |
| 2016  | 16.2 | 8.2     |
| 2017  | 16   | 8.6     |
| 2018  | 15.9 | 9.2     |
| 2019  | 15.8 | 9.9     |

Workers actively benefit from the right to strike. Due to the increasing number of dead doctors shot by patients or patients' relatives and the harsh working conditions, organizations and unions jointly went on a one-day strike on 15 June 2022 for better working conditions, pay and protection (Buyuk, 2022).



**Image:** An empty hall in a state hospital in Türkiye.

**Source:** Turkish Medical Association.



## Efficiency Wage Theory

Firms may want to pay a higher wage than the one where the quantity of labor supplied is equal to the quantity of labor demanded. The reason why firms are willing to pay more than the market equilibrium wage is to increase worker productivity, as it is beneficial for firms to keep worker motivation high and discourage them from quitting. The efficiency wage, however, leads to involuntary unemployment. There are many who are willing to work in the firms that pay the efficiency wage, but the firms are only willing to hire a few. Consequently, there is a gap between the number of those who want to work at the efficiency wage and those who can be hired at the efficiency wage.



your turn 5

Henry Ford introduced a wage of \$5 a day in 1914, which was higher than the average wage that is between \$2 and \$3. In return, Ford's profits and workers' productivity increased (Raff and Summers, 1987). Evaluate the consequences of the wage being above the equilibrium wage.

## Minimum Wage Laws

The floor wage set by the government is the minimum wage. Firms cannot pay workers a wage that is less than the minimum wage. This law affects the quantity of labor supplied and the quantity of labor demanded differently. Suppose the equilibrium wage in the market is  $W^*$  and the minimum wage is  $W^m$ , higher than  $W^*$ . The quantity at which supply and demand are equal is  $L^*$ . The minimum wage ( $W^m$ ) encourages more people (the quantity of labor supplied under the minimum wage law) to enter the labor market, while it discourages firms from hiring more people and even induces them to lay off existing workers (the quantity of labor demanded by firms under the minimum wage law). The difference between the quantity of labor demanded and the quantity of labor supplied corresponds to unemployment due to the minimum wage law.



attention

Due to the negative impact of COVID -19 and the Russia-Ukraine war, many countries, including Türkiye, are suffering from various problems. The annual inflation rate reached 78.62% in Türkiye in July 2022. The rising inflation rate leads to a drastic decrease in real wages. In order to increase purchasing power and alleviate people's economic hardship, the minimum wage is raised by 30 per cent on July 1st 2022. The new wage is 5,550 Turkish Liras from July 2022. This increase is unusual, as the annual minimum wage in Türkiye is announced in December every year.

## Cyclical Unemployment and Natural Rate of Unemployment

A slowdown in the aggregate economy leads to *cyclical unemployment*. In good times, we assume that most firms increase their production in such a way that they need more workers; but in the opposite case, firms may have to lay off many workers. Workers who are laid off due to a downturn in the business cycle are cyclically unemployed.

The sum of frictional and structural unemployment corresponds to the *natural rate of unemployment*. If the actual unemployment rate is higher than the natural unemployment rate, it is due to *cyclical unemployment*. Actual unemployment rate fluctuates around the natural rate of unemployment. In a recession, more workers are laid off and it is normal that the actual unemployment rate is higher than the natural rate of unemployment. The effects of the Great Recession in 2008 were observed in labor markets around the world from 2007 to 2009, resulting in many workers becoming unemployed. As Figure 5.3 shows, the unemployment rate in Türkiye rose sharply for both genders after the Great Recession. In 2008, the unemployment rate was 10 per cent and rose to more than 12 per cent in 2009.

## Unemployment and Inflation

The first lecture of microeconomics is based exclusively on the understanding of the factors of production. As is repeatedly pointed out, no



production is possible without human power and intelligence, at least now! An increase in aggregate demand (there is no/slight shift in aggregate supply), e.g. through an increase in government spending, leads to an increase in overall price level and aggregate output. The more that is produced, the more people are needed, and thus the unemployment rate falls. This leads to a lower unemployment rate, but inflation increases due to the rise in the overall price level. This relationship has been confirmed by many economists from different countries over several years, but it disappears in the long run. Let us start with the Phillips curve and explore why the relationship between inflation and unemployment disappeared in the following years. This part also helps us to assess the state of the globe in terms of output, inflation and unemployment.

### THE PHILLIPS CURVE AND NATURAL RATE OF UNEMPLOYMENT

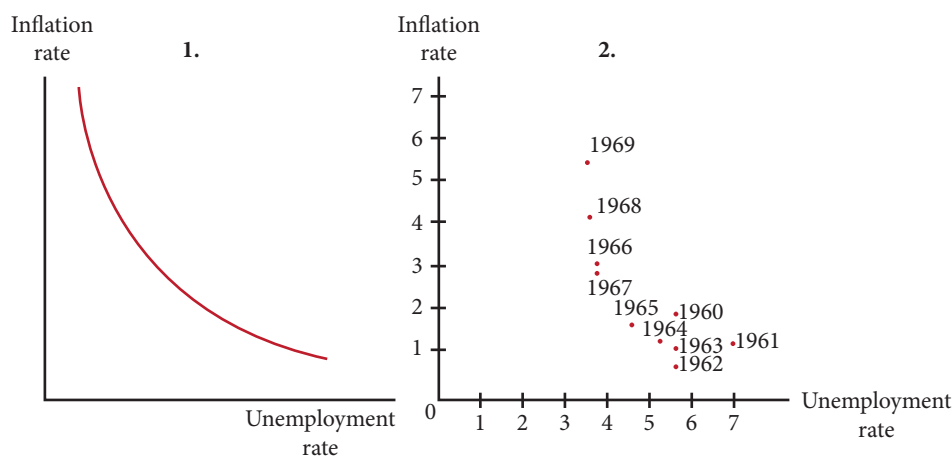
Philips (1958) published the well-known study in 1958 showing the relationship between the rate of change of money wage rates and the rate of unemployment in the UK from 1861 to 1957. It is reported that when unemployment is high, the rate of change of money wage rates is low and when unemployment is low, the rate of change of money wage rates is high. Since macroeconomic concerns relate to inflation rather than wages, and wages and prices are mutually dependent, the studies focus mainly on the inflation rate by modifying the Phillips curve. In 1960, Samuelson and Solow (1960) modified the Phillips curve for the US by focusing on the relation between average price rise as a measure of the inflation rate and unemployment rate. The study suggests that the increase in the price index is necessary to keep the unemployment rate at a certain level in order to achieve the goal of the non-perfectionist.

The *Phillips curve* illustrating the negative relationship between the inflation rate and the unemployment rate is depicted on the left-hand side of Figure 5.9. After the Recession of 1957-1958, the 1960s began with low gross domestic product (GDP) and high unemployment in the US (see also the right-hand side of Figure 5.9. for unemployment rate). The US policymakers

introduced expansionary monetary and fiscal policies to boost GDP and reduce unemployment. This policy results in a high overall price level and high aggregate output, causing unemployment to fall while inflation rises. This corresponds to a trade-off between inflation and unemployment *in the short run*. Illustration by the real data shows that the higher the inflation rate, the lower the unemployment rate between 1960 and 1969, as shown on the right-hand side of Figure 5.9. In the early 1960s, unemployment was high while inflation was low. In the following years of the 1960s, unemployment fell while inflation rose. In other words: In the 1960s, policymakers preferred low unemployment to high inflation. The Vietnam War also fueled inflation in the US in the late 1960s and rose in the 1970s, and the price of oil per barrel also rose sharply in 1973 and 1979, causing a supply shock. As a result, no particular previously confirmed pattern had emerged in the relationship between the inflation rate and unemployment in the 1970s (and also in the following decades due to other reasons). In contrast to the negative relationship suggested by the original Phillips curve, both inflation and unemployment increased, which is known as stagflation.

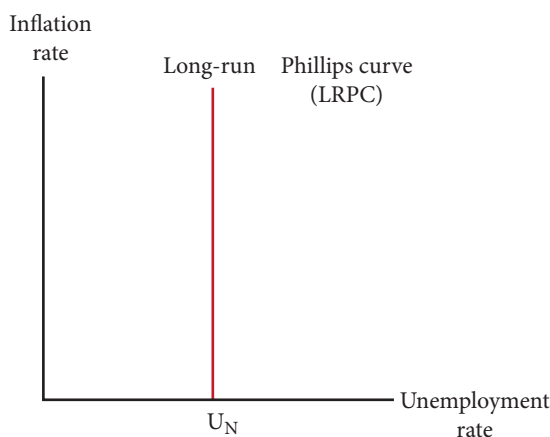
Because of the unsatisfactory original Phillips curve relation, economists have begun to criticize it in subsequent years and have gone further by extending the original curve. Friedman's (1968) study states that there is a short-run relationship between inflation and unemployment though this relationship is not *permanent*. In the late 1960s, Friedman (1968) and Phelps (1968) pointed to *the role of expected inflation*. At this point, we must first recall the natural rate of unemployment so that we can explain both the expectations-augmented Phillips curve and the long-run Phillips curve introduced by Friedman (1968). In the long run, the unemployment rate is at the natural rate, which is fully called the natural rate of unemployment ( $U_N$ ), when the economy is at potential GDP. *The natural rate of unemployment* is the sum of frictional unemployment and structural unemployment so it is above zero. In the short run, the unemployment rate fluctuates around the natural rate of unemployment, but in the long-run it returns back so the inverse relationship between inflation rate and unemployment rate is not permanent in the long run.

Having introduced the vertical long-run Phillips curve as drawn in Figure 5.10, let us understand in detail the role of expected inflation and why the long run Phillips curve is vertical. The flaw in the original work of Philips (1958) is that he does not distinguish between nominal wages and real wages, which is criticized by Friedman (1968) and Phelps (1968). Workers care about real wages. Strictly speaking, they care about how many goods and services they can buy. Firms also care about real wages. Unless firms expect a rise in the price level of their own product, higher pay to workers seems unlikely.



**Figure 5.9** The Phillips curve (1)(left) and inflation rate and unemployment rate between 1960-1969 (2)(right).

**Source:** Federal Reserve Economic Data (FRED), available at <https://fred.stlouisfed.org>, accessed on July 18<sup>th</sup>, 2022 (The 2nd figure).



**Figure 5.10** The long-run Phillips curve.

Expected inflation due to the expectation of an increase in the price level leads to an increase in the actual inflation, which affects real wages. The Phillips curve extended by Friedman (1968) and Phelps (1968), which is also known as *expectations-augmented Phillips curve*, can therefore be expressed by Equation 6:

$$\pi = \pi^e - \alpha(U - U_N) \quad (6)$$

where  $\pi$  is inflation,  $\pi^e$  is the expected inflation,  $U$  is the unemployment rate, and  $U_N$  is the natural rate of unemployment.  $\alpha$  is the strength of the unemployment gap ( $U - U_N$ ) on inflation. As shown in Equation 6, inflation depends on expected inflation and the deviation of unemployment from the natural rate of

unemployment. The short-run Phillips curve, which depends on expectations now, the effect of expected inflation on the curve and how to obtain the long-run Phillips curve are shown in Figure 5.11.

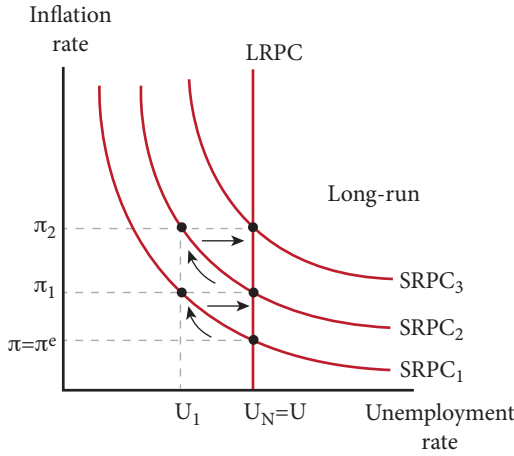


Figure 5.11 The short-run expectation-augmented Phillips curve and long-run Phillips curve.

As shown in Figure 5.11, the short-run expectations-augmented Phillips curve is downward sloping, i.e. there is a negative relationship between inflation and unemployment at any expected inflation rate. Suppose the expected inflation rate ( $\pi^e$ ) is equal to the inflation rate ( $\pi$ ) and unemployment ( $U$ ) is equal to the natural rate of unemployment ( $U_N$ ). The central bank (CB) in Türkiye (the Fed in the US) or the government decides to adopt an expansionary monetary or fiscal policy. Following the policy, the inflation rate rises to  $\pi_1$  and the unemployment rate falls to  $U_1$ , i.e. below the natural rate of unemployment. The real wages of workers whose expected inflation ( $\pi^e$ ) is equal to the inflation rate ( $\pi$ ) also fall.

Over time, workers and firms adjust their behavior with respect to the expected inflation ( $\pi_1$ ), and workers demand that firms increase their nominal wages by  $\pi_1$  to strengthen their purchasing power, which causes  $SRPC_1$  to shift to  $SRPC_2$ . Inflation rate will remain at  $\pi_1$  and the unemployment rate ( $U_1$ ) will return to the natural rate of unemployment ( $U_N$ ). If the government or CB continues to take expansionary policies to lower the unemployment rate, the inflation rate will rise to  $\pi_2$  and the unemployment rate will

fall back to  $U_1$ . Workers and firms adjust their expectation in the long run, shifting  $SRPC_2$  to  $SRPC_3$ . In the long run the economy will be at the natural rate of unemployment and high inflation rate. The long-run Phillips curve ( $LRPC$ ) is the line connecting each short-run Phillips curve at expected inflation rate.

In the late 1970s, Lucas and Sargent (1978), who introduced *rational expectations* into the model, argue that people do not adjust their expectations as slowly as assumed above. They assume that all available information is used to predict inflation and that all prices and wages are flexible. If firms and workers have rational expectations, both firms and workers respond more quickly to expansionary monetary policy, so there is no fall in real wages. So a fall in the unemployment rate is temporary and returns quickly. The result of this policy is an increase in the inflation rate and no change in the unemployment rate. Consequently, there is no short- and long run trade-off between the inflation rate and the unemployment rate.

Last year's inflation is a strong sign of expected inflation, so we can formulate the expected inflation as follows:

$$\pi^e = \pi_{t-1} \quad (7)$$

where  $\pi_{t-1}$  is last year's inflation rate,  $t$  is the year. Rewritten form of Equation 8 as:

$$\pi_t = \pi_{t-1} - \alpha (U_t - U_N) \quad (8)$$

If we move to the left-hand side of Equation 8, we get Equation 9:

$$\pi_t - \pi_{t-1} = -\alpha (U_t - U_N) \quad (9)$$

The Equation 9 shows that the difference between  $U_t$  and  $U_N$  affects the change in inflation rate. More precisely, when the unemployment rate ( $U_t$ ) is lower than the natural rate of unemployment ( $U_N$ ), the inflation rate increases. When the unemployment rate ( $U_t$ ) is above the natural rate of unemployment, the inflation rate decreases. When the unemployment rate is equal to the natural rate of unemployment ( $U_N$ ), the inflation rate does not change. This is called as *nonaccelerating inflation rate of unemployment (NAIRU)*.

### Okun's Law

At the beginning of this chapter we presented macroeconomics as a kind of chain. One of the rings of the chain is the representation of the relationship between the inflation rate and the unemployment rate, and arguments that extend the original Phillips curve. This part relates to the other ring. The seminal work of Okun (1962) presented the inverse relationship between changes in unemployment and the growth rate of real GNP. Thereafter the deviation of unemployment from the natural rate of unemployment and the deviation of real output from potential output is known as *Okun's law*. This law can be presented as follows:

$$U - U_N = -\frac{1}{2}(Y - Y^p) \quad (10)$$

where  $U$  is the unemployment rate, and  $U_N$  represents the natural rate of unemployment.  $Y$  is the real output in logs and  $Y^p$  is potential output in logs. According to the equation above, each one percentage point increase in real output leads to a one-half percentage point decrease in the unemployment rate. Broadly speaking, real output greater than its potential output leads to decline in unemployment rate.

## LO 1

Recognise basic concepts of the labor market

The three most important terms we hear almost daily are labor force participation rate, employment rate and the best known term, unemployment rate. To understand them, we must first distinguish between the population and the working age population. The working-age population includes all persons older than 15 years, while the population includes everyone. Labor force is the sum of the number of employed and unemployed persons.

The ratio of the number of employed persons to the working-age population is the employment rate and the ratio of the number of unemployed persons to the labor force is the unemployment rate. Labor force participation rate is the share of the labor force in the working age population.

## LO 2

Explain how the labor market works and the relationship between employment and wage

In the labor market, workers meet firms or firms meet workers. Workers supply their labor and firms demand the labor of workers for production. How many workers firms hire depends on the value of the marginal product of labor and the wage. Firms hire labor up to the point where the value of the marginal product of labor equals the wage. When the wage rises, less labor is demanded. Therefore, the labor demand curve is downward sloping. On the other hand, neglecting other details, when wages rise, people refrain from wasting their time on leisure, so the labor supply curve is upward sloping. The intersection of the two curves corresponds to the equilibrium of wage and employment in the labor market.

## LO 3

Understand why unemployment exists and explain how institutions, firms and the government affects the labor market

Unemployment is always above zero. And why? Because of frictional and structural unemployment. Job search takes time. Firms look for workers who fit their vacancies and workers look for the best job for them, but finding each other takes time. This is frictional unemployment. Structural unemployment is harder than frictional unemployment. The duration of unemployment is long. Because of the skill level of those affected, they may not find a job for a long time. Moreover, wage rigidity leads to structural unemployment. Unions set higher wages than the equilibrium wage or the government sets a minimum wage that is higher than the equilibrium wage. These are the reasons for unemployment. In addition, some firms may want to pay higher wages than the equilibrium wage. This is seen as another reason for unemployment. As for cyclical unemployment, when the economy is in good times, production increases, which means unemployment decreases, while bad times cause unemployment to increase. The sum of frictional and structural unemployment is the natural rate of unemployment.

## LO 4

Discuss the relationship between unemployment and inflation taking into account the Philips curve and its evolution over time

Interventions in the market to increase output reduce unemployment, but some interventions increase both output and the price level, leading to the emergence of inflation. Accordingly, the negative relationship between unemployment and inflation can be observed as it existed in the 1960s in the US. In the following years, the model was extended to include expected inflation. Friedman (1968) and Phelps (1968) pointed out the short-run trade-off between these two variables, while in the long-run there is no trade-off. Lucas and Sargent (1978) introduced the role of rational expectations. They supported the idea that there is no short-run or long-run trade-off.

## LO 5

Explain the relationship between unemployment and economic growth

Okun's law explains the relationship between unemployment and economic growth. When real output is higher than potential output, unemployment falls, and when real output is lower than potential output, unemployment rises, but according to the law there is no one-to-one change in unemployment. That is, every one percentage point increase in real output leads to a one-half percentage point decrease in the unemployment rate.

1 The number of people in the labor force is 18,000. The number of employed people is 15,300. What is the unemployment rate?

- A. 5%
- B. 15%
- C. 85%
- D. 11%
- E. 8%

2 If a person stops looking for a job and chooses to stay at home, that person is .....

Which of the following completes the sentence above?

- A. cyclically unemployed
- B. frictionally unemployed
- C. not in the labor force
- D. structurally unemployed
- E. in the labor force

3 When 4 million immigrants come to country X, the labor .....

Which of the following completes the sentence above?

- A. supply curve shifts to the left
- B. demand curve shifts to the right
- C. supply curve shifts to the right
- D. demand curve shifts to the left
- E. supply curve does not shift

4 Suppose that the quantity of labor demanded is  $L_D = 31,500 - 9W$  and the quantity of labor supplied is  $L_S = 4,500 + W$ . What is the equilibrium wage and employment?

- A. 2,700; 7,200
- B. 3,500; 31,500
- C. 4,500; 4,500
- D. 27,000; 10
- E. 36,000; 800

5 When firms pay wages ..... the equilibrium wage, ..... of workers increases.

Which of the following completes the sentence above?

- A. higher than; turnover
- B. higher than; productivity
- C. lower than; productivity
- D. lower than; morale
- E. lower than; human capital

6 If the government sets up institutions where some skills are taught to people who are actively looking for a job, the natural rate of unemployment will be .....

Which of the following completes the sentence above?

- A. increases due to an increase in cyclical unemployment
- B. decreases due to a decrease in frictional unemployment
- C. decreases due to a decrease in structural unemployment
- D. not change
- E. increases due to a decrease in structural unemployment

7 When the floor wage set by the government is above the equilibrium wage, the supply of labor ..... the demand for labor and the unemployment rate .....

Which of the following completes the sentence above?

- A. exceeds; increases
- B. is less than; decreases
- C. exceeds; decreases
- D. is less than; increases
- E. is equal to; does not change

8 The Phillips curve shows the relationship between .....

Which of the following completes the sentence above?

- A. inflation and output
- B. interest rate and rational expectations
- C. economic growth and unemployment
- D. unemployment and inflation
- E. money supply and output

9 The short-run expectations-augmented Phillips curve is ..... while the long-run Phillips curve is .....

Which of the following completes the sentence above?

- A. upward sloping; flat
- B. downward sloping; vertical
- C. flat; downward sloping
- D. vertical; upward sloping
- E. downward sloping; flat

10 Assume that Okun's law is represented by  $U - U_N = -\frac{1}{4}(Y - Y^p)$ .  $Y^p$  grows at 8 % per year and  $U_N$  remains constant. By how much does  $U$  decrease if  $Y$  increases by 4 percentage points?

- A. 3 percentage point
- B. 2 percentage point
- C. 0.5 percentage point
- D. 1 percentage point
- E. 4 percentage point



1. B

If your answer is wrong, please review the “Basic Concepts of the Labor Market” section.

6. C

If your answer is wrong, please review the “Existence of Unemployment” section.

2. C

If your answer is wrong, please review the “Basic Concepts of the Labor Market” section.

7. A

If your answer is wrong, please review the “Existence of Unemployment” section.

3. C

If your answer is wrong, please review the “Labor Market Equilibrium” section.

8. D

If your answer is wrong, please review the “The Phillips Curve and Natural Rate of Unemployment” section.

4. A

If your answer is wrong, please review the “Labor Market Equilibrium” section.

9. B

If your answer is wrong, please review the “The Phillips Curve and Natural Rate of Unemployment” section.

5. B

If your answer is wrong, please review the “Existence of Unemployment” section.

10. D

If your answer is wrong, please review the “Okun’s Law” section.

According to the statistics of Turkish Statistical Institute, the number of employed women (E) is 9.965.000 and the number of unemployed women (U) is 1.598.000 in Türkiye in May 2022. The female population of working-age (P) is 32.615.000 in Türkiye. Calculate female labor force participation rate (FLFPR).

your turn 1

According to the statistics of Turkish Statistical Institute, the number of employed women (E) is 9.965.000 and the number of unemployed women (U) is 1.598.000 in Türkiye in May 2022. The female population of working-age (P) is 32.615.000 in Türkiye. Calculate female labor force participation rate (LFPR).

$$LFPR = \frac{E + U}{P} * 100\%$$

$$LFPR = \frac{9.965.000 + 1.598.000}{32.615.000} * 100\%$$

$$LFPR = 35.5\%$$

According to the statistics of Turkish Statistical Institute, the number of unemployed men ( $U$ ) is 2.187.000 in Türkiye in May 2022. The number of men who are in the labor force ( $LF$ ) is 23.061.000 in Türkiye. Calculate male unemployment rate.

your turn 2

According to the statistics of Turkish Statistical Institute, the number of unemployed men ( $U$ ) is 2.187.000 in Türkiye in May 2022. The number of men who are in the labor force ( $LF$ ) is 23.061.000 in Türkiye. Calculate male unemployment rate.

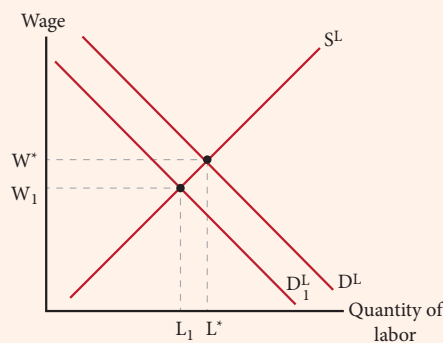
$$\text{Unemployment rate} = \frac{U}{LF} * 100\%$$

$$\text{Unemployment rate} = \frac{2.187.000}{23.061.000} * 100\%$$

Margarine used to be used in most of our households. The latest evidence shows that margarine contains high levels of trans fats and trans fats clog the arteries. As word has spread in society about the hazardous effects of using margarines, the demand for margarine decreases. Use a graph to show the effect of the decrease in demand for margarine on employment and wage in the labor market.

your turn 3

Margarine used to be used in most of our households. The latest evidence shows that margarine contains high levels of trans fats and trans fats clog the arteries. As word has spread in society about the disadvantages of using margarine, the demand for margarine decreases. Use a graph to show the effect of the decrease in demand for margarine on employment and wage in the labor market.

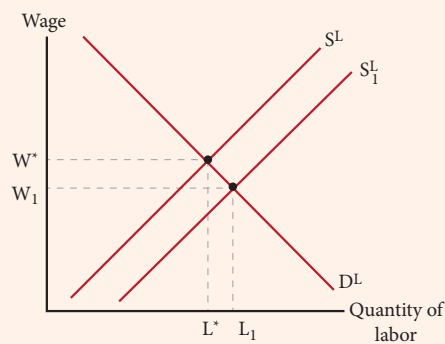


As shown in the figure, the labor demand curve shifts to the left, leading to a decrease in wage from  $W^*$  to  $W_1$  and a decrease in employment from  $L^*$  to  $L_1$ .

The study by Coen-Pirani, Leon, Lugauer (2010) provides evidence that having a dryer, a freezer and a washing machine at home makes women’s tasks easier in the United States. In other words, the appliances given women more free time. Use a graph to show the effect of the use of household appliances on women’s employment and wage in the labor market.

your turn 4

The study by Coen-Pirani, Leon, Lugauer (2010) provides evidence that having a dryer, a freezer and a washing machine at home makes women’s tasks easier in the United States. In other words, the appliances gave women more free time. Use a graph to show the effect of the use of household appliances on women’s employment and wage in the labor market.



As shown in the figure, the labor supply curve shifts to the right, leading to a decrease in wage from  $W^*$  to  $W_1$  and an increase in employment from  $L^*$  to  $L_1$ .

Henry Ford introduced a wage of \$5 a day in 1914, which was higher than the average wage that is between \$2 and \$3. In return, Ford’s profits and workers’ productivity increased (Raff and Summers, 1987). Evaluate the consequences of the wage being above the equilibrium wage.

your turn 5

This example shows that Henry Ford applied the efficiency wage theory to increase productivity and reduce employee turnover. Since a wage above the equilibrium wage attracts others, the quantity of labor supplied exceeds the quantity of labor demanded because firms cannot hire all applicants. Consequently, unemployment occurs.

## References

- Acemoglu, D., Laibson, D. & List, J. (2021). *Macroeconomics*. Pearson Higher Ed.
- Buyuk, H. F. (2022). Turkish medical workers strike for better rights and pay. *BalkanInsight*. Retrieved from <https://balkaninsight.com/2022/06/15/turkish-medical-workers-strike-for-better-rights-and-pay>.
- Coen-Pirani, D., León, A. & Lugauer, S. (2010). The effect of household appliances on female labor force participation: Evidence from microdata. *Labour Economics*, 17(3), 503-513.
- Friedman, M. (1968). The role of monetary policy. *The American Economic Review*, 58(1), 1-17.
- International Labour Organization. (2021). *Building forward fairer: Women's rights to work and at work at the core of the COVID-19 recovery*. Geneva, Switzerland: International Labour Organization.
- Lucas, R. E. & Sargent, T. J. (1978). "After Keynesian macroeconomics". In *After the Phillips curve: persistence of high inflation and high unemployment*. Federal Reserve Bank of Boston, Boston, MA.
- Mishkin, F. S. (2015). *Macroeconomics: Policy and practice, 2<sup>nd</sup> Edition*. Pearson Education Limited.
- Okun, A. M. (1962). Potential GNP: Its measurement and significance. *Proceedings of the Business and Economics Statistics Section*, American Statistical Association, 98-104.
- Phelps, E. S. (1968). Money-wage dynamics and labor-market equilibrium. *Journal of Political Economy*, 76(4), 678-711.
- Phillips, A. W. (1958). The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-1957. *Economica*, 25(100), 283-299.
- Raff, D. M. & Summers, L. H. (1987). Did Henry Ford pay efficiency wages? *Journal of Labor Economics*, 5(4), 57-86.
- Samuelson, P. A. & Solow, R. M. (1960). Analytical aspects of anti-inflation policy. *The American Economic Review*, 50(2), 177-194.
- T.R. Presidency of Migration Management of the Ministry of Interior. (2017). *2016 Türkiye goc raporu*. T.C. İçişleri Bakanlığı Göç İdaresi Genel Müdürlüğü Yayınları. Retrieved from [https://www.goc.gov.tr/kurumlar/goc.gov.tr/YillikGocRaporlari/2016\\_yiik\\_goc\\_raporu\\_haziran.pdf](https://www.goc.gov.tr/kurumlar/goc.gov.tr/YillikGocRaporlari/2016_yiik_goc_raporu_haziran.pdf).
- World Bank. (2020). *Global economic prospects, June 2020*. Washington, DC: World Bank. DOI: 10.1596/978-1-4648-1553-9. License: Creative Commons Attribution CC BY 3.0 IGO.

# Chapter 6 The AD-AS Model

After completing this chapter, you will be able to;

## Learning Outcomes

1 Define the concept of aggregate demand and elaborate on the factors that change it

3 Understand how the equilibrium levels of price and aggregate output in an economy are determined in the short-run and in the medium-run

5 Understand how supply side shocks create changes in the short-run and medium-run equilibria in an economy using the AD-AS analysis

2 Define the concept of aggregate supply, differentiate between the concept of short-run aggregate supply and the concept of long-run aggregate supply, and elaborate on the factors that change each of them

4 Describe how government policy changes have an effect on the short-run and medium-run equilibria in an economy using the AD-AS analysis

## Chapter Outline

Aggregate Demand  
Aggregate Supply  
Equilibrium in the AD-AS in the Short-run and in the Medium-run  
Demand-side Shocks in the AD-AS Model:  
Monetary and Fiscal Policy Effects  
Supply-side Shocks and Changes in Equilibrium in the AD-AS Model

## Key Terms

Aggregate Demand  
Short-Run Aggregate Supply  
Long-Run Aggregate Supply  
Wage Contracts  
Natural Unemployment Rate  
Potential Output; Inflationary Gap  
Recessionary Gap





## INTRODUCTION

In Chapter 4, using the IS-LM model, we studied the determination of simultaneous equilibrium in goods and money markets in a closed economy. Throughout the analysis, the price level was held constant in the background while we determined the equilibrium interest rate and output in the interaction of goods and money markets. Even with monetary and fiscal policy changes, the price level remained the same in moving from one equilibrium to another in goods and money markets. Furthermore, the IS-LM analysis in Chapter 4 did not include production and pricing decisions of firms, we assumed that supply was completely demand-determined: The firms were assumed to produce whatever output is demanded at some constant price level. However, the determination of the price level, the factors that lead to changes in the price level and the rate at which the price level changes are important issues in real economies.

We now move one step further to include the supply-side decisions into our equilibrium analysis. In doing so, we will be able to relate the changes in the price level to changes in the aggregate output, and thus we will be able to explain the causes and consequences of changes in the price level in real economies. To this end, we utilize the AD-AS (aggregate demand-aggregate supply) model to illustrate how the general level of prices and aggregate production level are determined in the general equilibrium of a closed economy. The AD-AS analysis takes simultaneous equilibria in the goods, money and labor markets into consideration in the determination of general equilibrium. As such, the analysis allows us to understand the effects of not only the demand-side policy changes on the general equilibrium of an economy, such as monetary and fiscal policy changes, but also supply-side shocks, including increases in production costs and institutional changes in the labor market. With this analysis, we will be able to understand the differences between short-run or temporary equilibrium situations, where the economy may be producing above or below its potential, and medium-run equilibrium situations, where the economy reaches its full employment potential. Accordingly, the AD-AS analysis helps us understand the formation of business cycles and what can be done about them.

This chapter first presents the concept of aggregate demand, and study what it means, how it is derived and how it changes. Secondly, we investigate the concept aggregate supply from alternative perspectives in economic theory. In doing so, we are able to understand how alternative economic theories interpret aggregate supply relationship, and using insights from these theories, we derive the aggregate supply function and discuss the factors that change this function. Finally, we combine the aggregate demand and aggregate supply to determine the economy's equilibrium price level and aggregate output (GDP), and analyze the drivers of changes in the equilibrium price level and aggregate output. In this respect, we consider the demand-side and supply-side shocks in an economy that may have an effect on the general equilibrium.

## AGGREGATE DEMAND

Aggregate demand shows the relationship between aggregate output and the price level in the simultaneous equilibrium of goods and money markets. We derive the aggregate demand relationship using the equilibrium conditions in both the goods and money markets. It is important to understand that the aggregate demand relationship we describe here is not a summation of individual market demand curves that you have studied in microeconomics. An individual market demand curve shows the relationship between the quantity demanded for a particular good at that good's particular market price, and the demand behavior is given by consumer preferences. Aggregate demand relationship on the other hand, considers the relationship between the general level of prices, such as the consumer price index or the GDP deflator, and the real GDP in an economy.



### attention

Aggregate demand relationship is not the summation of individual market demand curves in an economy.

How can we derive the *aggregate demand* relationship algebraically? Recall that equilibrium in the goods market is given by the IS relation, and

the equilibrium in the money market is given by the LM relation. Suppose that we have already derived these two relationships. Using the IS and LM functions, we construct a relationship between the aggregate output  $Y$  and the price level  $P$ , where  $P$  is the independent variable. The relationship that we derive implies simultaneous equilibria in both goods and money markets in terms of alternative combinations of  $Y$  and  $P$ .

In order to obtain the AD function, first consider the IS and LM functions as given below,

$$IS : Y = \alpha(\bar{A} - bi)$$

$$LM : i = \frac{1}{h} \left( kY - \frac{M}{P} \right)$$

Then, plug the interest rate  $i$  from LM relation into IS relation, solve for  $Y$  as a function of  $P$ , and thus we obtain the AD relationship between  $Y$  and  $P$  as follows:

$$Y = \frac{\alpha\bar{A} + \alpha\frac{k}{h}\frac{M}{P}}{1 + \alpha\frac{bk}{h}}$$

From the function given above, the relationship between  $P$  and  $Y$  is negative in the goods and money markets, all else held constant.

Now let's see the effects of a change in  $P$  on the equilibrium in the goods and money markets and the construction of the AD-curve in the following diagram, Figure 6.1.

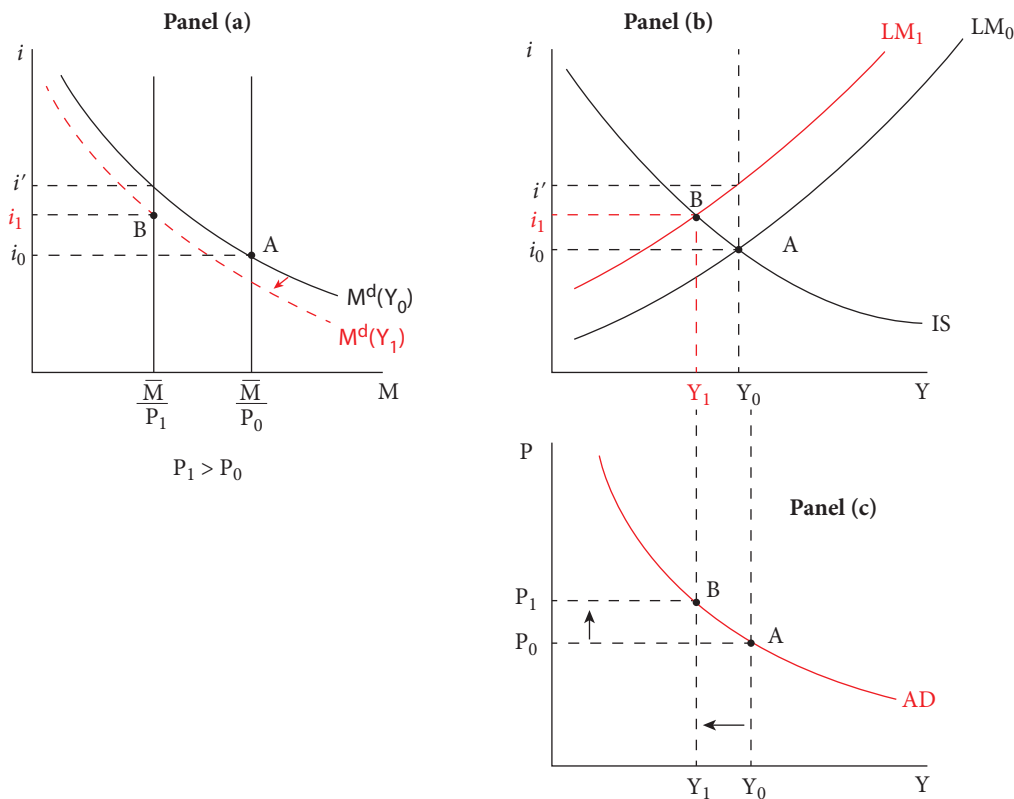


Figure 6.1 Construction of the AD-curve.

In Figure 6.1, Panel (a) shows the money market equilibrium, Panel (b) shows the equilibrium in IS and LM, and finally in Panel (c) we derive the AD-curve. Suppose that there is an increase in  $P$ , then the immediate impact is in the money market, by lowering the real money supply from  $\frac{\bar{M}}{P_0}$  to  $\frac{\bar{M}}{P_1}$ , as displayed in Figure 6.1, Panel (a). With the decrease in the real money supply, there appears an excess demand for money at the original interest rate  $i_0$ . The excess demand for money ultimately drives the interest rate up in the money market. This upward movement in the interest rate with the decrease in real money supply causes the LM-curve to shift to the left at the initial aggregate output level  $Y_0$  (Panel b). In the goods market, with the increase in the interest rate, there will be lower investment demand, and hence lower aggregate expenditure, and the equilibrium income in the goods market will fall, with an up and backward movement along the IS-curve. Simultaneous equilibrium in both goods and money markets will be established at a higher interest rate and a lower income and output level. Hence, from the goods and money markets equilibrium perspective, a higher price level will correspond to a lower income and output, implying a negatively sloped AD-curve (Panel c).

**Aggregate demand** relation shows how changes in the price level affect aggregate output.

At this point, we need to mention that at any point along the AD-curve, both the goods and money markets are in equilibrium simultaneously. The distinction between different points along the AD-curve (such as from point A to point B in Figure 6.1 Panel c) is that equilibria in the goods and money markets occur at alternative price levels. The magnitude by which the changes in the price level affects the aggregate output, in other words the magnitude of the slope of the AD-curve, depends on the magnitude of the shift in LM-curve as well as the slope of the IS-curve.

## Shifts in the AD Curve

In deriving the AD-curve, we hold the exogenous factors such as government policy or autonomous behavior of agents fixed. That is, along a given AD-curve, government spending, net taxes,

nominal money supply, autonomous consumption and autonomous investment spending are fixed. As such, any change in any one of these exogenous factors would imply a change in the relationship between the price level and the aggregate output, and hence cause a shift the AD-curve.

Let's first consider the impact of expansionary fiscal policy via an increase in government spending,  $G$ . As shown in Figure 6.2 Panel (a), an increase in government spending would lead to an increase in aggregate output in the equilibrium of goods and money markets from  $Y_0$  to  $Y_1$ , with a rightward shift in IS. In this case, the price level remains unchanged. Hence, given the price level, the equilibrium output increases in both markets, which implies a new relationship between the price level and aggregate output. The new output  $Y_1$  now corresponds to the original price level  $P_0$  along the new aggregate demand curve  $AD_1$  as given in Panel (b) of Figure 6.2. A decrease in net taxes, or increases in autonomous components of consumption and investment functions would also create a similar effect on aggregate demand.

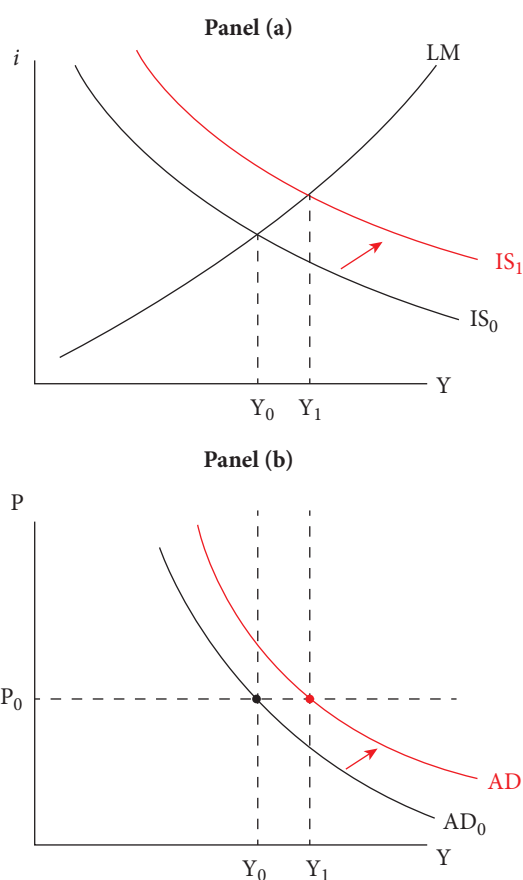


Figure 6.2 Expansionary fiscal policy and the shift in AD-curve.



The magnitude of the shift in the AD-curve from  $AD_0$  to  $AD_1$  in Figure 6.2 depends on the size of the shift in the IS-curve (i.e. given by the size of the change in government policy or the autonomous factors and the size of the multiplier) and also the slope of the LM-curve.

A shift in the AD-curve can also be the result of a change in monetary policy. In this case, given the price level, an increase in the nominal money supply (due to expansionary monetary policy such as an open market purchase, a decrease in the required reserve ratio or a decrease in discount rate) increases the real money supply, which leads to a rightward shift in the LM-curve as given in Figure 6.3 Panel (a). The initial price level  $P_0$  now corresponds to a higher level of income and output,  $Y_1$  in both markets. This correspondence is no longer on the original  $AD_0$  curve, it is on the new  $AD_1$  curve, as shown in Figure 6.3 Panel (b). Hence, expansionary monetary policy shifts the AD-curve to the right. The magnitude of the shift depends on the magnitude of the shift in the LM-curve and also the slope of the IS-curve.

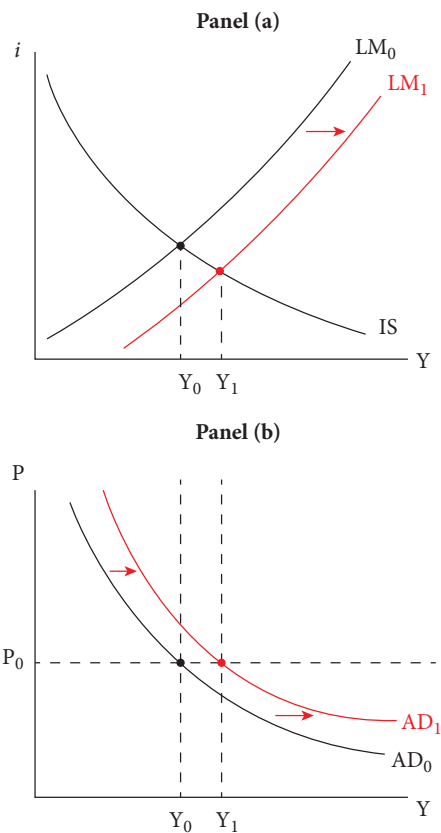


Figure 6.3 Expansionary monetary policy and the shift in AD-curve.

### attention

A movement along a given AD-curve is caused only by changes in the price level. A change in any one of the exogenous factors (other than the price level) will cause a shift of the AD curve.

Table 6.1 Government policies that cause a shift the AD curve.

| AD curve shifts up and to the right     |                                           |
|-----------------------------------------|-------------------------------------------|
| <i>Expansionary Fiscal Policy</i>       | <i>Expansionary Monetary Policy</i>       |
| An increase in government spending, $G$ | An increase in nominal money supply       |
| A decrease in net taxes, $T$            | An open market purchase                   |
| An increase in transfers                | A decrease in the required reserve ratio  |
| A decrease in taxes collected           | A decrease in discount rate               |
| AD curve shifts down and to the left    |                                           |
| <i>Contractionary Fiscal Policy</i>     | <i>Contractionary Monetary Policy</i>     |
| A decrease in government spending, $G$  | A decrease in nominal money supply        |
| An increase in net taxes, $T$           | An open market sale                       |
| A decrease in transfers                 | An increase in the required reserve ratio |
| An increase in taxes collected          | An increase in discount rate              |



## your turn 1

Assume an economy represented by the following relationships:

$$C = 80 + \frac{2}{3}Y_D$$

$$T = (20 + \frac{1}{4}Y) - 80$$

$$G = 230$$

$$I = 250 - 5i$$

$$M^d = 400 + \frac{1}{2}Y - 20i$$

$$M^s = 500$$

where  $Y$  is national income (GDP),  $C$  is consumption,  $Y_D$  is disposable income,  $T$  is net taxes,  $G$  is government spending,  $I$  is private investment,  $i$  is interest rate,  $M^d$  is real money demand,  $M^s$  is the nominal money supply,  $P$  is price level.

**A.** For the economy given by the functions above, construct the AD-curve relationship (*Hint*: First derive the IS and LM relationships).

**B.** For the following two government policy changes, derive the new AD-curve relationship, separately.

- i. The government spending increases from 230 to 380 units
- ii. The nominal money supply decreases from 500 to 320 units

## AGGREGATE SUPPLY

**The Aggregate Supply** curve shows how the general level of prices respond to changes in aggregate output or the GDP. The Aggregate Supply curve is not simply the horizontal summation of all the sectors' output at every price level, rather, it shows how the general level of prices respond to changes in GDP, given the behavior of all actors, such as the employees or workers and the employers or the firms, and the condition of pricing institutions in an economy.

Aggregate supply relation shows how changes in aggregate output affect the general level of prices in the economy.

In economic theory, the shape of the aggregate supply curve depends on the time frame during which prices may be fixed or flexible. In the short-run, since prices are sticky at predetermined levels, the aggregate supply curve is horizontal, and prices do not respond to changes in the GDP. In the long-run on the other hand, prices are fully flexible, the

level of aggregate output is only determined by the amount of capital and labor and the technology by which they are combined, and the same output will be produced regardless of the price level. These are the two extreme views on the aggregate supply relationship. Below, we also present other models where aggregate supply implies a positive relationship between the price level and the aggregate output, and in particular, a version of aggregate supply which involves a trade-off between higher prices and lower unemployment, which is a temporary phenomenon. According to this trade-off, the economy must face higher prices in order to reduce unemployment or increase aggregate output, or to reduce prices, the economy must endure high unemployment with low aggregate output.

We first introduce the short-run Keynesian Aggregate Supply relationship, which is also known as the Short-run Aggregate Supply (SRAS).

### Keynesian Aggregate Supply-SRAS

The SRAS is also called the Keynesian Aggregate Supply curve and it is horizontal, implying that at the existing price level, firms are willing to supply whatever amount of goods is demanded in

the economy. This implies that there is ongoing unemployment in the economy, such that firms can hire as much labor as they want and increase production at the current wage without raising the prices. Firms are willing to supply as much output as demanded in the economy at the existing price level. Another justification for the horizontal aggregate supply curve is that in the short-run, some prices are sticky, and prices do not adjust to changes in demand. In the short-run, firms may find it costly to change prices (issue new restaurant menus, or issue new catalogs with new prices), and hence prices will be stuck at predetermined prices even if the demand conditions change in the short-run. In that sense, the firms will be willing to produce and sell as much as the customers demand, and hire workers to produce just the amount demanded without raising prices. As depicted in Figure 6.4, with an increase in AD, firms are willing to supply as much output as demanded at the given price  $P_0$ , and an increase in AD will not induce higher prices in the economy.

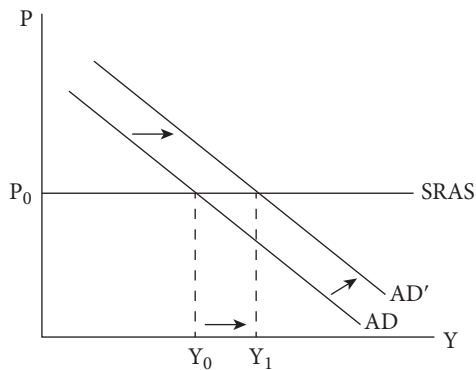


Figure 6.4 An increase in Aggregate Demand and the Keynesian aggregate supply curve.

Next, we introduce the other extreme where prices are fully flexible but output is fixed at its potential, and output level is not affected by fluctuations in aggregate demand.

### Classical Aggregate Supply-LRAS

LRAS, or the Classical Aggregate Supply curve is vertical, indicating that the same amount will be supplied regardless of the price level in the economy. The Classical Aggregate Supply assumes that the economy is at full employment producing the potential output of the economy,  $Y^*$  (the output that the economy produces under full employment of labor is called the potential output

or the natural output level). Potential output depends on the fixed amounts of available factors, labor, capital and land and available technology by which these factors of production is combined, and hence will change only if resources accumulate over time and/or if production technology changes. The rightward shift of the vertical LRAS curve given in Figure 6.5 corresponds to the growth of potential GDP via growth in factors and/or technological improvements, including institutional changes.

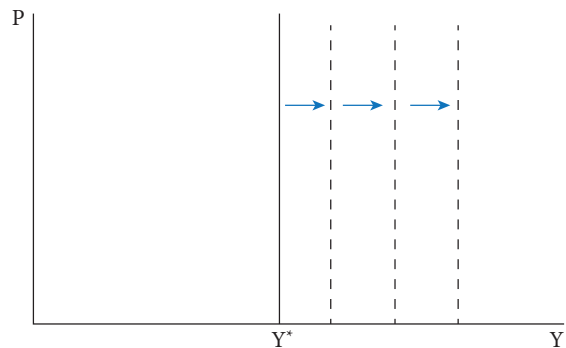


Figure 6.5 The Long-run Aggregate Supply (LRAS) curve.

In the long-run, changes in the aggregate demand have no effect on the aggregate supply of output, rather, the change in the aggregate demand will only create a proportional change in the price level when prices are fully flexible (Figure 6.6). For example, if nominal money supply increases, this will only create a proportional increase in the price level with no change in potential output, because potential output does not respond to changes in AD, and changes only if the given amounts of factors and/or available technology change. Later, we will examine this phenomenon as *the neutrality of money*.

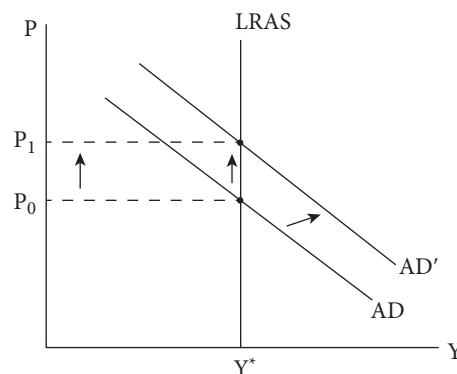


Figure 6.6 An increase in the Aggregate Demand and the LRAS.

## Upward Sloping AS Curve

Above we looked at the extreme cases where in the long-run prices are fully flexible and the aggregate supply curve is vertical at the potential output level, and in the short-run prices are perfectly sticky and the aggregate supply curve is horizontal at the fixed price level. Although there are different approaches and theories in macroeconomics about how best to explain the aggregate supply relationship outside of these extreme cases, ultimately, they put forward the same positive relationship between the price level and aggregate output in the short-run in the supply side of an economy. Even though the approaches differ in some details, they all share the common premise that in the short-run prices and wages are sticky and the result that in the short-run AS-curve is upward sloping. Below we introduce alternative theories as to why prices and wages are sticky in the short-run. After introducing these alternative theories, we present the model in Blanchard (2013) to put them all together to explain the short-run AS relationship.

## Monopolistic Competition

One of the explanations provided by the Keynesian theory for price stickiness is that most firms actively set their prices of their products rather than take the prices of their output as given by the market. In perfectly competitive markets, prices adjust immediately to changing supply and demand conditions. In these perfectly competitive markets with perfect price flexibility, the products are highly standardized, there are a large number of buyers and sellers, and the participants in these markets are price takers. Markets with fewer participants and less standardized goods may show price setting rather than price taking behavior. Although the market is competitive and the product is not completely standardized, the producer may have some price setting discretion. This is called monopolistic competition. A monopolistically competitive firm can raise its price without the risk of losing all of its customers. The profit maximizing strategy of a monopolistically competitive firm is to set the price above the marginal cost with some positive mark-up. The following mark-up rule determines the price:

$$P = (1 + \mu)MC$$

Where  $P$  is the nominal price charged by the price-setting firm,  $\mu$  is the mark-up (profit) rate, and

$MC$  is the marginal cost of production. Now suppose that at the given price, the demand for the product increases. The firm will be able to increase output to meet the demand at the given price and still find it profitable. As long as the  $MC$  of producing one more unit remains below the fixed price, the firms will be able to increase output at the fixed price. The price can be readjusted from time to time when cost conditions and therefore the  $MC$  change.

## Menu Costs

Another Keynesian explanation for price stickiness is when firms attempt to change their prices, they incur a cost called a *menu cost*. Such costs of price changes are called menu costs because when restaurants want to change their prices, they need to print new menus. If firms incur costs when changing prices, they will clearly change prices less often than they would otherwise, creating a certain degree of price rigidity. Other examples of menu costs that apply to any kind of firm may be any type of managerial cost, cost of remarking the merchandise, reprinting price lists and product catalogues, and informing the potential customers. The problem is that menu costs are relatively small, and the firms will change the price only when the profits lost by not changing the price outweigh the cost of changing the price.

## Imperfect Information

According to the imperfect information model, the AS-curve is upward sloping because firms and workers have imperfect information about absolute and relative prices. Firms perceive the rise in the nominal price of their products as a relative price increase and therefore raise the quantity supplied. Firms do not realize that in fact all nominal prices in the economy have risen. Once firms realize that all nominal prices have increased and their relative prices remain the same, they will cut back production and the economy will return to its potential in the long-run. Workers, on the other hand, perceive the rise in their nominal wages as a signal to supply more labor because they believe that their real wage has risen. Hence, in the short-run, until workers realize that the rise in the nominal wage is the result of a rise in the price level, a rise in the nominal wage (with a rise in the price level) is associated with higher output and lower unemployment.

## Contracts and Long-term Relationships

Firms may have contractual agreements (implicit or explicit) with their customers in order not to raise prices at least for a given period of time, even if there are changes in market conditions, hence prices may be *sticky* in the short-run during the contract period. In that sense, what creates stickiness in prices is not imperfect information on behalf of the market players, but an agreement to not change prices. However, this situation may be only temporary.

Another explanation as to why wages and thus prices might be sticky or rigid relies on institutional and legal factors such as the existence of minimum wage law or union contracts. Labor market involves long term relationships between firms and workers. Working conditions including wages are negotiated periodically but not frequently because it is costly to negotiate frequently.

## Insider-outsider Models

The insider-outsider model which claims that wages do not quickly and fully adapt to changes in unemployment, or to changes in the conditions in the labor market offers another explanation for the existence of sticky wages and therefore sticky prices. One important requirement in the insider-outsider model is that both the goods and the labor market are imperfectly competitive. Imperfect competition in labor market originates from the fact that the unemployed do not have full information about or access to wage negotiations: The unemployed do not sit at the negotiation or bargaining table. The unemployed would like to cut wages and create jobs for the unemployed, while firms negotiate with those who already have jobs (unionized workers). The reason that firms negotiate with those who are already employed is because it is costly for the firm to turn over labor: There are firing costs, hiring costs, training costs, etc., hence an *insider* has an advantage over an *outsider*.

## Efficiency Wages

Efficiency wage model claims that a worker's productivity depends on the real wage received by workers, and hence firms may choose to pay the worker above the market-clearing level (i.e.

worker's real wage does not necessarily reflect labor market conditions). Efficiency wages are often determined without resorting to a bargaining process or negotiation between the employer and the employee. Efficiency wage model asserts that higher wages can be used as a means of motivating labor, making the worker more productive. The amount of effort workers show on the job is related to how well the job pays relative to alternatives. Firms may want to pay wages above the market clearing wage to make sure that workers work hard enough not to lose their jobs. Another reason is that firms do not like high turnovers on the job, due to firing and hiring and retraining costs. Paying the worker an efficiency wage would prevent frequent quits and increase productivity on the job.

## Construction of the Upward Sloping AS-Function

We now turn to Blanchard's (2013) model of upward sloping Aggregate Supply which incorporates ingredients from some of the models explained above. The two important components of the positive relationship between the price level and the aggregate output are the wage determination process by wage setters and the price determination process by firms or price-setters.

We first start by describing the wage determination process. In the economy, one method of wage determination may be bargaining (collective or bilateral), or wages can be set directly by employers without any bargaining process (i.e., efficiency wages). In general, wage determination can be described by the following wage-setting (WS) equation:

$$W = P^e F(u, z)$$

Here, the nominal wage  $W$  depends on the expected price  $P^e$ , the unemployment rate  $u$ , and all of the other factors related to the labor market that may affect the wage determination process, summarized by the variable  $z$ .

First of all, the price level is positively and proportionately related to the wages that workers receive. Both workers and firms are concerned about the real wages, not the nominal wages. Workers are concerned about the purchasing power of the wages that they receive, or the real wage,  $W/P$  in terms of goods and services that  $W$



can purchase. Firms, on the other hand, also pay attention to the wages that they pay in relation to the price of output that they sell, which is also the real wage  $W/P$ .

The next question is, why do wages depend on the expected price level  $P^e$  and not the actual or current price level,  $P$ ? The answer is that when nominal wages are set for a certain period of time by the employer or within a contract by negotiation and bargaining, the relevant price level for that future period is not yet known. While negotiating and setting the wages, both parties, workers and firms, have to agree on what the nominal wages are going to be for the duration of the contract period, given that they agree on an expected price level to be written into contracts. Even when the wages are set by the employer without any bargaining, the employer has to factor in an expected price level into the wage, as the nominal wages are not readjusted frequently whenever there is a price level change. In fact, within the contract period, if the actual price level falls short of the expected price written into the wage contract, firms will be worse off, on the other hand, if the actual price level turns out to be higher than the expected price written into the wage contracts, workers will be disadvantaged. In that sense, both parties have a motivation to agree on a common expected price.

According to the wage determination equation, unemployment rate is negatively related to the nominal wage. In the real world, wages can be set through a bargaining process, either bilaterally or through collective bargaining. How much bargaining power a worker has depends on several factors. One important factor is the condition of the labor market or the current rate of unemployment. If unemployment is low, it would be more difficult for firms to find new workers and replace workers. Also, it is easier for workers to quit their current jobs and find new ones. In this case workers have a higher bargaining power in bargaining or negotiations for wage contracts. On the other hand, if the unemployment rate is high, then firms will find it easier to find replacement workers and it would be more difficult for workers to find new jobs. In this case, workers have a weaker bargaining power and will be in a position to accept lower wages. Hence for a given expected price level and given other conditions in the labor market, there is a negative relationship between  $u$  and  $W$ .

Finally, the other factors summarized in the variable  $z$  are defined in such a way that  $z$  affects  $W$  positively. Here we think of  $z$  as factors other than the expected price level and the unemployment rate that may influence the wage setting process, such as the existing policies in the labor market: The existence of unemployment insurance benefits, the existence of employment protection (related to firing costs), severance pay, the level of minimum wage. We can extend these labor market conditions to include the cost of hiring new workers (the search costs), the cost of retraining new workers, etc. for firms. Any change in these conditions will also affect the nominal wages given the unemployment rate and expected price.

The other component in the derivation of aggregate supply relationship is price determination by firms. Here we assume a monopolistically competitive firm with the following price setting behavior:

$$P = (1 + \mu)MC$$

where  $0 < \mu < 1$  is the mark-up rate, and  $MC$  is the marginal cost of production, as defined before. For our purposes, assume that the economy has a simple production function, using only labor in the production process:

$$Y = N$$

Then the marginal cost of production will only be the marginal cost of hiring another unit of labor, in other words the nominal wage,  $W$ ,

$$MC = W$$

Then, the price setting (PS) behavior becomes

$$P = (1 + \mu)W$$

The equilibrium in the labor market occurs when the real wage chosen by the wage setting process is equal to the real wage implied by the price setting process. That is, when the wage setters and the price setters agree on a common real wage, there is equilibrium in the labor market. The wage contracts are signed when both the wage setters and the price setters have no more motivation or desire to readjust the expected price  $P^e$  written into

the contracts, that is, when  $P^e = P$ . Here, the  $P^e$  is the common expected price level written into the contracts by the wage setters and the price setters in the wage determination process, and during the contract period, nominal wages remain the same even if the actual price level may differ from the expected price level. When it is time to renegotiate or renew the wage contracts, the expected price  $P^e$  will be readjusted up or down, depending on whether  $P > P^e$  or  $P < P^e$  in the current period.

Now assume that  $P^e = P$ . Then, from the wage setting (WS) equation,

$$\frac{W}{P} = F(u, z)$$

Also, from the price setting (PS) equation,

$$P = (1 + \mu)W,$$

$$\frac{P}{W} = 1 + \mu$$

or,

$$\frac{W}{P} = \frac{1}{1 + \mu}$$

Then in the agreement of price setters and the wage setters, it has to be the case that

$$F(u, z) = \frac{1}{1 + \mu}$$

That is, with  $z$  and  $\mu$  values given and constant, there is a unique unemployment rate  $u_n$  that satisfies this equilibrium condition, where  $P^e = P$ , i.e. when price level is unchanging. This unemployment rate which corresponds to unchanging price level is called the *natural unemployment rate*.

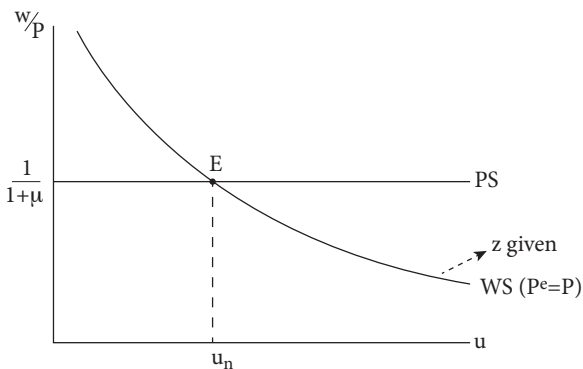


Figure 6.7 The Price-setting (PS), the Wage-setting (WS) and the natural unemployment rate,  $u_n$

Figure 6.7 depicts the equilibrium real wage and the corresponding unemployment rate when  $P^e = P$ . The natural output level or the potential output  $Y_n$  is the output level that corresponds to the natural rate of unemployment when  $P^e = P$ . We know that the unemployment rate  $u$  is given by the ratio of the number of employed people to the number of people in labor force  $L$ :

$$u = \frac{U}{L} = \frac{L - N}{L} = 1 - \frac{N}{L}$$

From the production function,  $Y = N$ ,

$$u = 1 - \frac{Y}{L}$$

Hence, at the labor market equilibrium with  $P^e = P$ ,  $u = u_n$ ,  $Y = Y_n$ , it has to be the case that

$$F\left(1 - \frac{Y_n}{L}, Z\right) = \frac{1}{1 + \mu}$$

According to this equilibrium condition, for a given function  $F(.,.)$ , the potential output of the economy depends on the number of people in the labor force,  $L$ , the factors that affect the wage setting process,  $z$ , and the mark-up rate,  $\mu$ . When any one of these factors change, the potential output of the economy will also change.

The Aggregate Supply relation describes the impact of changes in output on the general level of prices in an economy. The Aggregate Supply relation is derived from the behavior of wages and prices as given by the wage setting (WS) and price setting (PS) relationships:

$$W = P^e F(u, z)$$

$$= P^e F\left(1 - \frac{Y}{L}, Z\right)$$

$$P = (1 + \mu)W$$

From now on, we will not impose the restriction  $P^e = P$  on the expected prices, because we would like to assess the impact of changes in price expectations on wages and on actual prices, eventually (i.e., by allowing  $P > P^e$  or  $P < P^e$ ). Eliminating the assumption that  $P^e = P$ , and combining the two equations of PS and WS, we have

$$P = P^e(1 + \mu)F\left(1 - \frac{Y}{L}, Z\right)$$

This equation shows the relationship between the general level of prices and the unemployment rate given  $\mu$ ,  $P^e$ ,  $z$  and  $L$ . Next, how can we now describe a relationship between aggregate output,  $Y$  and the price level,  $P$ ?

First of all, an increase in aggregate output requires an increase in employment, given the production technology. An increase in employment implies a decrease in the number of unemployed, and a decrease in the rate of unemployment, given the labor force,  $L$ . A decrease in the unemployment rate implies an increase in the wage, through the wage-setting relationship,  $W = P^e F(u, z)$ . This is related to the labor market conditions and thus who retains a higher bargaining power in the next round of wage negotiations. In this case, since there is a fall in the unemployment rate, wage setters or the employees gain a higher bargaining power, and they are in a position to ask for higher wages, and this occurs through the readjustment of  $P^e$  upwards by the wage setters. Through the price-setting relationship, an increase in the wage implies an increase in the price level,  $P = (1 + \mu)W$  as the unit cost increases with wage. Firms pass the increase in the unit cost of production on to the product prices to maintain profitability. Hence, there is a positive relationship between output and the price level on the supply side of the economy, implying a positively sloped AS-curve. This positive relationship summarizes a trade-off in the short-run: A higher output is only possible via increasing prices, that is, in order to reduce unemployment and increase output, the economic actors must accept a higher price level.

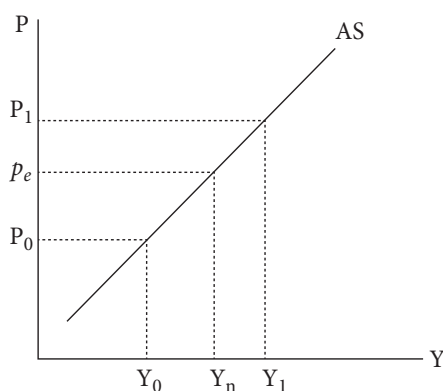


Figure 6.8 The upward sloping AS-curve.

Another implication that we can draw from the AS-relationship is that the increase in price expectations  $P^e$  would lead to an upward shift in the AS-curve. An exogenous increase in price expectations would lead to an exogenous increase in wages, at the given unemployment rate and at constant  $z$ . This exogenous increase in wages would prompt an exogenous increase in the price level, at the given output level. This implies a vertical upward shift in the AS-curve, as shown in Figure 6.9.

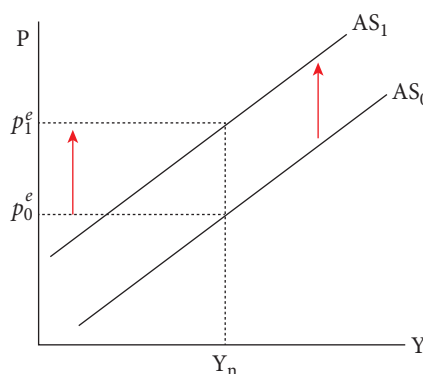


Figure 6.9 The impact of an increase in  $P^e$

Other factors that may lead to a shift in the AS-curve are the changes in the parameters  $z$  and  $\mu$  which we hold fixed along a given AS-curve.

Consider an increase in the  $z$  parameter. The increase in  $z$  might be related to an increase in minimum wage, an increase in unemployment benefits, or a stricter enforcement of employment protection, for example. An increase in  $z$  results in an upward shift in the WS-function, implying a higher natural rate of unemployment at labor market equilibrium, holding all else constant. A higher natural rate of unemployment corresponds to a lower potential output,  $Y_n$ . Recall that we have not mentioned any change in price expectations, which are given exogenously, and hence at the given  $P^e$ , now the corresponding potential output is lower, implying a leftward shift of the AS-curve. Hence the AS-curve shifts to the left with an increase in  $z$  (Figure 6.10).



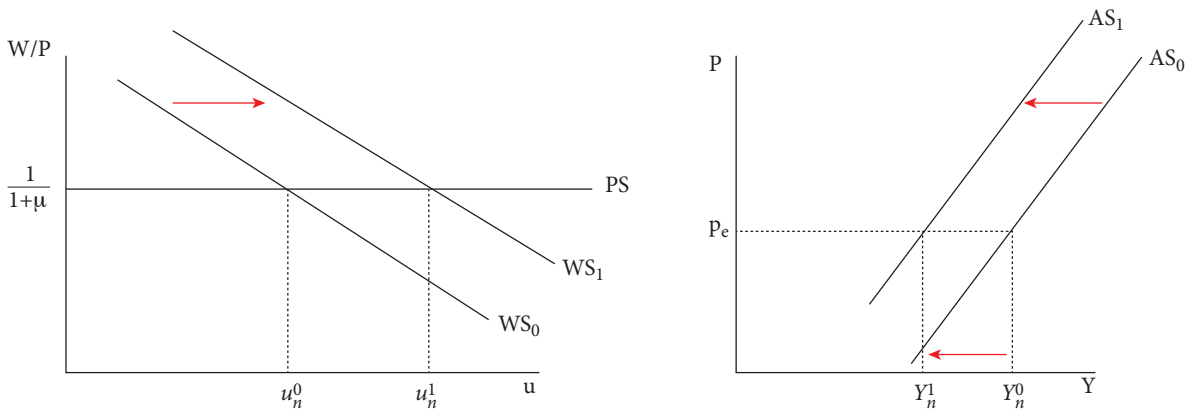


Figure 6.10 An increase in  $z$  and the shift in the AS-curve.

In the determination of the labor market equilibrium, the parameter  $\mu$  also plays a role. As mentioned previously,  $\mu$  stands for the mark-up rate, or in a broader sense, may represent the production cost factors other than labor cost. For that matter, for example an increase in  $\mu$  as given in Figure 6.11 implies a downward shift of the Price setting (PS) relationship, leading to a higher natural rate of unemployment in labor market equilibrium, thus a lower potential output. Similarly, as above, the given expected AS-curve shifts to the left, at the given expected price the corresponding potential output is lower.

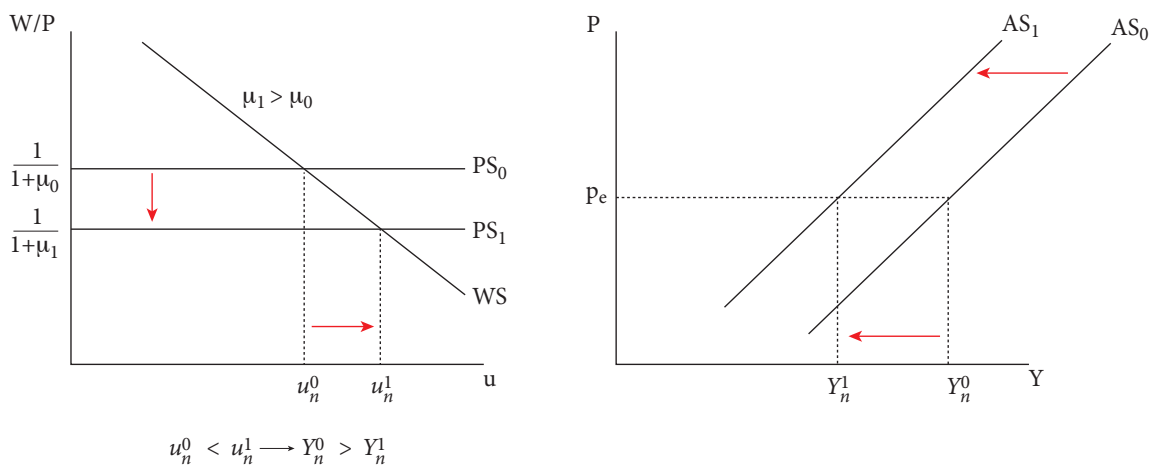


Figure 6.11 An increase in  $\mu$  and the shift in the AS-curve.

Table 6.2 Examples of factors that cause a shift in the AS-curve.

| AS shifts down and to the right                    |                                                    |
|----------------------------------------------------|----------------------------------------------------|
| <i>Labor market policy effects</i>                 | <i>Other effects</i>                               |
| A decrease in minimum wage                         | A decrease in inflationary expectations $P^e$      |
| A decrease in unemployment benefits                | A decrease in mark-up rate, $\mu$                  |
| A decrease in the degree of employment protection  | A more stringent anti-trust regulation             |
|                                                    | A decrease in energy prices                        |
|                                                    | A decrease in input prices other than labor price  |
|                                                    | A decrease in production taxes                     |
| AS shifts up and to the left                       |                                                    |
| <i>Labor market policy effects</i>                 | <i>Other effects</i>                               |
| An increase in minimum wage                        | An increase in inflationary expectations, $P^e$    |
| An increase in unemployment benefits               | An increase in mark-up rate, $\mu$                 |
| An increase in the degree of employment protection | A less stringent anti-trust regulation             |
|                                                    | An increase in energy prices                       |
|                                                    | An increase in input prices other than labor price |
|                                                    | An increase in production taxes                    |

## EQUILIBRIUM IN THE AD-AS IN THE SHORT-RUN AND IN THE MEDIUM-RUN

At the intersection of the AD and AS curves, we obtain the general equilibrium of the economy. Note that since AD-curve is downward sloping and AS-curve is upward sloping, there is a unique equilibrium at the intersection of these two curves. We know that along a given AD-curve, goods and money markets are simultaneously in equilibrium for given values of  $M$ ,  $G$  and  $T$ . For a given  $P^e$ , and also for given values of  $z$  and  $\mu$ , the labor market is in equilibrium along a given AS-curve. Therefore, at the intersection of AD and AS curves, the equilibrium values of price level and aggregate output satisfy the equilibrium conditions in goods, money and labor markets for given values of  $M$ ,  $G$ ,  $T$ ,  $P^e$ ,  $z$ , and  $\mu$ .

### Short-run Equilibrium in the AD-AS Model

In order to find the algebraic expression of the equilibrium, we solve the AD and AS functions simultaneously for the equilibrium pair  $(Y_0, P_0)$ :

$$AD: Y = \frac{\alpha \bar{A} + \alpha \frac{k}{h} \frac{M}{P}}{1 + \frac{\alpha b k}{h}}$$

$$AS: P = P^e (1 + \mu) F\left(1 - \frac{Y}{L}, Z\right)$$

From the two equations above, as long as we know the shape of the production function, the equilibrium pair  $(Y, P)$  can be solved for given values of  $M$ ,  $\bar{A}$ ,  $P^e$ ,  $z$ ,  $\mu$ , and the parameters relating to AD. Note that since we do not impose the condition  $P^e = P$  in the short-run, it is possible that the actual (or current) equilibrium output  $Y_0$  may deviate from the potential output,  $Y_n$ . Below, we examine the cases of inflationary gap when in the short run  $Y > Y_n$  and actual price level exceeds  $P^e$ , the recessionary gap when in the short run  $Y < Y_n$  and actual price is lower than  $P^e$ , and the medium run equilibrium when  $Y = Y_n$  with  $P^e = P$ .

In Figure 6.12, we present the case of an inflationary gap in the short-run. The economy is producing above the potential output level  $Y_n$ , hence the actual unemployment rate is very low and below the natural unemployment rate  $u_n$ , and the actual price level in the economy is higher than the expected price written into existing wage contracts. This is a short-run equilibrium because the current situation is temporary and will not last for too long, the equilibrium will change once the new wage contracts are negotiated with a higher expected price  $P^e$ . This is why this gap is called an inflationary gap because eventually a rise in the price level ensues this short-run equilibrium.

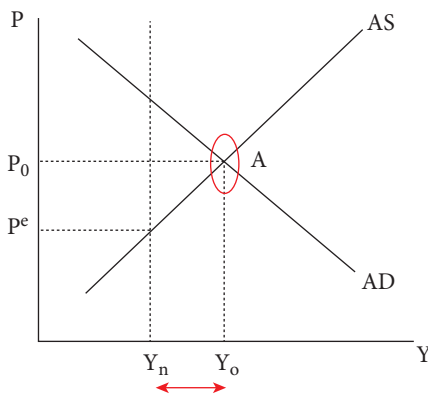


Figure 6.12 Inflationary gap,  $Y_0 > Y_n$ ;  $P_0 > P^e$

Another example of a short-run or temporary equilibrium is where there is a recessionary gap in the economy as depicted in Figure 6.13. It is said that an economy is in a recessionary gap when it is producing below the potential output, has a high unemployment rate above the natural unemployment rate, and currently the actual price level is below the expected price written into the current wage contracts. Again, this situation is temporary as new wage contracts will be negotiated over time with a lower expected price  $P^e$ , and the actual price level will fall in the process.

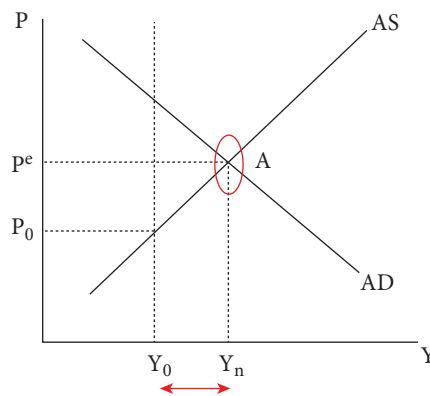


Figure 6.13 Recessionary gap,  $Y_0 < Y_n$ ;  $P_0 < P^e$

In the special case when  $P^e = P$ , the economy is producing its potential output at the natural unemployment rate (Figure 6.14). Note that in this analysis, we call this particular equilibrium the medium-run equilibrium rather than the long-run equilibrium since the potential output can only change over the long-run with the accumulation of resources and/or a change in technology. Under the given labor market conditions (for given values of  $z$ ,  $\mu$  and  $L$ ), the economy's potential output is given and constant in the medium-run.

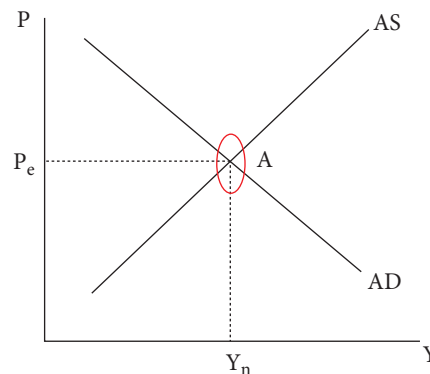


Figure 6.14 Medium run equilibrium,  $Y = Y_n$ ,  $P^e = P$

As mentioned above in the cases of an inflationary gap and a recessionary gap, the equilibria are only temporary. That is, as long as the markets are functioning efficiently and are left to their own devices, the economy will eventually converge to its medium-run equilibrium and produce the potential output and settle in the medium-run equilibrium, unless there are demand side and/or supply side shocks that disturb this equilibrium. In what follows, we describe the process by which an economy converges to its medium-run equilibrium starting from a random short-run equilibrium.

### From Short-run to Medium-run Equilibrium

Now suppose that currently the economy is in equilibrium at point A with an inflationary gap as in Figure 6.15. At short-run equilibrium A, the actual level of output is larger than the potential level of output, and the current level of prices is higher than the expected prices written into the current wage contracts. This means that the current price level is higher than the price level that was expected when the wage contracts in effect were written and signed in the past. Also, we understand that the unemployment rate is below the natural rate of unemployment, and the level of unemployment is very low in the economy.

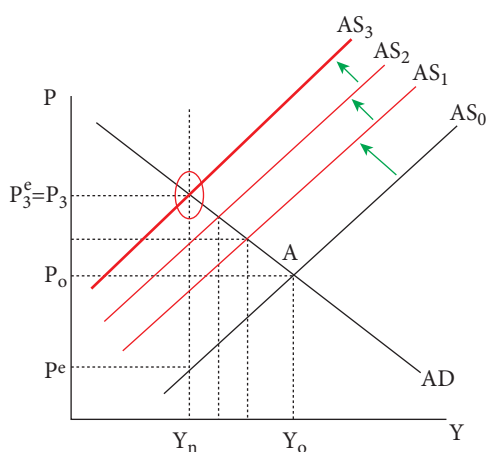


Figure 6.15 From short-run to medium-run equilibrium (from an inflationary gap).

If the economy is left to its own dynamics (i.e., there is no policy intervention by the government), when the next round of wage negotiations take place, it is very likely that the wage setters or employees increase their price expectations written into new wage contracts. The wage setters are in a position to increase their price expectations as the unemployment rate is very low and the wage setters have a higher bargaining power in wage negotiations. As the expected price level increases, the AS-curve starts shifting to the left. As long as the inflationary gap remains and the actual price level remains above the expected price level, the leftward shift of the AS-curve continues. The process will continue until when the actual price level is equal to the expected price level and there is no more motivation of the wage setters to increase the expected price level in the wage contracts. This process will stop when  $Y = Y_n$ ;  $u = u_n$ ;  $P = P^e$ , that is, when the economy achieves its medium-run equilibrium at the potential level of output.

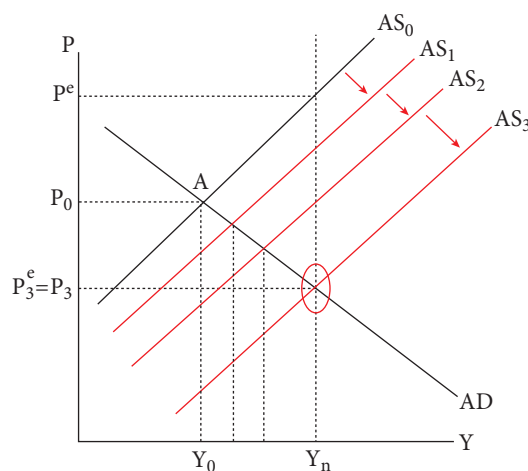


Figure 6.16 From short-run to medium-run equilibrium (from a recessionary gap).

On the other hand, it can be that currently the economy is in a recessionary gap, producing a lower output than the potential output and the current price level in the economy is higher than the expected prices written into the current wage

contracts as given in Figure 6.16. At this equilibrium, there is high unemployment (actual unemployment rate is higher than the natural rate of unemployment), and the price setters or employers have a higher bargaining power in wage negotiations. As such, the wage setters revise their price expectations downwards in the next round of wage negotiations, and the AS-curve starts shifting rightwards as a result. The downward movement of expected prices and the downward shift of the AS-curve continues as long as the recessionary gap remains and the actual price level stays above the expected price level. The motivation to lower the expected prices will stop when the expected price level is equal to the actual price level, and when the economy no longer experiences a recessionary gap. This happens when the economy reaches its medium run equilibrium,  $Y = Y_n$ ;  $u = u_n$ ;  $P = P^e$ .

In both cases, the government does not intervene to eliminate the recessionary or the inflationary gap. It may also be the case when the government does not wait for the medium-run process to take its course, and intervenes to close the gap. Let's say that there is a recessionary gap with a high unemployment rate in the economy. In this case, the government may intervene to stimulate AD (by expansionary policies) up to the potential output, or if there is an inflationary gap, government may act to reduce AD (by contractionary policies) to reach the potential output (Figure 6.17). In these cases, the policy intervention by the government creates side effects: In the recessionary gap case, the price level increases at a level higher than the initial level, and in the inflationary gap case, prices fall below the initial price level, both of which are opposite of what happens in the cases where the government does not intervene.

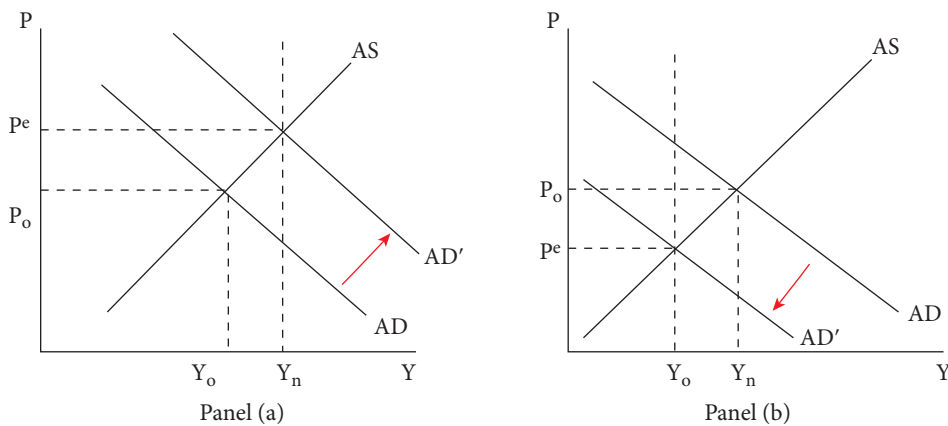


Figure 6.17 Closing the recessionary and inflationary gaps by active government policy.

## DEMAND-SIDE SHOCKS IN THE AD-AS MODEL: MONETARY AND FISCAL POLICY EFFECTS

Now let's examine the short-run and medium-run equilibrium effects of demand-side policy changes using the AD-AS model. First let's start with the equilibrium effects of expansionary monetary policy (e.g. an open market purchase, a decrease in required reserve ratio, a decrease in the discount rate). Without loss of generality, assume that initially the economy is at its medium-run equilibrium at point A where  $Y = Y_n$ ;  $u = u_n$ ;  $P = P^e$ .

### Monetary Policy Effects

Figure 6.18 depicts that any increase in demand due to the increase in money supply  $M$  will lead to a rightward shift in the AD-curve. The rise in AD will lead to an increase in the output above the potential and moving up along the AS-curve, leading to an increase in the price level above the expected price level

which is written into existing wage contracts. The new short-run equilibrium is established at point B, where  $Y > Y_n$ ;  $u < u_n$ ;  $P > P^e$ . Starting from this new short-run equilibrium, a new medium-run process is initiated. With very low unemployment below the natural rate and actual price level being above the expected price level written into current wage contracts, the workers have a higher bargaining power and they raise the expected price level in the next round of wage negotiations. As the expected price level increases, the nominal wage increases, and hence through the price setting relationship, the price level increases, the AS-curve shifts leftwards. The leftward shift of the AS-curve continues until wage setters no longer have any more motivation or bargaining power to raise the expected price level in the wage contracts, and at point C, again, they no longer have an upper hand in negotiations. Hence, the new medium run equilibrium is now established at point C, with higher prices (which have risen proportionally with M) and the potential output. Final outcome is that monetary expansion has only led to a proportional increase in the price level, with no change in the level of output and unemployment rate. This phenomenon is what we call **neutrality of money**. Neutrality of money means that in the medium-run (and also in the long-run), a monetary policy change has no effect on the economy's real variables, such as employment, real wage and output; the only effect is on another nominal variable, the price level.

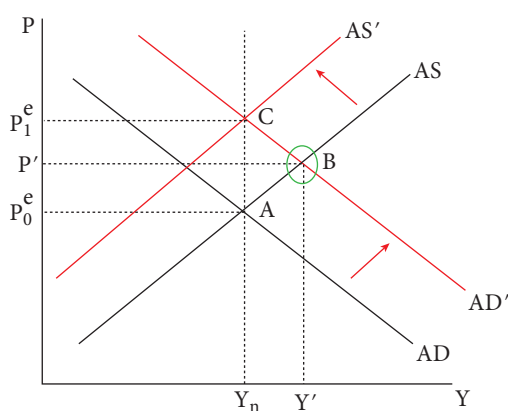


Figure 6.18 The effect of expansionary monetary policy.

To examine the impact of the monetary expansion on all markets in the short-run and in the medium-run, now let's dig deeper and incorporate the IS-LM model into our analysis. In Figure 6.19, Panel (a) depicts the dynamics effects of monetary expansion in the goods and money markets using an IS-LM analysis, and Panel (b) shows the AD-AS analysis.

Now suppose that while the economy is settled at medium-run equilibrium point A in both Panel (a) and Panel (b), there is an increase in money supply. At the medium-run equilibrium, the economy is producing the potential output  $Y_n$ . The increase in money supply, holding all else including the price level, shifts the LM curve to  $LM_1$  and shifts the AD curve to  $AD'$ . With the shift of the AD-curve to the right, we know that even in the short-run, there is an increase in the price level. As shown in Panel (b), the new short-run equilibrium with higher price level is at Point B. With this increase in the price level, the real money supply is now lower in the money market, therefore the  $LM_1$  curve shifts somewhat to the left, to  $LM'$ . Now, the short run equilibrium point B depicted in Panel (b) corresponds to the point B in Panel (a).

We know that from the point B on, the new medium-run process is initiated. Unless there is any more policy intervention by the government, and the economy is left to its own dynamics, because there is an inflationary gap in the economy at equilibrium point B with very low unemployment (lower than the natural unemployment rate), in the next round of wage negotiations wage setters adjust their price expectations upwards. With the increase in price expectations, all else held constant, the AS-curve starts shifting to the left. The shift in the AS continues until there is no more motivation of the wage setters to increase price expectations, and the new medium run equilibrium will be established at point C, where the economy is again producing the same potential output, with a higher price level. Note that in the money market, the  $LM'$  curve shifts all the way back to the original LM curve because in the final medium-run equilibrium, there is

no change in the real money supply with the increase in the price level: The price level increases at the same rate as the money supply. As such, there is no change in the interest rate in the economy.

The important issue to observe here is that there are no real effects on the economy in the medium-run in response to this monetary expansion: The output level is the same as before, and the composition of GDP also did not change (same consumption level, same investment and same government spending as before the policy change). The increase in the money supply only has led to a proportional price level increase.

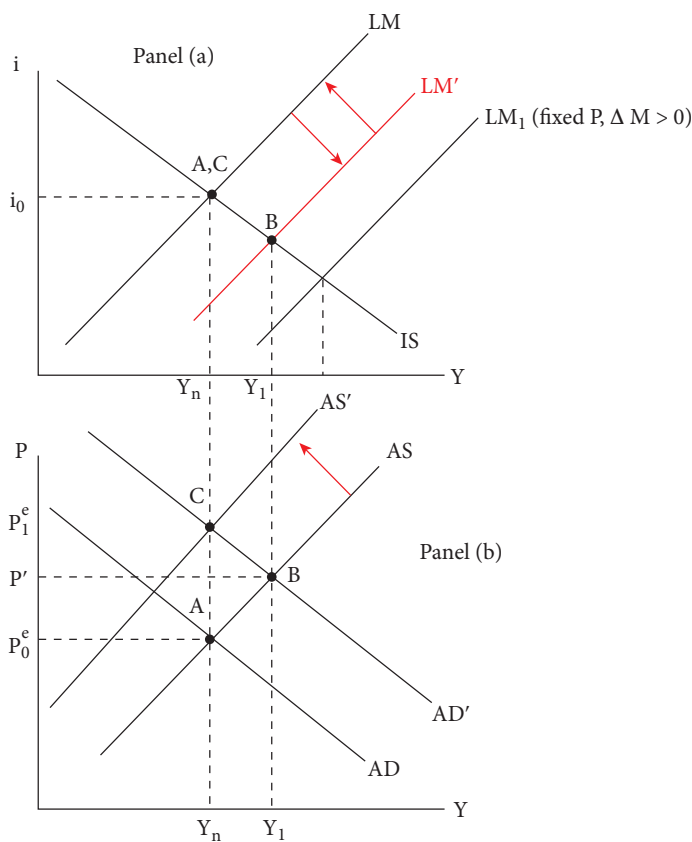


Figure 6.19 The dynamic effects of expansionary monetary policy.

**Neutrality of Money:** According to the classical school of thought in economics, money only acts as a medium of exchange and it is neutral meaning that an increase in the supply of money would only lead to an increase in the price level by the same proportion, and it has no real effects—leads to no change in real output, employment, real wages and relative prices.

## Fiscal Policy Effects

Now for the sake of a fiscal policy example, consider contractionary fiscal policy. Suppose that the economy is initially settled at equilibrium point A as in Figure 6.20 producing its potential output. In an attempt to reduce the budget deficit, the government decreases government spending  $G$ . With the decrease in  $G$ , AD curve shifts leftwards to  $AD'$ , equilibrium output falls to  $Y' < Y_n$  and price level falls to  $P' < P_0$ . Equilibrium Point B is the new short-run equilibrium. From Point B, now the new medium-run process is initiated as over time, new wage contracts will be negotiated.

At the short-run equilibrium point B, the economy is producing below potential output and there is higher unemployment than the natural unemployment. Since the actual price level is now lower than the expected price level written into wage contracts that are in effect, firms or employers are in a disadvantaged



position in terms of the price they receive in the markets. Firms' marginal revenue is smaller than the marginal cost of production, thus they compel workers to agree for a lower expected price to be written into wage contracts in wage negotiations. In this situation, workers agree to lower the expected price level written into new wage contracts because they have a lower bargaining power under a high unemployment rate. As expected price level written into wage contracts falls, AS-curve shifts rightwards, until workers no longer have any motivation to lower the expected prices (or firms no longer have the motivation to push for lower wages). The new equilibrium in the medium-run (point C) settles at a lower price level with the same potential output as before the policy change.

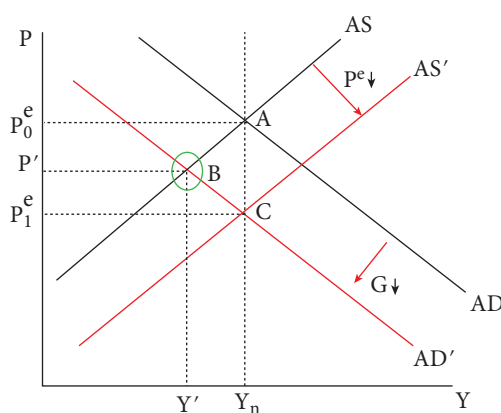


Figure 6.20 The effect of contractionary fiscal policy.

Now let's have a more detailed examination of the dynamic effects of fiscal contraction in all markets via the full IS-LM/AD-AS analysis in Figure 6.21. Suppose that the economy is in medium-run equilibrium at point A in both Panel (a) and Panel (b) diagrams. Now consider a fall in government spending while the economy is at point A. The fall in government spending firstly shifts the IS-curve to the left to  $IS'$  at the given price level, which prompts a leftwards shift in the AD curve to  $AD'$ . With the leftward shift in AD-curve, now a new short-run equilibrium is established at point C in Panel (b). In the new short-run equilibrium, the price level falls. With the fall in the price level real money supply increases in the money market, shifting the LM curve to  $LM'$ . Hence, the corresponding equilibrium in the goods and money markets is at point C in Panel (a). In the new short-run equilibrium there is a recessionary gap with high unemployment and low output. From this point on, the new medium-run process starts with a new round of wage negotiations. As explained before, the firms or employers have higher bargaining power in wage negotiations and the wage setters agree to reduce price

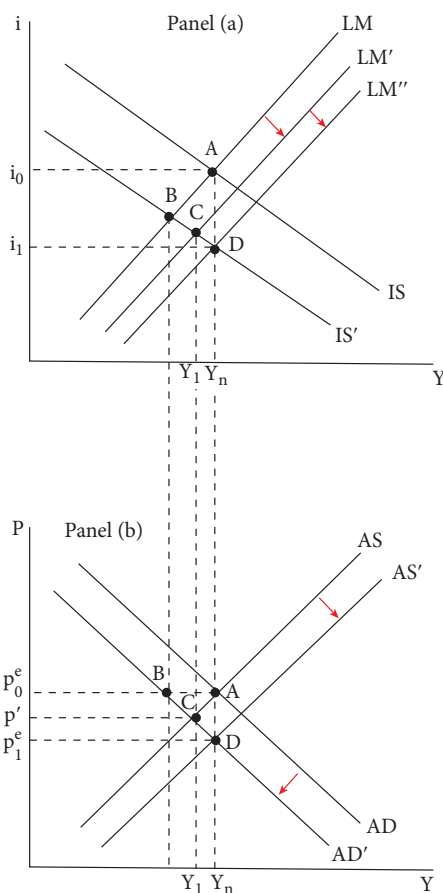


Figure 6.21 Dynamic effects of fiscal contraction.



expectations written into new wage contracts. As the expected price is revised downwards, the AS-curve starts shifting down and to the right, until the employers no longer have any higher bargaining power, with  $P^e = P$ ,  $Y = Y_n$ ,  $u = u_n$ , the economy returns back to producing the potential output. The new medium-run equilibrium is established at a lower price level at point D in Panel (b).

As the price level decreases in the money market, the real money supply further increases, shifting the LM curve further to the right to  $LM''$  as shown in Panel (a). The shift of the LM curve stops when the goods and money market equilibria are both established at point D in Panel (a). Note that now the interest rate is lower in the new equilibrium compared to the initial equilibrium. This is important because now, even though the economy is producing the same level of output as before the policy change, the composition of output is now different. With a lower interest rate, the economy's investment is now higher compared to the initial equilibrium. The composition of GDP has changed in favor of investment, with a lower government spending.

**Table 6.3** Equilibrium effects of demand-side policy shocks.

|                      | Short-run |           | Medium-run    |           |           |
|----------------------|-----------|-----------|---------------|-----------|-----------|
|                      | Output    | Price     | Interest rate | Output    | Price     |
| Monetary expansion   | Increases | Increases | No change     | No change | Increases |
| Fiscal expansion     | Increases | Increases | Increases     | No change | Increases |
| Monetary contraction | Decreases | Decreases | No change     | No change | Decreases |
| Fiscal contraction   | Decreases | Decreases | Decreases     | No change | Decreases |



your turn 2

Describe the dynamic adjustment process by which an economy's short-run and medium-run equilibria in the goods, money and labor markets are affected in response to a decrease in net taxes. You must describe and explain the adjustment process using both the IS-LM and AD-AS models.

## SUPPLY-SIDE SHOCKS AND CHANGES IN EQUILIBRIUM IN THE AD-AS MODEL

Any change in the economy that causes an exogenous change in the production process can be considered an aggregate supply shock. This change can stem directly from a change in technology, capital stock, the population, or input prices other than labor such as oil or energy. Changes in the production process can also be due to changes in labor market laws or competition laws. Such changes will be considered institutional changes. Holding all else constant, all of these factors mentioned may lead to a change in the economy's natural rate of unemployment and thus a change in the potential output or natural level of output.

Suppose that there is a negative oil price shock (an increase in the price of oil). As oil prices therefore energy prices rise, firms' marginal cost rises, and firms reflect this increase in cost or production directly in the price of output,  $P$ , in order to maintain profitability. In our model, the rise in the price of oil therefore the rise in the marginal cost of production is reflected as a rise in the parameter  $\mu$  (this parameter reflects the rise in cost of production other than the rise in wage  $W$ ). In Figure 6.22, with the rise in  $\mu$ , the price setting (PS) function shifts down, and there is a movement down along the wage setting (WS) function, and the new  $\mu$  now corresponds to a higher natural unemployment rate in the equilibrium of the labor market. With a higher natural unemployment rate, the potential output of the economy decreases, for a given expected price  $P^e$  (recall that there is no exogenous process that changes the initial expected price).

With the exogenous rise in costs and thus in prices (represented as an increase in  $\mu$ ), the AS-curve shifts to the left horizontally to the new potential output  $Y_n^I$  at the initial expected price  $P_0^e$ . The new AS-curve now passes through point  $A'$ . But now, the new short-run equilibrium is established at point B at the intersection of AD and the new  $AS'$  curve, where  $P' > P_0^e$ ,  $Y' > Y_n^I$ . That is, as the potential output of the economy declines, in the short-run, an inflationary gap occurs.

From the point B on, the new medium-run process begins. In the medium-run process, wages are renegotiated. In the new round of wage negotiations, with low unemployment, workers have a higher bargaining power, and the actual prices that they pay in the marketplace is higher than the prices that were written into their wage contracts, hence the workers have a motivation to revise expected prices written into contracts upwards. As the expected prices are revised upwards in wage contracts,  $AS'$  starts shifting leftwards. This re-negotiation of nominal wages and new contracts continues until workers no longer have any bargaining power and desire to revise expected prices upwards when the economy reaches medium-run equilibrium at point C where  $P = P_1^e$ ;  $Y = Y_n^I$ ;  $u = u_n^I$ . Notice that compared to the initial equilibrium before the oil price shock, the potential output is lower and the price level is higher. This condition is called *stagflation* (stagnation together with inflation).

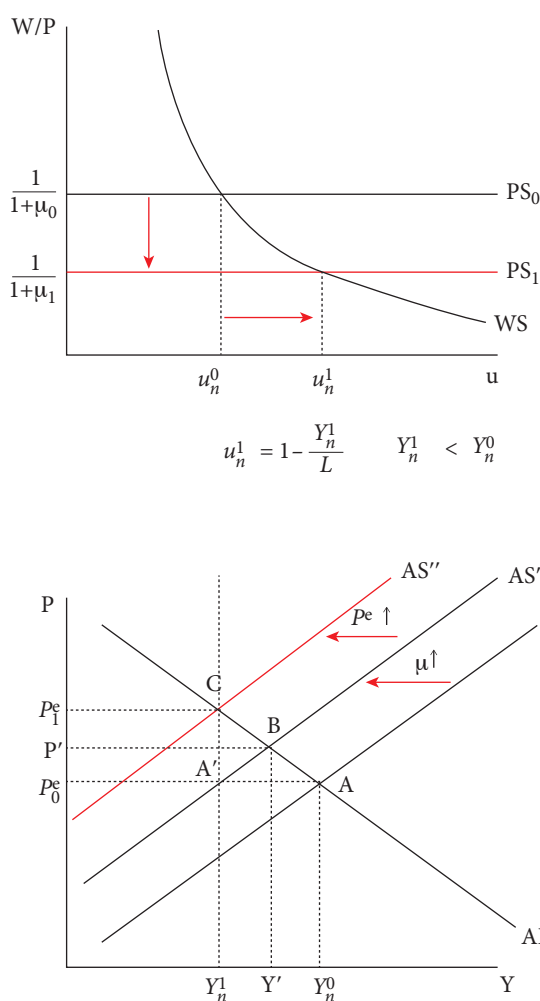


Figure 6.22 A negative supply-side shock.

Stagflation is a word that combines two words: Stagnation and inflation. Stagflation is an economic phenomenon when the economy experiences significant inflation together with high unemployment, little or no growth in real GDP.

Other examples of negative supply shocks that create a similar final effect of stagflation in the economy may be an increase in minimum wage, an increase in unemployment insurance benefits, an increase in employment protection and a reduction in the degree of enforcement of competition laws (such as less stringent enforcement of anti-trust laws). These factors all tend to increase the natural rate of unemployment (by creating a higher degree of frictions in the labor market) and thus decrease the potential output of the economy, creating similar effects as an increase in the price of oil.



### your turn 3

Consider two countries with closed economies, Country A and Country B. Both economies have the same mark-up rate  $0 < \mu < 1$ , the same variable  $z$  that stands for all variables that influence the wage-setting process, and initially both countries are at their medium-run equilibria, producing their potential output.

Suppose now that in both countries, there is a drastic increase in energy prices, which affects the economies of Country A and Country B in the same way. Faced with the permanent rise in the price of energy, the government of Country A introduces stricter enforcement of competition laws in the country in an attempt to keep the unemployment rate and output at their initial natural levels. On the other hand, the government of Country B considers that such an intervention may have undesirable political repercussions. Instead, following the rise in energy prices, the government of Country B increases government spending in order to keep the unemployment rate and the output running at their original natural levels.

Using the wage-setting/price-setting labor market relationships, and AD-AS relationships, explain and show the effects of the rise in energy prices and subsequent stricter enforcement of competition laws on the economy of Country A. In your answer, explain the changes in the unemployment rate, real wages, price level, and output: i. immediately after the energy price shock; and ii. after the labor market policy change, i.e. the final medium-run equilibrium.

Using the wage-setting/price-setting labor market relationships, and AD-AS relationships, explain and show the effects of the rise in energy prices and the subsequent fiscal policy changes on the economy of Country B. In your answer, explain the changes in the unemployment rate, real wages, price level, and output: i. immediately after the energy price shock; and ii. after the fiscal policy change, i.e. the final medium-run equilibrium.

Compare and contrast the final medium-run price level, output level, and unemployment rates in these two countries. What do you think are the relative advantages and disadvantages of each country's policy response to the energy price shock? Discuss.

## LO 1

Define the concept of aggregate demand and elaborate on the factors that change it

Aggregate demand relation shows how changes in the price level affect the aggregate output. The aggregate demand relation summarizes the simultaneous equilibrium in goods and money markets. In the simultaneous equilibrium of goods and money markets, there is a negative relationship between the price level and aggregate output. A given aggregate demand relation may change due to exogenous factors such as demand-side policy changes (monetary and fiscal policies) or other autonomous factors affecting demand, such as autonomous consumption or investment.

## LO 2

Define the concept of aggregate supply, differentiate between the concept of short-run aggregate supply and the concept of long-run aggregate supply, and elaborate on the factors that change each of them

The aggregate supply function shows how changes in aggregate output affect the general level of prices in the economy. The aggregate supply relation summarizes the equilibrium condition in the labor market. In fact, the shape of the aggregate supply curve depends on the time frame during which prices may be fixed or flexible. In the short-run, prices are fixed, the aggregate supply curve is horizontal, and fixed prices do not respond to changes in employment and the GDP. In the long-run, prices are fully flexible, the level of aggregate output is only determined by the amounts of factors of production and the technology by which they are combined, and the same output will be produced regardless of the price level. The aggregate supply relation is also described to be a positive relation where prices are allowed to respond to output and employment changes, but they are still not fully flexible as in the long-run situation. As aggregate supply is related to labor market equilibrium, it will be affected by changes in the labor market, as well as changes in cost conditions of the firms, such as changes in energy prices.

## LO 3

Understand how the equilibrium levels of price and aggregate output in an economy are determined in the short-run and in the medium-run

In the short-run, equilibrium price level and the aggregate output level are determined at the equilibrium of Aggregate Demand and Aggregate Supply. At the short-run equilibrium, the economy might be producing above or below the economy's potential output, or the natural level of output, which corresponds to the natural unemployment rate. If, in the short-run, the economy produces above potential output, over time labor markets adapt so that expected prices and wages increase, and eventually employment decreases and unemployment increases up to the natural unemployment rate where the economy produces its potential output. On the other hand, if the economy produces below potential output in the short-run, over time labor markets adjust as expected prices thus wages decline, eventually employment increases, and unemployment rate decreases down to natural unemployment rate. In the medium-run of an economy, the current prices will be equal to expected prices, aggregate output will be equal to potential output.

## LO 4

Describe how government policy changes have an effect on the short-run and medium-run equilibria in an economy using the AD-AS analysis

Demand-side policy changes, i.e., monetary and fiscal policies do not have an effect on the potential level of output, but they can change the level of prices in the medium-run. In the short-run, however, demand-side policies indeed lead to changes in the aggregate output. For example, expansionary monetary policy increases aggregate output and the price level in the short-run with the rightward shift of the AD-curve, but over time the aggregate output returns to potential output, and the price level increases fully proportionally with the change in money supply. Expansionary fiscal policy also increases the aggregate output in the short-run with the rightward shift of the AD-curve, but with the increase in prices over time, aggregate output returns to potential in the medium-run.

## LO 5

Understand how supply side shocks create changes in the short-run and medium-run equilibria in an economy using the AD-AS analysis

Supply side shocks, such as shocks to non-labor cost factors like energy prices, shocks in the labor market like minimum wage changes, or institutional shocks such as changes in competition law will lead to changes in the labor market equilibrium, the equilibrium real wage, the natural rate of unemployment, and thus the potential output. In the short-run, the immediate effect will be a change in aggregate supply and the price level, but in the medium-run, the potential output of the economy will change. Negative supply-side shocks such as an increase in energy prices will cause “stagflation”, where the economy experiences a decrease in the potential output along with an increase in the price level. Under such exogenous circumstances, policymakers are expected to counteract the negative effects of such supply-side shocks by careful supply-side policy changes so that the economy escapes stagflation. Demand-side policy changes cannot remedy negative supply-side shocks in the medium-run.

1 We derive the aggregate demand curve assuming fiscal and monetary policies are -----.

Which of the following completes the sentence above?

- A. fixed
- B. always expansionary
- C. Always contractionary
- D. never expansionary but always contractionary
- E. never contractionary but always expansionary

2 The aggregate demand curve summarizes a ----- relationship between -----

Which of the following completes the sentence above?

- A. positive; the interest rate and the GDP
- B. positive; the interest rate and the money demand
- C. negative; the general level of prices and the GDP
- D. negative; the general level of prices and consumption
- E. negative; the interest rate and consumption

3 A reduction in net taxes will cause -----.

Which of the following completes the sentence above?

- A. a leftward shift in the AD
- B. an upward movement along the AD
- C. a rightward shift in AD
- D. a downward movement along AS
- E. a leftward shift in the AS

4 An increase in the general level of prices will cause -----.

Which of the following completes the sentence above?

- A. a rightward shift in the AD
- B. a leftward shift in the AD
- C. a rightward shift in the AS
- D. a leftward shift in the AS
- E. only a movement along the AD and AS curves

5 The AD curve has a negative slope because of the effects of -----.

Which of the following completes the sentence above?

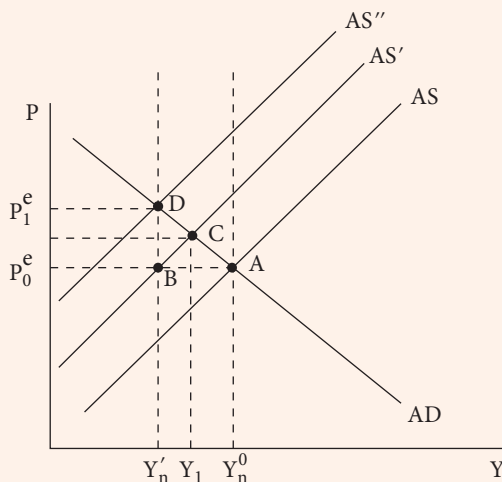
- A. Government spending on the interest rate
- B. Money supply in the LM curve
- C. Government spending on the IS curve
- D. Net taxes on the IS curve
- E. Price level on the real money supply  $M/P$

6 Money is said to be “neutral” because -----.

Which of the following completes the sentence above?

- A. It has no real effects in the short run
- B. It has no real effects in the medium run
- C. It has no effect on nominal variables in the short run
- D. It has no effect on nominal variables in the medium run
- E. Both a and c

7 Refer to the figure below. Suppose that the economy is initially at point A. If there is an increase in the cost of energy, which of the following describes the economy's correct path of equilibrium in the medium run?



- A. First point B, then point D
- B. First point B, then point C
- C. The economy settles at point C in the medium run
- D. First point C then point D
- E. First point C then back to point A

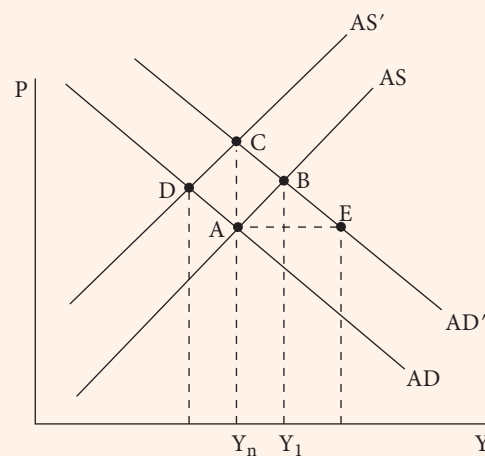
8 An increase in government spending will have which effects in the medium run?

- A. An increase in the interest rate
- B. A fall in the price level
- C. An increase in the expected price  $P^e$
- D. Both a and c
- E. An increase in the income level in the medium-run

9 An increase in the minimum wage will cause which of the following in the short run?

- A. A fall in the price level
- B. A fall in the expected prices  $P^e$
- C. An increase in interest rates
- D. An increase in real money supply
- E. An increase in aggregate output

10 Refer to the figure below. Suppose that the economy is initially at point A. If the government conducts an open market purchase and increases the money supply, which of the following describes the economy's correct path of equilibrium in the medium run?



- A. The economy settles at point E in the medium run
- B. First point E then point B in the medium run
- C. First point B then point C in the medium run
- D. First point D then point C in the medium run
- E. The economy settles at point B in the medium run

|      |                                                                                                      |       |                                                                                                                        |
|------|------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------|
| 1. A | If your answer is wrong, please review the “Aggregate Demand” section.                               | 6. B  | If your answer is wrong, please review the “Monetary policy effects” section.                                          |
| 2. C | If your answer is wrong, please review the “Aggregate Demand” section.                               | 7. D  | If your answer is wrong, please review the “Supply-side shocks and changes in equilibrium in the AD-AS model” section. |
| 3. C | If your answer is wrong, please review the “Aggregate Demand” section.                               | 8. D  | If your answer is wrong, please review the “Fiscal policy effects” section.                                            |
| 4. E | If your answer is wrong, please review the “Aggregate Demand” and “Upward Sloping AS-curve” section. | 9. C  | If your answer is wrong, please review the “Supply-side shocks and changes in equilibrium in the AD-AS model” section. |
| 5. E | If your answer is wrong, please review the “Aggregate Demand” section.                               | 10. C | If your answer is wrong, please review the “Monetary policy effects” section.                                          |



Assume an economy represented by the following relationships:

$$C = 80 + \frac{2}{3}Y_D$$

$$T = (20 + \frac{1}{4}Y) - 80$$

$$G = 230$$

$$I = 250 - 5i$$

$$M^d = 400 + \frac{1}{2}Y - 20i$$

$$M^s = 500$$

where  $Y$  is national income (GDP),  $C$  is consumption,  $Y_D$  is disposable income,  $T$  is net taxes,  $G$  is government spending,  $I$  is private investment,  $i$  is interest rate,  $M^d$  is real money demand,  $M^s$  is the nominal money supply,  $P$  is price level.

A. For the economy given by the functions above, construct the AD-curve relationship (Hint: First derive the IS and LM relationships).

B. For the following two government policy changes, derive the new AD-curve relationship, separately.

- i. The government spending increases from 230 to 380 units
- ii. The nominal money supply decreases from 500 to 320 units

a. In order to derive the AD function, first we construct the IS and then the LM functions.

i. The IS function can be obtained as follows:

$$\begin{aligned} Y = C + I + G &= 80 + \frac{2}{3}Y_D + 250 - 5i + 230 = 80 + \frac{2}{3}(Y - T) + 250 - 5i + 230 \\ &= 80 + \frac{2}{3}\left(Y - 20 - \frac{1}{4}Y + 80\right) + 250 - 5i + 230 = 600 + \frac{1}{2}Y - 5i \end{aligned}$$

Then, the IS function is

$$Y = 1200 - 10i$$

ii. The LM function can be obtained as follows:

$$\frac{M^s}{P} = M^d$$

$$\frac{500}{P} = 400 + \frac{1}{2}Y - 20i$$

From this money market equilibrium condition, we obtain the LM function:

$$i = 20 + \frac{1}{40}Y - \frac{25}{P}$$

iii. Finally, we derive the AD-function by plugging the LM into IS:

$$Y = 1200 - 10\left[20 + \frac{1}{40}Y - \frac{25}{P}\right] = 800 + \frac{200}{P}$$

Thus, the AD-function is given by

$$Y = 800 + \frac{200}{P}$$

B. Now we obtain the new AD function under the following government policy changes:

- i. The government spending increases from 230 to 380 units.

your turn 1



## your turn 1

With this change in fiscal policy the IS now becomes:

$$Y = 1500 - 10i$$

The LM is the same as before,

$$i = 20 + \frac{1}{40}Y - \frac{25}{P}$$

Then, the new AD function is derived as

$$Y = 1040 + \frac{200}{P}$$

This change implies a rightward shift in the AD-curve:

- ii. The nominal money supply decreases from 500 to 320 units.

In this case, the LM function changes. The money market equilibrium condition becomes

$$\frac{320}{P} = 400 + \frac{1}{2}Y - 20i$$

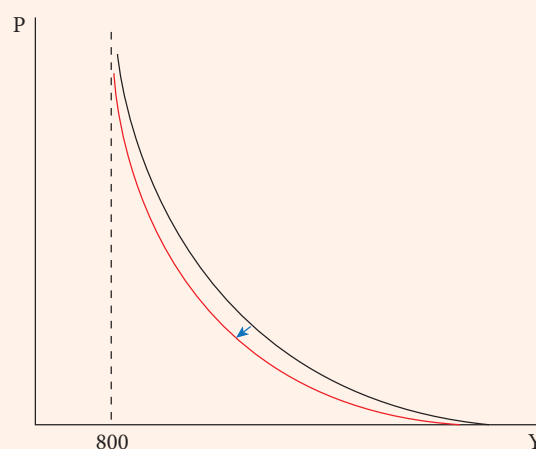
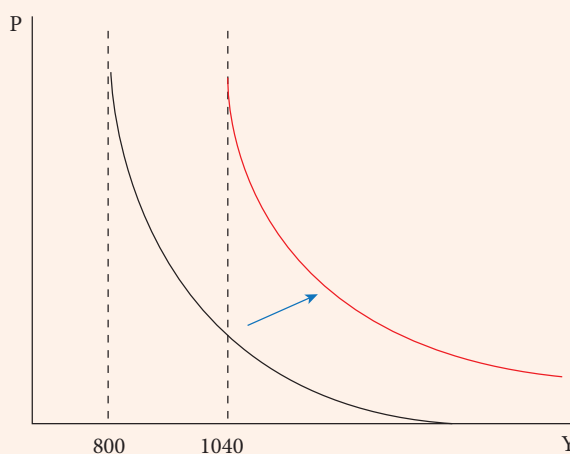
From this equilibrium condition, LM is obtained as:

$$i = 20 + \frac{1}{40}Y - \frac{16}{P}$$

Assuming that there is no change in the IS function, the AD can be derived as the following:

$$Y = 1200 - 10 \left\{ 20 + \frac{1}{40}Y - \frac{16}{P} \right\} = 800 + \frac{128}{P}$$

This change implies a leftward shift in the AD-curve:



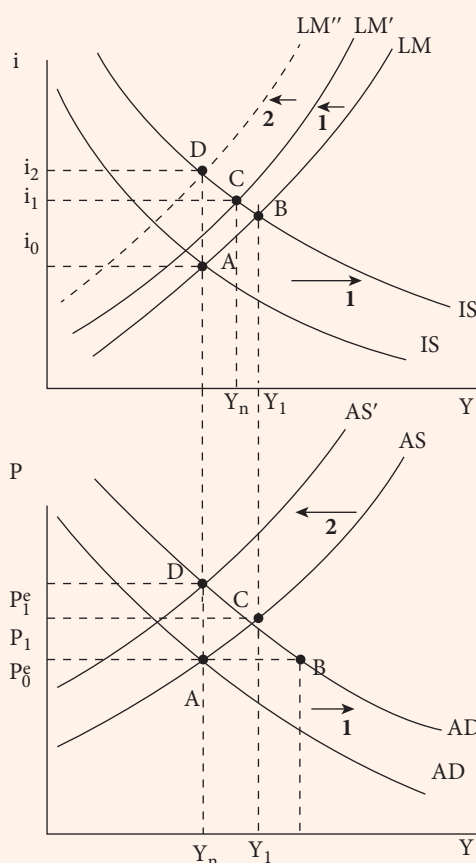
Describe the dynamic adjustment process by which an economy's short-run and medium-run equilibria in the goods, money and labor markets are affected in response to a decrease in net taxes. You must describe and explain the adjustment process using both the IS-LM and AD-AS models.

### your turn 2

A decrease in net taxes is an example of expansionary fiscal policy. In the following diagram, we summarize the dynamic effects of a decrease in net taxes:

(1) A fall in net taxes increase consumption exogenously by increasing disposable income, hence the aggregate demand increases at the given interest rate and price level, the IS and AD-curves shift to the right. At the given price level, the new equilibrium in goods and money markets is at point B. But the price level also increases at the intersection of the new AD-curve and the AS-curve. As the price level increases, real money supply decreases, and the LM curve shifts to the left to  $LM'$ . The new short-run equilibrium in goods and money markets is at point C in both diagrams. In the short-run, income increases above the potential level, price level increases above the initially given expected price, and the interest rate increases.

(2) Since output is above the potential output in the short-run, there is an inflationary gap with very low unemployment below the natural unemployment rate. In the medium-run process, with new wage negotiations, wage setters increase their price expectations, hence wages and prices increase, shifting the AS-curve to the left. The shift of the AS-curve will continue until there are no new wage negotiations at the natural unemployment rate and at the potential output level. In the money market, with the increase in the price level, real money supply further decreases and LM curve shifts to  $LM''$ . In the new medium-run equilibrium, the output level is the same as before, the price level is higher, and the interest rate is higher than before. Since interest rate is now higher at the new equilibrium, investment is lower, while consumption is higher with a higher disposable income



Consider two countries with closed economies, Country A and Country B. Both economies have the same mark-up rate  $0 < \mu < 1$ , the same variable  $z$  that stands for all variables that influence the wage-setting process, and initially both countries are at their medium-run equilibria, producing their potential output.

Suppose now that in both countries, there is a drastic increase in energy prices, which affects the economies of Country A and Country B in the same way. Faced with the permanent rise in the price of energy, the government of Country A introduces stricter enforcement of competition laws in the country in an attempt to keep the unemployment rate and output at their initial natural levels. On the other hand, the government of Country B considers that such an intervention may have undesirable political repercussions. Instead, following the rise in energy prices, the government of Country B increases government spending in order to keep the unemployment rate and the output running at their original natural levels.

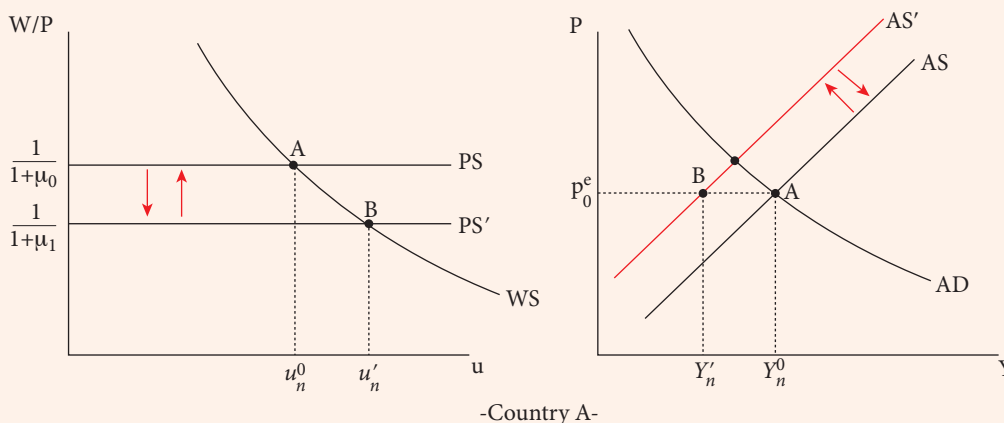
Using the wage-setting/price-setting labor market relationships, and AD-AS relationships, explain and show the effects of the rise in energy prices and subsequent stricter enforcement of competition laws on the economy of Country A. In your answer, explain the changes in the unemployment rate, real wages, price level, and output: i. immediately after the energy price shock; and ii. after the labor market policy change, i.e. the final medium-run equilibrium.

Using the wage-setting/price-setting labor market relationships, and AD-AS relationships, explain and show the effects of the rise in energy prices and the subsequent fiscal policy changes on the economy of Country B. In your answer, explain the changes in the unemployment rate, real wages, price level, and output: i. immediately after the energy price shock; and ii. after the fiscal policy change, i.e. the final medium-run equilibrium.

Compare and contrast the final medium-run price level, output level, and unemployment rates in these two countries. What do you think are the relative advantages and disadvantages of each country's policy response to the energy price shock? Discuss.

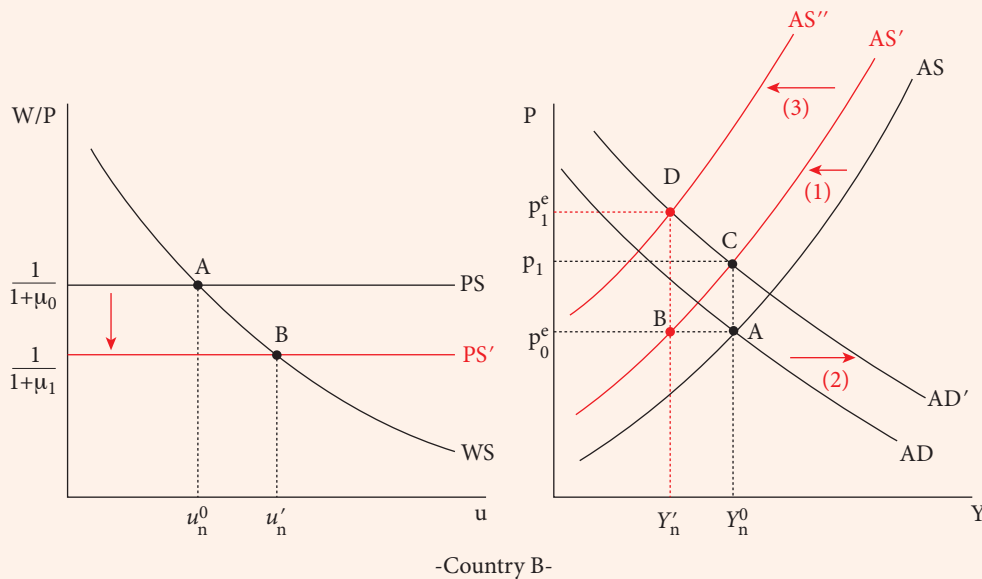
### your turn 3

a) In Country A, a rise in oil prices is represented by an increase in the mark-up rate,  $\mu$ . A rise in the mark-up rate lowers the PS function, and in the labor market equilibrium, natural rate of unemployment increases. An increase in natural rate of unemployment implies that at the given expected price level, the AS-curve shifts to the left (the expected price level now corresponds to a lower potential output level,  $Y'_n < Y_n^0$ ). Immediately following the rise in oil prices, the government of Country A introduces stricter enforcement of competition laws, which has the effect of reducing the mark-up rate. As a result, the PS function returns to its original position, and the AS-curve returns to its original position. In the final analysis, the output, price and unemployment rate return to their medium-run levels.



## your turn 3

b) As in Country A, the initial shock is in the labor market. With the rise in oil prices, the following diagram shows that price setters' mark-up rate rises, and PS function shifts down to  $PS'$ . The natural rate of unemployment rises and the potential output falls in Country B. The leftward shift in the AS-curve as a response to the rise in oil price is given as shift (1). Immediately following the rise in oil prices, the government in Country B increases government spending so that output is again attained at the original potential output,  $Y_n^0$ . The shift in AD-curve is given as (2). But since  $Y_n^0 > Y_n'$ , there is now an inflationary gap in the economy (the new potential output is  $Y_n'$  while the current output is  $Y_n^0$ ). With this inflationary gap, in the medium-run process, the wage setters raise their price expectations, with the rise in price expectations, wages hence prices increase, and there will be a leftward shift in the AS-curve towards  $AS''$ , as given in shift (3). The final equilibrium is settled at point D, with a lower potential output and a higher price level compared to the original medium-run equilibrium.



## References

- Abel, A., Bernanke, B. & McNabb, R. (1998). *Macroeconomics (European Edition)*. Essex: Pearson Education Limited.
- Blanchard, O. & Johnson, D. R. (2013). *Macroeconomics (Global Edition)*. 6th Ed., Essex: Pearson Education Limited.
- Colander, D.C. & Gamber, E. N. (2002). *Macroeconomics*. New Jersey: Pearson Education.
- Dornbusch, R., Fischer, S. & Startz, R. (2018). *Macroeconomics*. 13<sup>th</sup> Ed., New York, NY: McGraw-Hill Education.
- Froyen, R. T. (2005). *Macroeconomics: Theories and Policies*. 8<sup>th</sup> Ed., New Jersey: Pearson Prentice Hall.



# Chapter 7

## Openness in Goods and Financial Markets, and Policy in the Open Economy

After completing this chapter, you will be able to;

### Learning Outcomes

- 1 Understand the concept of trade balance and elaborate on its determinants
- 2 Understand how equilibrium is attained in international financial markets and derive the uncovered interest parity condition
- 3 Examine the components of Balance of Payments and construct the BP-curve
- 4 Determine the general equilibrium in a small open economy
- 5 Analyze adjustments in equilibrium in response to policy changes and other exogenous shocks under fixed and flexible exchange rate regimes

### Chapter Outline

Introduction  
Openness in Goods Markets  
Openness in Financial Markets  
The Balance of Payments  
General Equilibrium in an Open Economy  
Adjustments in Equilibrium and Policy in an Open Economy

### Key Terms

Trade Balance  
Exchange Rate Regime  
Marshall-Lerner Condition  
J-curve  
Uncovered Interest Parity Condition  
Balance of Payments  
Mundell-Fleming Model  
Capital Mobility



## INTRODUCTION

So far in our analysis, we assumed the economy was closed or autarkic: The goods, factors and money (financial) markets were autarkic in the sense that there was no trade in these markets with the rest of the world. We made the closed economy assumption in order to understand the basic mechanisms of how the macroeconomy functioned. However, in the real world, all economies are open at least to some extent. We cannot analyze a single country's economy independent of what happens in the rest of the world.

In an open economy, openness has three main components: Openness in goods markets, openness in factor markets and openness in financial markets. Openness in goods markets implies the degree by which the consumers and firms are free to choose between domestic goods and foreign goods. Openness in factors markets is about the flow of labor and physical capital, or the choice of location of production. Most discussions about openness in factor markets concentrate on migration issues and choice of location of plants by multinational firms, both in academic research and in practice. Finally, openness in financial markets is implied by the degree by which financial investors are free to choose between domestic and foreign financial assets. The degree of openness in financial markets is measured by the degree of capital mobility, and the level restrictions and controls on financial flows determine the degree of capital mobility in a country.

In this chapter, we will focus only on the openness in goods markets and in financial markets to describe the country's goods market, money market and balance of payments equilibrium. Openness in factor markets has implications with respect to factor accumulation and labor mobility issues which relate to the long-run of an economy, hence for this chapter, we leave those issues aside to focus on the short-run equilibrium of an economy. We first start with the concept of openness in goods markets, followed by the concept of openness in financial markets, and the construction of balance

of payments equilibrium. We then turn to the Mundell-Fleming Model to examine the general equilibrium in a *small open economy*, and discuss the impacts of policy and other exogenous shocks on the equilibrium under two different exchange rate regimes: Fixed and flexible, under varying degrees of capital mobility.

**A small open economy** engages in international trade and is open to capital flows, but is small enough not to affect world goods prices, world interest rate or trading partners' incomes. In other words, small open economies are price takers in world goods and financial markets.

## OPENNESS IN GOODS MARKETS

In today's world, 164 countries are committed to World Trade Organization (WTO) rules which make sure that trade flows occur as smoothly, freely and predictably as possible among countries. Particularly with the 1990s, most countries have adopted WTO rules which not only govern commodity trade but also services and intellectual property rights trade across countries. Although some countries still impose tariffs (taxes on imports) or quotas (quantity restrictions on imports), under the WTO rules these tariffs and quotas are low and most countries agree on the mutual benefits of free flow of goods and services across countries.

Openness in goods markets is often measured by the ratio of the sum of imports and exports to GDP of a country. Figure 7.1 depicts the degree of openness in some selected economies, China, USA, Japan, Germany, South Korea and Türkiye. As can be seen in the figure, over time, particularly with the 1990s and WTO membership, openness started to increase in these countries. Most notable examples are South Korea and Germany with the highest degrees of openness from 70 to 80 percent of GDP as of 2020 while the Turkish economy is also considered to be one of the countries with a high degree of openness at about 60 percent of GDP.



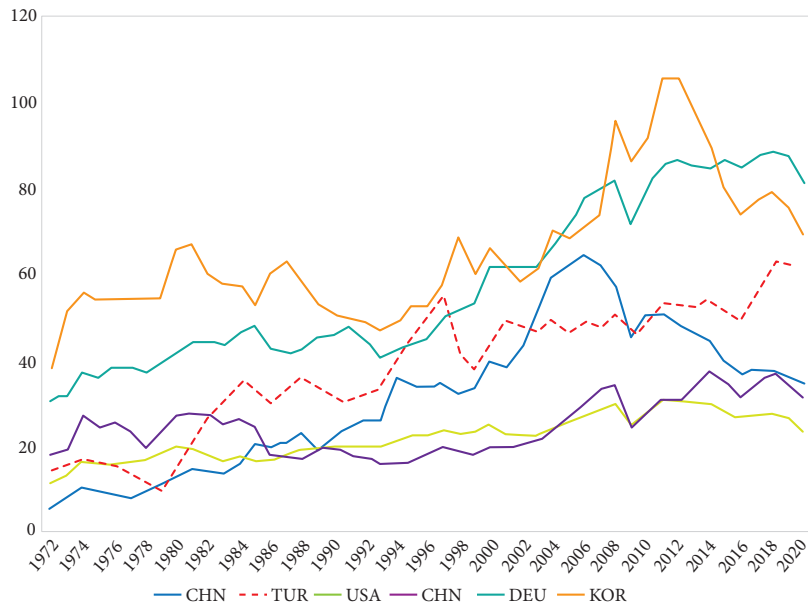


Figure 7.1 Degree of openness in foreign trade in selected countries.

Source: World Bank World Development Indicators

As depicted in Figure 7.2, up until the 1980s, the share of the trade volume in the Turkish economy did not exceed 15 percent of GDP, hence we can say that up until the 1980s, the Turkish economy was virtually a closed economy with little trade with the rest of the world. But with the 1980s, particularly after the 1990s, following the general trends elsewhere in the world, the Turkish economy experienced large increases in both exports and imports and started to further integrate into the world markets. Since the 1980s, we see a steady rise in the degree of openness in the Turkish economy. We see that except for short periods of time, imports have consistently exceeded exports, implying that the Turkish economy has consistently run a trade deficit with the rest of the world.

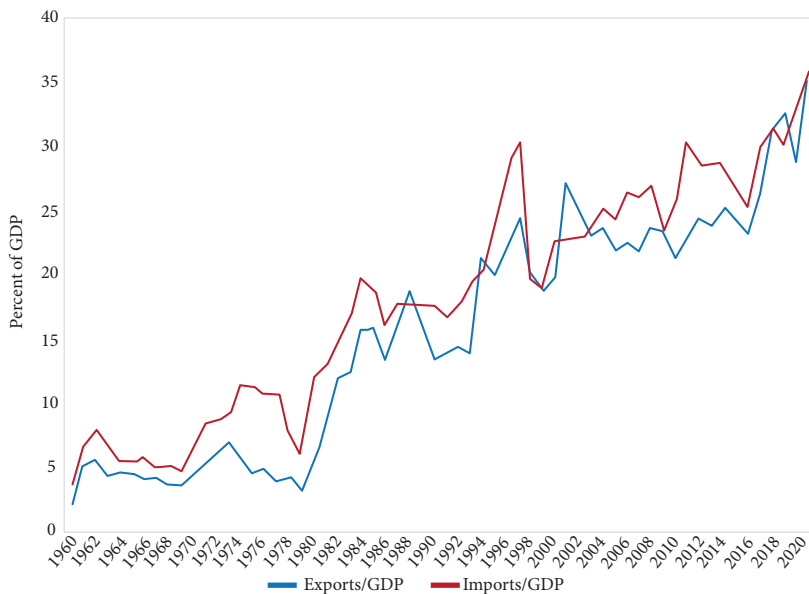


Figure 7.2 Exports and Imports as a share of GDP in Türkiye since 1960.

Source: World Bank World Development Indicators



Detailed Turkish Foreign Trade Statistics can be accessed from the Turkish Statistical Institute Website,  
<https://data.tuik.gov.tr/Kategori/GetKategori?p=dis-ticaret-104&dil=2>



In open economies, buyers, both consumers and firms, are free to choose between domestic goods and foreign goods. The choice depends on many factors, such as the income level in the domestic country, as well as the relative price between foreign goods and domestic goods. As we show below, the relative price between foreign goods and domestic goods is linked to the nominal exchange rate between domestic and foreign currencies and the differences in price level in domestic and foreign countries. Furthermore, the ability to export from a domestic economy is also dependent on the ability of the foreign partner to import, given by the foreign income level.

## Nominal and Real Exchange Rates

**Nominal exchange rate ( $E$ )**, by definition, is the *price of the foreign currency in terms of domestic currency*. For example, if we say that the US dollar exchange rate in Türkiye is 10 ( $E=10$ ), it means that the price of 1 US dollar is ₺10, i.e. 1 US dollar is worth ₺10, or, ₺1 can buy 0,1 US dollars in Türkiye.

In the Turkish economy, the **nominal exchange rate** is defined as the price of foreign currency in terms of domestic currency.

Over time, this price or the exchange rate between two currencies may change, if the country

operates under a floating or flexible **exchange rate regime**, this price may change every day, even every hour depending on market conditions. Such price changes will be denoted as (nominal) depreciations or (nominal) appreciations:

**Depreciation** of the domestic currency is a decrease in the price of domestic currency in terms of foreign currency (or an increase in the price of foreign currency in terms of domestic currency, an increase in  $E$ ). For example, if the exchange rate  $E$  between ₺ and US dollar increases from 10 to 12, it means that before the change, ₺1 was worth  $\frac{1}{10}$  = 0,1 US dollars, now it is worth  $\frac{1}{12}$  = 0,083 US

dollars. That means, the ₺ has lost value against the US dollar (while the US dollar has gained value against the ₺).

**Appreciation** of the domestic currency is an increase in the price of domestic currency in terms of foreign currency (or a decrease in the price of foreign currency in terms of domestic currency, a decrease in  $E$ ). For example, we say that the ₺ has appreciated against the US dollar if the exchange rate  $E$  between these two currencies decreases from 10 to 8. With this change in the exchange rate, the price of the domestic currency ₺ increases from  $\frac{1}{10}$  = 0,1 US dollars to  $\frac{1}{8}$  = 0,125 US dollars, that is, the ₺ gains value against the US dollar (or, the US dollar loses value against the ₺).

An exchange rate regime is a system by which a country's monetary authority-usually the central bank-chooses to determine the value of the country's currency against other currencies of the world. Some countries choose to operate under a fixed exchange rate regime where the value of the country's currency is pegged to the value of another currency, or at the other extreme, a flexible (free floating) exchange rate regime where the value of the country's currency is fully determined by market conditions. Some other countries may choose a regime somewhere in between. The choice of an exchange rate regime is one of the most debated issues in macroeconomics, and policymakers try to choose the regime that is considered to be optimal for their economies.

Under the fixed exchange rate regime, the exchange rate is determined by the monetary authority, and the decrease in the value of domestic currency against other currencies is called *devaluation*, and the increase in the value of domestic currency against other currencies is called *revaluation*. Devaluations and revaluations can only be implemented by government authority with a deliberate policy objective. Under the fixed exchange rate regime, the monetary authority or the central bank stands ready to buy or sell foreign currency in order to keep the exchange rate fixed, and these actions are called *foreign exchange interventions*. The central bank loses or gains in official reserves as a result of these interventions. Note that the terms devaluation and revaluation only apply for the case of a fixed exchange rate regime, while depreciation and appreciation are general terms.



#### attention

Currency devaluation or currency revaluation are specific terms used for changes in official fixed exchange rate, while the terms depreciation or appreciation reflect changes in the currency's value in general.



Since 2001, Türkiye has adopted the flexible (floating) exchange rate regime under which the exchange rate is determined by market forces. The daily exchange rates between the TRY and all major currencies of the World are issued by the Central Bank of Türkiye. You may access daily exchange rate data from the Bank's website <https://tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN> under Statistics and Exchange Rates pages.

The nominal exchange rate provides us only partial information about the value of goods in one country against the value of goods in another country. In that sense, the nominal exchange rate may not be a good measure of the relative values of goods in different countries if there are large differences in price level changes or inflation rate

across countries. For the correct measure of the value of a goods in one country in terms of goods in other countries, we resort to the "real exchange rate".

**Real exchange rate** measures the relative price of foreign goods in terms of domestic goods.

By definition, **real exchange rate** is the measure of the relative price, or relative value of foreign goods in terms of domestic goods. Let's go through the measurement of real exchange rate with an example:

Suppose that there are only two countries in the world, Türkiye (home country) and Germany. Both countries produce only one good, let's say washing machines; Türkiye produces XYZ washing machines and Germany produces ABC washing machines. The price of a XYZ washing machine in Türkiye is ₺900, and the price of an ABC washing machine in Germany is 1,000 euros. Let's say that the nominal exchange rate between the ₺ and the Euro is 1,8 i.e.,  $E=1,8$ . Then, the price of a ABC washing machine in Türkiye is  $E \cdot 1,000 = 1,8 \cdot 1,000 = ₺1,800$  (we convert the Euro price into ₺ price). Then, the relative price of a foreign (ABC) washing machine in terms of domestic (XYZ) washing machine is

$$\frac{1,800}{900} = 2$$

That is, the German ABC washing machine is twice as expensive as a domestic XYZ washing machine. Now let's examine the same concept in real exchange rate notation:

$$\varepsilon = \frac{E \times P^*}{P}$$

Here,  $\varepsilon$  is the real exchange rate,  $P^*$  is the foreign price level, and  $P$  is the domestic price level. The real exchange rate is obtained by multiplying the foreign price with the nominal exchange rate, and then dividing by the domestic price. In real world applications, the real exchange rate is an index number just like the GDP deflator or the Consumer price Index (CPI). In the real world measurement of the real exchange rate, for the measurement of the domestic and foreign prices, we may make use of the

CPI in the domestic economy, and a weighted average of CPI in all major trading partners, and a weighted average of nominal exchange rates. That is, in real world cases, we do not necessarily report the real exchange rate between only two countries, but a real exchange rate between the domestic economy and her major trading partners. Furthermore, since the real exchange rate is an index number, it does not have much meaning on its own, but its rate of change is important, and the change may stem from changes in the nominal exchange rate and/or inflation rate variations across countries.



#### your turn 1

Suppose that foreign inflation rate is 6 percent, and the domestic inflation rate is 10 percent. What must be the rate and direction (depreciation or appreciation) of the change in nominal exchange rate in order to achieve an 8 percent real depreciation in domestic currency?

## Determinants of Exports and Imports

In an open economy, the demand for domestically produced goods (in real terms) is given by

$$ZZ \equiv C + I + G - \epsilon IM + X$$

Here  $ZZ$  denotes the aggregate demand for domestic goods in an open economy,  $C$  is domestic consumption,  $I$  is investments,  $G$  is government spending,  $IM$  is the volume of imports (in terms of foreign goods),  $\epsilon IM$  is volume of imports in terms of domestic goods and  $X$  is volume of exports (already in terms of domestic goods).

Here,  $C + I + G$  is domestic demand for all goods (both domestic and foreign),  $\epsilon IM$  is domestic demand for foreign goods (note that imports,  $IM$ , are denominated in foreign goods, multiplying with the real exchange rate  $\epsilon$  converts them into domestic goods),  $C + I + G - \epsilon IM$  is the domestic demand for domestic goods, and finally  $X$  is foreign demand for domestic goods. Hence, the sum  $C + I + G - \epsilon IM + X$  is aggregate (both domestic and foreign) demand for domestically produced goods. In the goods market equilibrium, it has to be the case that

$$Y = ZZ \equiv C + I + G - \epsilon IM + X = C + I + G + (X - \epsilon IM) = C + I + G + NX$$

In an open economy, the volume of imports depend positively on the domestic income and negatively on the real exchange rate,

$$IM = IM(Y, \epsilon)$$

As domestic income increases, the domestic demand for all types of goods increase, including the imported goods. On the other hand, real exchange rate and the volume of imports are negatively related:

- i. If there is an increase in nominal exchange rate (nominal depreciation or devaluation in domestic currency against foreign currency), an increase in foreign prices and/or a decrease in domestic prices, foreign goods become relatively more expensive compared to domestically produced goods, domestic demand for foreign goods decreases, hence import volume decreases;
- ii. If there is a decrease in nominal exchange rate (nominal revaluation or appreciation in domestic currency against foreign currency), a decrease in foreign prices and/or an increase in domestic prices, foreign goods become relatively cheaper compared to domestically produced goods, domestic demand for foreign goods increases, hence the import volume increases.

The volume of exports are determined by the foreign income level  $Y^*$  and the real exchange rate,  $\epsilon$ :

$$X = X(Y^*, \epsilon)$$

If income rises in foreign countries, their demand for all types of goods increases, including goods produced in the domestic economy. On the other hand, real depreciation of domestic currency makes domestic goods relatively cheaper compared to foreign goods, hence foreign demand for domestically produced goods rises and the domestic country exports more to foreign countries. A real appreciation has

the opposite effect: A real appreciation makes domestically produced goods relatively more expensive in foreign countries, hence the foreign demand for domestically produced goods decreases, and the domestic economy exports less to foreign countries.

### Simple Multiplier in an Open Economy

Since imports are a function of domestic income level  $Y$ , simple multiplier in an open economy will not be the same as a multiplier in a closed economy. In calculation of the simple multiplier in an open economy, we need to factor in the rate of marginal propensity to import, given by the  $0 < m_1 < 1$  parameter in import function. In the following analysis of the open economy multiplier, assume that the real exchange rate is given and constant, and that it is equal to 1,  $\epsilon = 1$ .

$$Y = C(Y_d) + I + G + X(Y^*, \epsilon) - \epsilon IM(Y, \epsilon)$$

$$= c_0 + c_1(Y - T) + I + G + x_1 Y^* - m_1 Y$$

$$Y = \frac{1}{1 - (c_1 - m_1)} [c_0 - c_1 T + I + G + x_1 Y^*]$$

The simple multiplier in the open economy is  $\frac{1}{1 - c_1 + m_1}$ . Since  $0 < m_1 < 1$ , the simple multiplier in an open economy is smaller than that in a closed economy, where  $m_1 = 0$ . For example, ceteris paribus, the impact of a change in government spending  $\Delta G$  on income in open economy is calculated as

$$\Delta Y = \frac{1}{1 - c_1 + m_1} \Delta G$$

How the net exports are affected by the change in government spending is given by the following:

$$NX = X - \epsilon IM = X - \epsilon m_1 Y$$

$$\Delta NX = -m_1 \Delta Y = -\frac{m_1}{1 - c_1 + m_1} \Delta G$$

Holding all else the same, since an increase in government spending increases domestic income in the goods market equilibrium, volume of imports rise and hence net exports or the trade balance deteriorates as a result.



#### your turn 2

You are given the following information regarding an open economy:

$$C = 180 + 0,75 Y_d$$

$$T = 60 + 0,2 Y$$

$$I = 195$$

$$G = 300$$

$$X = 200$$

$$M = 30 + 0,1 Y$$

$$\epsilon = 1$$

- For this economy, calculate the equilibrium income level.
- Calculate the net exports at the equilibrium income level. Is the economy running a trade deficit or a trade surplus at equilibrium?
- Calculate the open economy multiplier.
- When the government increases government spending to 400 from 300, what happens to the trade balance?

### Depreciation, Trade Balance and the Marshall-Lerner Condition

Over time, there may be changes in the real exchange rate, caused by a change in the nominal exchange rate, a relative change in foreign and domestic prices, or a combination of both. In that case, there will be changes in exports, imports, and the relative price of imports. Recall that net exports or trade balance is given by:

$$NX(Y, Y^*, \varepsilon) = X(Y^*, \varepsilon) - \varepsilon IM(Y, \varepsilon)$$

Trade balance (NX) is positively related to foreign income, negatively related to domestic income, but the impact of changes in real exchange rate (for example real depreciation) may be ambiguous:

- Volume of exports increase with real depreciation;
- Volume of imports decrease with real depreciation;
- The relative price of imports in terms of domestic goods increases with real depreciation:

$$\underbrace{NX(Y, Y^*, \varepsilon)}_{?} = \underbrace{X(Y^*, \varepsilon)}_{\uparrow} - \underbrace{\varepsilon}_{\uparrow} \times \underbrace{IM(Y, \varepsilon)}_{\downarrow}$$

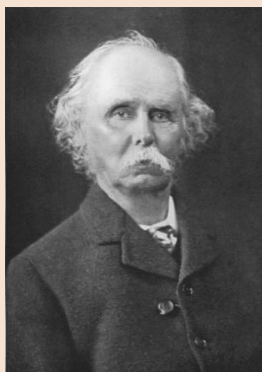
Given domestic and foreign income levels,  $Y$  and  $Y^*$ , the Marshall-Lerner condition foresees that with real depreciation of the domestic currency, volume of exports rise large enough and volume of imports fall large enough to compensate for the rise in the relative price of imports in terms of domestic goods, hence net exports or trade balance improves as a result. This condition holds true when the sum of the price elasticities of export demand (in foreign countries) and import demand (in domestic country) is larger than one. Hence in order to stimulate net foreign demand and thus aggregate demand for domestic goods, governments may choose to implement policies leading to a real depreciation of domestic currency:

$$\underbrace{NX(Y, Y^*, \varepsilon)}_{\uparrow} = \underbrace{X(Y^*, \varepsilon)}_{\uparrow\uparrow} - \underbrace{\varepsilon}_{\uparrow} \times \underbrace{IM(Y, \varepsilon)}_{\downarrow\downarrow}$$



## In Practice

### THE MARSHALL-LERNER CONDITION



Alfred Marshall



Abba P. Lerner

The Marshall-Lerner condition is named after Alfred Marshall (1842-1924), an English economist and Abba P. Lerner (1903-1982), a Russian-born economist. The Marshall-Lerner condition states that the depreciation of the domestic currency will lead to an improvement in the country's trade balance, as long as the sum of price elasticities of demand for exports and imports is larger than one.

The mathematical derivation of the Marshall-Lerner condition is as follows:

$$NX(Y, Y^*, \varepsilon) = X(Y^*, \varepsilon) - \varepsilon IM(Y, \varepsilon)$$

Holding  $Y$  and  $Y^*$  fixed, and taking the derivatives with respect to real exchange rate,  $\varepsilon$ , we have:



$$\begin{aligned}
\frac{\partial NX}{\partial \varepsilon} &= \frac{\partial X}{\partial \varepsilon} - \left[ \varepsilon \times \frac{\partial IM}{\partial \varepsilon} + IM \right] = \frac{\partial X}{\partial \varepsilon} - \varepsilon \times \frac{\partial IM}{\partial \varepsilon} - IM = IM \left[ \frac{\partial X}{\partial \varepsilon} \times \frac{\varepsilon}{X} \times \frac{X}{\varepsilon IM} - \frac{\varepsilon}{IM} \times \frac{\partial IM}{\partial \varepsilon} - 1 \right] \\
&= IM \left[ \eta_x \times \frac{X}{\varepsilon IM} - \eta_{IM} - 1 \right] = IM \left[ \eta_x \times \frac{X}{\varepsilon IM} - \eta_x + \eta_x - \eta_{IM} - 1 \right] \\
&= IM \left[ \eta_x \left( \frac{X}{\varepsilon IM} - 1 \right) + \eta_x - \eta_{IM} - 1 \right] = IM \left[ \eta_x \left( \frac{X - \varepsilon IM}{\varepsilon IM} \right) + \eta_x - \eta_{IM} - 1 \right]
\end{aligned}$$

Here,  $\eta_x$  is the price elasticity of exports,  $\eta_{IM}$  is the price elasticity of imports.

If the economy starts from a trade balance situation,  $X - \varepsilon IM = 0$ , then, the equation above becomes

$$\frac{\partial NX}{\partial \varepsilon} = IM [\eta_x - \eta_{IM} - 1]$$

Hence,  $\frac{\partial NX}{\partial \varepsilon} > 0$  only if  $\eta_x - \eta_{IM} - 1 > 0$ .

Note that the same condition must hold if the economy initially starts from a trade deficit situation,  $X - \varepsilon IM < 0$ . If the economy starts out with a trade surplus,  $X - \varepsilon IM > 0$ , then the sum of the elasticities may be less than one in order to ensure  $\frac{\partial NX}{\partial \varepsilon} > 0$ .

### The J-curve Effect

So far in our analysis, we talked about the effects of real depreciation of domestic currency like a static phenomenon, like it would immediately positively affect the trade balance. But in fact it is a dynamic process. Consider a nominal depreciation in domestic currency, let's say by 5 percent. At first, this nominal depreciation will be felt on nominal prices of goods, rather than on quantities actually traded since it takes a while for the consumers to realize the changes in relative prices or firms to adapt to new prices. In that sense, there might be lags between the changes in nominal prices and changes in actual quantities traded. Hence, a depreciation in domestic currency may first lead to a worsening of the trade balance as the price of imported goods rise initially without any change in quantities traded. But over time as economic agents adapt to the changes in relative prices and change import and export demand behavior, trade balance will start improving, eventually surpassing its initial position. This dynamic effect is depicted by the *J-curve*, an inverted J-shaped diagram as given in Figure 7.3.

In the remainder of this chapter, we will assume that the Marshall-Lerner condition holds with real depreciation of domestic currency, i.e. net exports improve immediately with real depreciation.

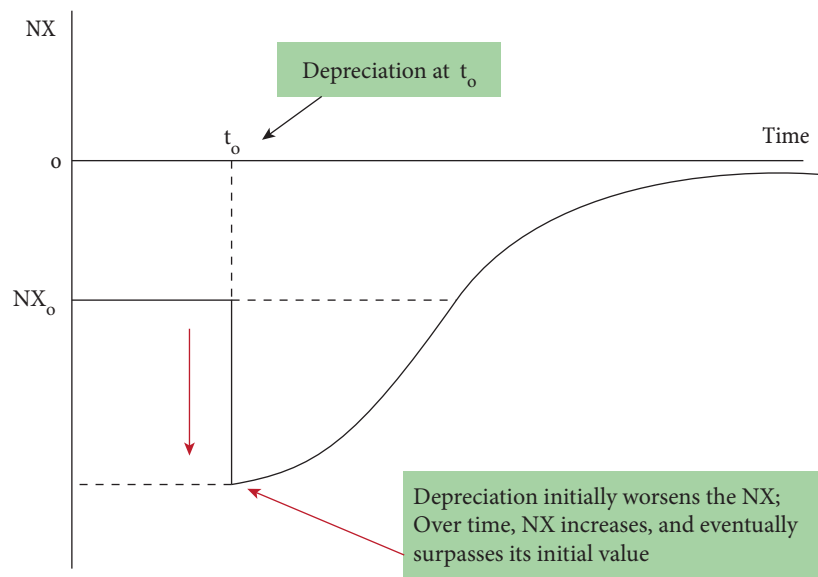


Figure 7.3 The J-curve.

## OPENNESS IN FINANCIAL MARKETS

We now move on to discussing openness in financial markets. Openness in financial markets implies that agents are free to choose between domestic assets and foreign assets, and the degree of openness or capital mobility depends on the degree of freedom by which this choice can be exercised. Openness in financial markets allows both domestic and foreign investors to seek the highest rate of return on their financial investments through the purchase and sale of both domestic and foreign financial assets. Openness in financial markets also allows the domestic economy to run a deficit or a surplus in trade balance with the rest of the world. As we will show in the discussion of balance of payments, a country can run a trade deficit by net borrowing from other countries, or run a trade surplus by net lending to other countries.

Let's first start by looking more closely at the determination of equilibrium in financial markets in an open economy.

### Equilibrium in Financial Markets

So far, in our closed economy case that was presented in the previous chapters, agents were allowed to hold the domestic currency (money) and/or domestic bonds as part of their wealth. In an open economy, they also have the choice of holding foreign bonds, or in general, foreign interest-bearing assets. For our purposes, we assume that the domestic country has full capital mobility, and that there are no restrictions to agents' choices between domestic and foreign assets. Suppose that the domestic country is Türkiye with domestic currency ₺, the foreign country is the US with currency US dollar, and the agents have the choice between ₺-denominated bonds versus US dollar-denominated bonds as alternative interest-bearing assets. We assume these bonds are one-year bonds in both economies. We further assume that financial investors are rational in the sense that they seek the highest expected rate of return on their financial investments.

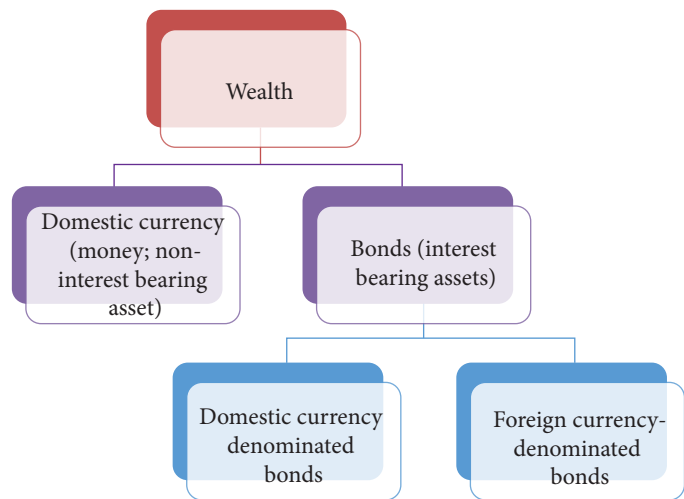


Figure 7.4 Agents' decision of how to hold wealth.

Suppose that the gross expected rate of return on ₺1 invested in a ₺-denominated 1-period bond at time  $t$  yields  $(1+i_t)$  ₺ at the time of maturity, time  $(t+1)$ . Here,  $i_t$  is the (nominal) rate of interest on the domestic bond. On the other hand, let's say that the (nominal) interest rate on the US-denominated bond is  $i_t^*$ , the nominal exchange rate between ₺ and the US dollar at time  $t$  is  $E_t$ , the future expected nominal exchange rate is  $E_{t+1}^e$ , then the gross expected rate of return on the same ₺1 invested in a US bond (in ₺ terms) becomes  $\frac{1}{E_t}(1+i_t^*)E_{t+1}^e$  ₺.

$$\text{₺1} = \frac{1}{E_t} \text{ US dollars at time } t$$

Return on the US-dollar denominated bond at maturity time  $(t+1)$  (in US dollars) is  $\frac{1}{E_t}(1+i_t^*)$

Convert time  $(t+1)$  US dollar value into ₺ value using the expected exchange rate:  $\frac{1}{E_t}(1+i_t^*)E_{t+1}^e$



When there are no restrictions imposed on capital mobility, and assuming that the financial investors are rational and seek the highest rate of return on their financial investments, if both the ₺ and US dollar-denominated bonds are to be held, in order for the financial investor to be indifferent (or in equilibrium), the expected rates of return on both assets must be the same. In other words, the expected rate of return on ₺1 invested into the ₺-denominated bond and the expected rate of return on ₺1 invested into the US dollar-denominated bond must be equal to each other. Under no arbitrage possibilities, it must be that

$$(1+i_t) = \frac{1}{E_t} (1+i_t^*) E_{t+1}^e$$

Reorganizing we have

$$(1+i_t) = (1+i_t^*) \left( \frac{E_{t+1}^e}{E_t} \right) = (1+i_t^*) \left( 1 + \frac{E_{t+1}^e - E_t}{E_t} \right)$$

Then,

$$i_t \approx i_t^* + \frac{E_{t+1}^e - E_t}{E_t}$$

or,

$$i_t - i_t^* \approx \frac{E_{t+1}^e - E_t}{E_t}$$

This is what we call the “**uncovered interest parity (UIP) condition**”, and it shows that the difference between domestic and foreign (nominal) interest rates is approximately given by the expected depreciation (or appreciation) in the nominal exchange rate. The reason why this condition is called *uncovered* interest parity is because the future exchange rate is uncertain, and the risk to the financial investor from exchange rate fluctuations is “uncovered”.

This is an equilibrium condition for the financial markets where the financial investor is indifferent between holding domestic bonds and holding foreign bonds. Now suppose that there are two countries, Türkiye (domestic) and US (foreign), and that the domestic interest rate is 4 percent and the foreign interest rate is 2,5 percent. The question is: Should the financial investor hold ₺-denominated bonds or US dollar-denominated bonds? The answer is straightforward, based on the uncovered interest parity condition: Whether the financial investor holds ₺ (domestic) bonds or US (foreign) bonds depends on the expected depreciation of the ₺, i.e.,  $\frac{E_{t+1}^e - E_t}{E_t}$

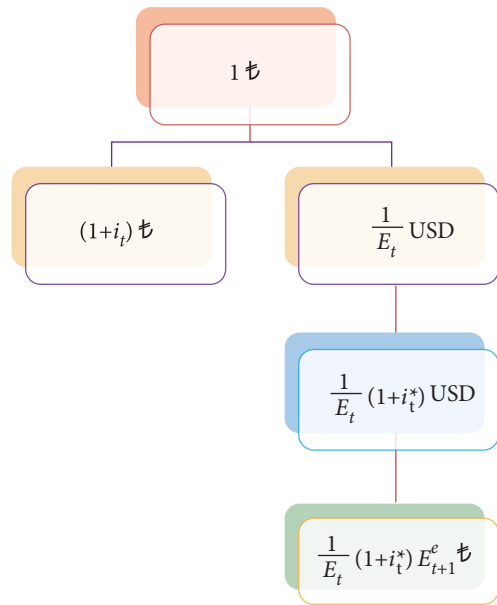


Figure 7.5 Expected returns on alternative investments of 1 ₺

Uncovered interest parity (UIP) condition is an equilibrium condition in international financial markets which shows that financial investors make decisions based on the difference in domestic and foreign nominal interest rates in relation to the expected depreciation or appreciation in domestic currency:

$$i_t - i_t^* \approx \frac{E_{t+1}^e - E_t}{E_t}$$

In our example,

$$i_t = 4\%$$

$$i_t^* = 2,5\%$$

Then,

$$i_t - i_t^* = 1,5\%$$

If the financial investor expects the ₺ to depreciate against the US dollar by more than 1,5 percent in the next period,

$$\frac{E_{t+1}^e - E_t}{E_t} > 1,5\%$$

That is,

$$\frac{E_{t+1}^e - E_t}{E_t} > i_t - i_t^*$$

$$\frac{E_{t+1}^e - E_t}{E_t} + i_t^* > i_t$$

This is a disequilibrium situation where investing into a US dollar-denominated bond is more attractive for the financial investor than investing into a ₺-denominated bond. It is expected that the US dollar will appreciate at a higher rate than the interest rate differential next year (when the financial investor liquidates the bond, the gain is higher than the interest rate differential), hence there is an advantage in holding a US dollar-denominated bond versus a ₺-denominated bond today.

Reversely, if the financial investor expects the ₺ to depreciate by less than 1,5 percent (or even appreciate) next period,

$$\frac{E_{t+1}^e - E_t}{E_t} < 1,5\%$$

We know that

$$\frac{E_{t+1}^e - E_t}{E_t} < i_t - i_t^*$$

$$\frac{E_{t+1}^e - E_t}{E_t} + i_t^* < i_t$$

In this disequilibrium situation, the financial investor will be motivated to purchase ₺-denominated bonds, as the US dollar is expected to appreciate by less than the interest rate differential, or even appreciate against the ₺ in the next period. Finally if the financial investor expects that the ₺ depreciates exactly by 1,5 percent next period,

$$\frac{E_{t+1}^e - E_t}{E_t} = 1,5\%$$

This is the equilibrium situation where investing into a ₺-denominated bond is no more attractive than investing in a US dollar-denominated bond. The financial investor is indifferent between these two assets.

## THE BALANCE OF PAYMENTS

Balance of Payments accounts summarize a country's transactions with the rest of the world, both in terms of trade flows and financial flows. Balance of Payments accounts have two main components: Current Account and Capital & Financial Account. To understand how the system of Balance of Payments works, we need to go back to our knowledge of goods market equilibrium in an open economy.

The goods market equilibrium in an open economy is given by

$$Y = C + I + G + NX$$

where  $Y$  is the GDP,  $C$  is domestic consumption,  $I$  is domestic investment,  $G$  is government spending and  $NX$  is net exports. Now, subtract net taxes,  $T$  from both sides of the equation,

$$Y - T = C + I + G - T + NX$$

and subtract  $C$  from both sides of the equation,

$$Y - T - C = I + G - T + NX$$

Finally, add net income received ( $NI$ ) and net current transfers received from abroad ( $NT$ ) to both sides,

$$Y + NI + NT - T - C = I + G - T + (NX + NI + NT)$$

The sum  $NX + NI + NT$  on the right hand side is the Current Account balance of the economy. The Current Account ( $CA$ ) balance is given by the sum of trade balance or net exports ( $NX$ ), Net income received ( $NI$ ) and Net current transfers received ( $NT$ ) as will be explained below in detail. The left hand side of the equation is domestic private savings,  $S$ . Then,

$$S = I + G - T + CA$$

or,

$$CA = (S + T - G) - I$$

- The country runs a current account surplus ( $CA > 0$ ) as long as it saves more (both private and public) by more than it invests,  $(S + T - G) > I$  (this implies a net lending to the rest of the world and a deficit in Capital & Financial Account);

- The country runs a current account deficit ( $CA < 0$ ) as long as it saves (both private and public) by less than it invests,  $(S + T - G) < I$  (this implies a net borrowing from the rest of the world and a Surplus in Capital & Financial Account).

Now we are ready to understand the main components and subcomponents in the Balance of Payments accounts:

At the top half of the Balance of Payments, we have the Current Account. Current Account has three main sub-components:

- Net Exports = Exports-Imports = Trade Balance on Goods and Services (Merchandise trade & services trade—services trade includes patents, property rights and other intellectual property rights)
- Net income received from abroad = Income received on holdings of foreign assets by domestic residents minus income received on holdings of domestic assets by foreigners (Note: This account appears as interest income/primary income in the Turkish Balance of Payments)
- Net current transfers received from abroad (personal transfers including workers remittances & foreign aid. This account appears as Secondary income in the Turkish Balance of Payments)

At the bottom half of the Balance of Payments, there is the Capital & Financial Account:

- Capital Account (Gross acquisitions and disposals of non-produced non-financial assets such as franchising, purchase and sale of trademarks)
- Financial Account
  - Net Foreign Direct Investment (equity capital, other capital and real estate)
  - Net Portfolio Investment (firm securities and government's debt securities)
  - Net Other Investment (commercial loans)



Current Account: Surplus → Capital and Financial Account: Deficit (Net lending to the rest of the world: Net outflow of capital from the country; Sum of capital and financial outflows are larger than inflows; Acquisition of assets from the rest of the world by domestic investors is larger than acquisition of domestic assets by foreign investors)

Current Account: Deficit → Capital and Financial Account: Surplus (Net borrowing from the rest of the world: Net inflow of capital to the country; Sum of capital and financial inflows are larger than outflows; Acquisition of domestic assets by foreign investors is larger than acquisition of assets from the rest of the world by domestic investors)

As shown above, the Current Account balance should be equal to the Capital & Financial Account balance in the equilibrium, and this equilibrium is what is known as *the balance of payments*:

$$CA = (S + T - G) - I$$

However in real world situations, this balance is not always achieved, and the Official Reserves (or changes in reserve assets of the central bank) are used for adjustment. Sometimes there might also be mistakes and/or omissions in the collection of Balance of Payments data from different sources, and these will be recorded under the *Net errors and omissions* account. In practice, if the changes in reserve assets are larger (or smaller) than the sum of Current Account and Capital & Financial Account, the discrepancy is recorded as *net errors and omissions* in the Balance of Payments accounts.

Now let's examine a sample Balance of Payments table from the Turkish economy as given in Table 7.1.

**Table 7.1** Summary Balance of Payments Accounts, Türkiye, 2017 (bill. USD).

|                                                         |         |
|---------------------------------------------------------|---------|
| Current Account                                         | -40,877 |
| Balance on Goods                                        | -58,575 |
| Exports of goods                                        | 169,214 |
| Imports of goods                                        | 227,789 |
| Balance on Goods and Services                           | -32,242 |
| Balance on Goods, Services and Primary Income           | -43,402 |
| Current Transfers (Secondary Income)                    | 2,525   |
| Capital & Financial Account (assets net of liabilities) | -41,473 |
| Current, Capital & Financial Accounts                   | 596     |
| Net Errors and Omissions                                | -8,803  |
| General Balance                                         | 8,207   |
| Reserve Assets (Change in Official Reserves)            | -8,207  |

**Source:** Central Bank of the Republic of Türkiye Statistics.

According to the Balance of Payments Accounts of Türkiye from 2017, the Current Account deficit was 40,877 billion USD. This Current Account deficit was financed by 41,473 billion USD net borrowing from other countries, i.e. Türkiye has run a Capital & Financial Account surplus in 2017. The negative sign of the Capital & Financial Account indicates a net borrowing or a negative asset acquisition net of liabilities: Net Turkish foreign indebtedness has increased as there is an increase in foreign holdings of Turkish assets minus Turkish holdings of foreign assets. This also indicates that there has been a net capital

inflow to Türkiye in 2017. The net of the Current Account and the Capital & Financial Account is 596 million USD. The fall in Central Bank's official reserves for the year 2017 was by 8,207 billion USD, hence the discrepancy between the net of Current Account and Capital & Financial Account and the Reserve Assets account is -8,803 billion USD, which is recorded as the Net errors and omissions in 2017.



Balance of Payments data for Türkiye can be accessed from the Central Bank of Türkiye Statistics website under Balance of Payments and related statistics pages:  
<https://tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Statistics/Balance+of+Payments+and+Related+Statistics/Balance+of+Payments+Statistics/>



### your turn 3

Consider the summary table of Balance of Payments for Türkiye for the year 2013 from the Central Bank of the Republic of Türkiye Statistics. Fill in the blanks marked with X, then answer the following questions below.

|     | (Million US Dollars)                                   | 2013    |
|-----|--------------------------------------------------------|---------|
| A-  | CURRENT ACCOUNT                                        | X       |
| 1.  | Exports (f.o.b.)                                       | 167.397 |
| 2.  | Imports (f.o.b.)                                       | 249.282 |
|     | Balance on Goods                                       | X       |
| 3.  | Services: Credit                                       | 58.870  |
| 4.  | Services: Debit                                        | 25.500  |
|     | Balance on Goods and Services                          | -48.515 |
| 5.  | Primary Income: Credit                                 | 5.289   |
| 6.  | Primary Income: Debit                                  | 13.907  |
|     | Balance on Goods, Services and Primary Income          | -57.133 |
| 7.  | Secondary Income (current transfers)                   | 1.277   |
| B.  | CAPITAL & FINANCIAL ACCOUNT (borrowing net of lending) | 65.651  |
|     | Current, Capital and Financial Accounts                | X       |
| D.  | NET ERRORS AND OMISSIONS                               | X       |
|     | GENERAL BALANCE                                        | -10.763 |
| E.  | RESERVE ASSETS                                         | 10.763  |
| 14. | Official Reserves                                      | X       |
| 15. | Credit and loans with the IMF                          | 852     |
| 16. | Exceptional Financing                                  | 0       |

- Did Türkiye run a trade deficit or a trade surplus in 2013?
- What is the change in official reserves in the BoP above? Did the official reserves of Türkiye increase or decrease in 2013?

## GENERAL EQUILIBRIUM IN AN OPEN ECONOMY

The determination of general equilibrium in an open economy will be different than what we have studied in a closed economy, where we were only concerned about the determination of equilibrium interest rate and income at the simultaneous equilibrium in domestic goods and money markets. Now we also need to be concerned about the equilibrium in the balance of payments: As we have seen above, a Current Account deficit must be accompanied by a Capital & Financial Account surplus, or vice versa, and the economy's interest rate and income level must satisfy this equilibrium condition. In that sense, we need an additional device other than the goods and market equilibrium device (the IS-LM model) to depict the alternative equilibria in interest rate and income in balance of payments. **The Mundell-Fleming Model**, named after Robert Mundell and Marcus Fleming, incorporates the balance of payments equilibrium or the BP-model into the IS-LM model to analyze the simultaneous equilibria in all goods market, money market and balance of payments of a small open economy. With this model, it is possible to determine the general equilibrium of a small open economy in the short-run, and examine the effects of policy changes or other exogenous shocks to both internal (goods and money markets) and external (balance of payments) equilibrium. The model is versatile in the sense that it allows us to examine an open economy both under fixed and flexible exchange rate regimes, and also under varying degrees of capital mobility. Depending on the country's choice of exchange rate regime and also degree of capital mobility, it is possible to analyze the effects of monetary and fiscal policy changes, and also the exogenous shocks such as foreign income changes leading to changes in exports.

The Mundell-Fleming Model, which is also known as the IS/LM/BP Model, has been developed by Robert Mundell (1932-2021) and Marcus Fleming (1911-1976), although independently. Mundell-Fleming model describes the determination of equilibrium in the short-run of a small open economy with respect to income, interest rate and exchange rate. The model considers the determination of equilibrium in goods and money markets as well as in balance of payments under varying degrees of capital mobility in a small open economy.

### Equilibrium in Goods Market in an Open Economy

Equilibrium in goods market in an open economy is achieved by the equilibrium of income and output and aggregate demand. Aggregate demand in an open economy is given by

$$ZZ \equiv C(Y - T) + I(i) + G - \epsilon IM(Y, \epsilon) + X(Y^*, \epsilon)$$

As we have shown before, here  $C(Y - T) + I(i) + G$  denotes domestic demand (DD) for all goods,  $C(Y - T) + I(i) + G - \epsilon IM(Y, \epsilon)$  denotes the domestic demand for domestic goods, and  $X(Y^*, \epsilon)$  is the foreign demand for domestic goods, the sum of domestic demand for domestic goods and the foreign demand for domestic goods makes the aggregate demand for domestic goods. In goods market equilibrium, for given values of  $T$ ,  $G$ ,  $Y^*$ , interest rate  $i$  and real exchange rate  $\epsilon$ , it must be that

$$Y = ZZ \equiv C(Y - T) + I(i) + G + X(Y^*, \epsilon) - \epsilon IM(Y, \epsilon)$$

Now let's plot the components of aggregate demand in an open economy for given values of  $T$ ,  $G$ ,  $Y^*$ , interest rate  $i$  and real exchange rate  $\epsilon$ :

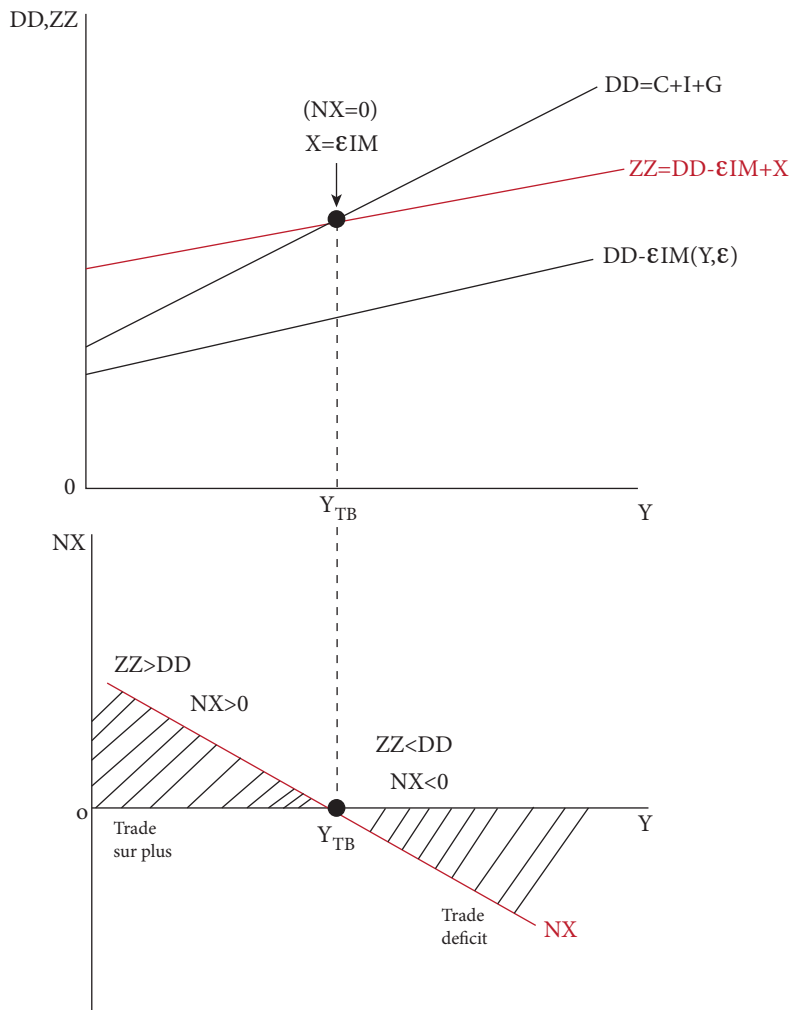


Figure 7.6 Aggregate demand in open economy and Net Exports.

In the top panel of Figure 7.6, we derive the aggregate demand  $ZZ$  in an open economy.  $DD$  curve shows the domestic demand for all goods, from  $DD$ , we subtract imports  $\epsilon IM(Y, \epsilon)$  for a given  $\epsilon$  value. Since imports depend positively on income level, imports increase with income, and the distance between  $DD$  and  $DD - \epsilon IM(Y, \epsilon)$  increase with higher levels of  $Y$ . To  $DD - \epsilon IM(Y, \epsilon)$  we add the exogenous exports  $X(Y^*, \epsilon)$  hence there is a parallel upward shift.  $DD - \epsilon IM(Y, \epsilon) + X(Y^*, \epsilon)$  is our aggregate demand function in the open economy, or  $ZZ$ . Notice that the  $DD$  and  $ZZ$  functions intersect when  $X(Y^*, \epsilon) - \epsilon IM(Y, \epsilon) = 0$  or trade balance is equal to zero. They intersect at the income level which makes it possible to have trade balance in the economy,  $Y_{TB}$ .

The lower panel of Figure 7.6 shows the derivation of the net exports function against income level  $Y$ . As shown in the top panel,  $Y_{TB}$  is the income level when  $NX = 0$ ; To the left of  $Y_{TB}$ ,  $ZZ$  is larger than  $DD$ , hence  $NX > 0$ , implying trade surplus; To the right of  $Y_{TB}$ ,  $DD$  is larger than  $ZZ$ , hence  $NX < 0$ , implying trade deficit.

Now let's have a look at the determination of goods market equilibrium in Figure 7.7 below. Once we construct the aggregate demand  $ZZ$ , it is straightforward to determine equilibrium in the Keynesian cross diagram at the intersection of the  $ZZ$ -function and the 45-degree line:

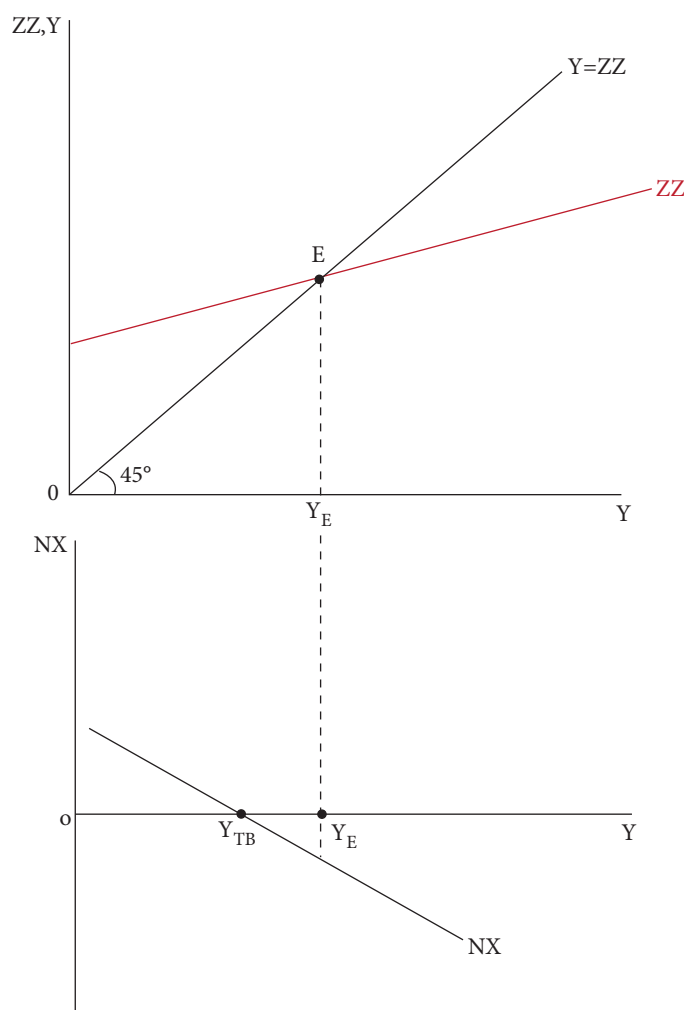


Figure 7.7 Equilibrium and net Exports in an open economy.

One important issue we need to observe in an open economy is that there need not be trade balance at the economy's goods market equilibrium,  $Y^E$ . As shown in Figure 7.7 as an example, there may be a trade deficit at the goods market equilibrium. Occurrence of a trade deficit or a trade surplus does not prevent an equilibrium in the goods market.

Note that we have obtained the goods market equilibrium under given values of  $T$ ,  $G$ ,  $Y^*$ , interest rate  $i$  and real exchange rate  $\epsilon$ . Recall that the IS-curve shows all alternative combinations of interest rate  $i$  and income  $Y$  that bring the goods market to equilibrium. For the open economy case, along with the policy variables  $T$  and  $G$ , we take the real exchange rate  $\epsilon$  and the exports  $X$  as constants in the derivation of the IS-curve:



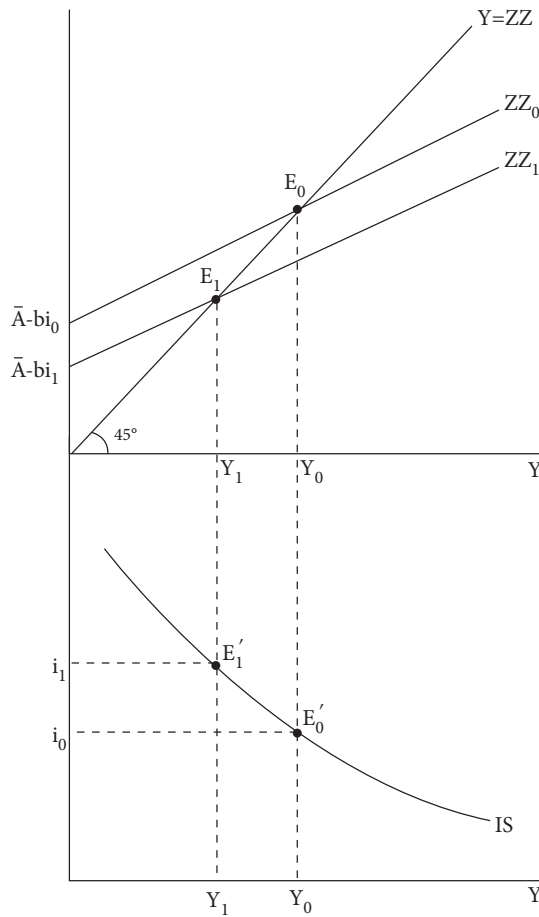


Figure 7.8 Derivation of the IS-curve in an open economy.

The following factors will tend to shift the IS-curve in an open economy:

- Increases in autonomous  $I$ ,  $X$ ,  $G$ , or a decrease in net taxes  $T$  will shift IS-curve to the right;
- With real depreciation, assuming that Marshall-Lerner condition holds, an improvement in  $NX$  shifts the IS-curve to the right;
- Decreases in autonomous  $I$ ,  $X$ ,  $G$  or an increase in net taxes  $T$  will shift IS-curve to the left;
- With real appreciation, assuming that  $NX$  worsens, the IS-curve shifts to the left.

### Equilibrium in the Money Market in an Open Economy

Equilibrium in the money market in an open economy is achieved similarly as in a closed economy and alternative equilibria in the money market are depicted along an upward sloping LM-curve:

Along a given LM-curve, the money market equilibrium holds for every alternative combination of interest rate  $i$  and income  $Y$  for a give real money supply,  $\frac{M}{P}$ :

$$\frac{M}{P} = M^d(Y, i)$$

Since we have already studied the derivation of the LM-curve in Chapter 3, we will skip the details about the LM-curve in this chapter.

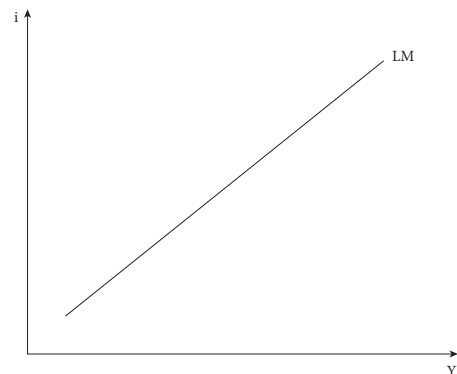


Figure 7.9 The LM-curve

## Equilibrium in the Balance of Payments or External Balance in an Open Economy

In an open economy, in addition to the domestic or internal (i.e. goods market equilibrium and money market equilibrium), we are also concerned about the balance of payments equilibrium or the external balance. The external balance or equilibrium in the Balance of Payments (BoP) in an open economy is represented by the Balance of Payments (BP) curve. The BP-curve shows all alternative combinations of interest rate and income level which ensure balance of payments equilibrium in an open economy. In the external balance of an economy, the relationship between the interest rate and income level is positive, i.e., the BP-curve is positively sloped. We know that income level ( $Y$ ) and the volume of imports ( $M$ ) are positively related. Hence, if there is an increase in the income level, imports will increase and holding all else the same, net exports ( $NX$ ) will worsen (if initially  $NX = 0$  now there is a  $NX$  deficit, if initially  $NX > 0$ , now there is a smaller  $NX$  surplus or even a deficit, finally if initially  $NX < 0$ , now there is a larger  $NX$  deficit). As a result, increasing the income level from point A in Figure 7.10, a balance of payments deficit will emerge to the right of point A. To achieve a balance of payments equilibrium, now there needs to be net capital and financial inflows into the country. This inflow can be achieved by an increase in interest rate to attract net short-term capital and financial inflows, and the equilibrium will be restored at point B. As shown in Figure 7.10, there is a positive relationship between  $Y$  and  $i$  in the economy's external balance (from A to B). Also, if there is a fall in the income level, imports will fall, the  $NX$  will improve, leading to a balance of payments surplus to the left of point A. To reestablish balance of payments equilibrium, interest rate must fall so that there are net capital and financial outflows from the country. The balance of payments equilibrium is reestablished at point C with a lower income and lower interest rate.

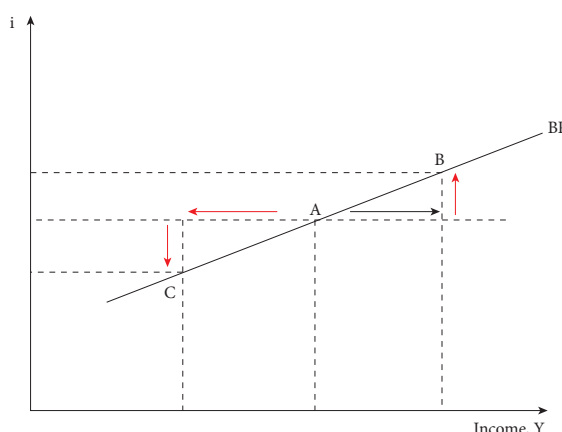


Figure 7.10 Positively-sloped BP-curve.



attention

- Each point on the BP curve implies a BoP equilibrium.
- Each point to the left of the BP curve implies a BoP surplus.
- Each point to the right of the BP curve implies a BoP deficit.

Although we describe a positively-sloped BP-curve, the shape or the slope of the curve depends on the degree of capital mobility in the economy. There are two extreme cases of capital mobility: Perfect capital mobility and perfect capital immobility. In real world cases, capital mobility in all countries may be somewhere in between these two extreme cases. If there is perfect capital mobility where there are no restrictions or risks to the financial investors with respect to capital and financial inflows and outflows, Figure 7.11 shows that the country's BP-curve will be horizontal at the world interest rate,  $i^*$ . On the other hand, if there are perfect capital controls or there is perfect capital immobility where balance of payments equilibrium cannot be achieved via capital and financial flows, the BP-curve will be vertical. The slope of the BP-curve increases with lower degrees of capital mobility or stricter capital controls.

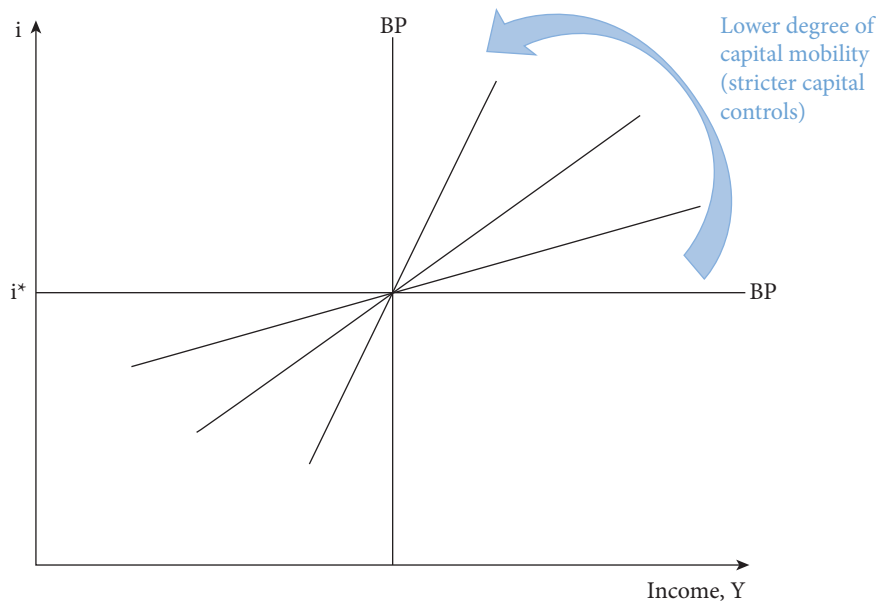


Figure 7.11 BP-curves with varying degrees of capital mobility.

### Shifts in the BP-Curve

Along a given BP-curve, we assume certain factors relating to the balance of payments equilibrium such as the exchange rate (both nominal and real), foreign income level and the world interest rate are held fixed. Whenever there is a change in any one of the factors affecting the equilibrium in balance of payments, the BP-curve will change position or shift. Below we examine some of these external shocks to the balance of payments.

### Exchange Rate Shocks

When we construct a BP-curve, we assume that the exchange rate (both nominal and real) is fixed in establishing the relationship between income level and the interest rate in the balance of payments equilibrium. However, either by government policy or by market conditions, the exchange rate may change over time from its initial value.

Suppose that nominal exchange rate increases from its initial value (consider a devaluation or a nominal depreciation of domestic currency). If the domestic currency loses value against foreign currencies, with an increase in exports and decrease in imports (assuming Marshall-Lerner condition holds), there will be an improvement in the Current Account at the given domestic income level. Therefore, the country's need for foreign borrowing will be smaller which necessitates a lower interest rate to ensure balance of payments equilibrium. The BP-curve shifts down to the right with domestic currency depreciation. A fall in the nominal exchange rate (a revaluation or nominal appreciation of domestic currency), on the other hand, shifts the BP-curve up to the left. A fall in the exchange rate decreases exports and increases imports, which leads to a deterioration in the Current Account at the given income level. A deterioration in the Current Account requires larger net capital and financial inflows into the country to achieve equilibrium in balance of payments, hence the interest rate must be higher at the given income level.

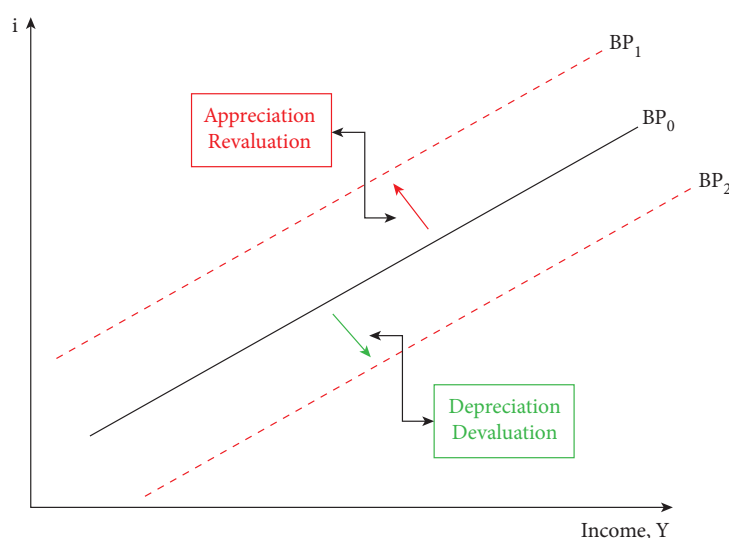


Figure 7.12 Shift of the BP-curve with exchange rate changes.

## Foreign Income Changes

Foreign income is another factor that we hold fixed along a given BP-curve. Suppose there is an increase in the income of the home country's major trading partner. In that case, the exports of the home country will increase as the country's major trading partner will start to import more, holding all else the same. With the increase in exports, at the given domestic income level, there will be an improvement in the Current Account, hence the need for foreign borrowing will be reduced, interest rate will be lower at the given domestic income level. With a lower interest rate at the given income level, the BP-curve shifts down to the right. Opposite will be true when foreign income falls: Exports will be lower, leading to a deterioration in the Current Account, which necessitates a higher interest rate to attract higher capital and financial inflows into the country. Thus, the BP-curve shifts up to the left.

## Changes in the World Interest Rate

In constructing a given BP-curve, we hold the foreign or world interest rate fixed. Hence, an exogenous change in the foreign or world interest rate will also affect the equilibrium in balance of payments and change the position of the BP-curve. Holding all else constant, an increase in foreign interest rate will cause a net outflow of capital and financial resources from the country, and therefore will necessitate a higher domestic interest rate to reestablish equilibrium in balance of payments, shifting the BP-curve to the left at the given income level. Reversely, a fall in foreign interest rate will make domestic assets more attractive, hence there will be a net inflow of capital and financial resources, which will imply that the same Current Account Balance can now be financed with Capital & Financial Account under a lower domestic interest rate.

Table 7.2 Exogenous shocks to the BP-curve.

| Exogenous shocks                                                     | Position of the BP-curve |
|----------------------------------------------------------------------|--------------------------|
| Devaluation of domestic currency                                     | Shifts down to the right |
| Revaluation of domestic currency                                     | Shifts up to the left    |
| Increase in domestic prices (real appreciation of domestic currency) | Shifts up to the left    |
| Increase in foreign prices (real depreciation in domestic currency)  | Shifts down to the right |
| Increase in foreign income                                           | Shifts down to the right |
| Increase in world interest rate                                      | Shift up to the left     |
| Increase in (future) expected depreciation in domestic currency      | Shifts up to the left    |
| Increase in perceived riskiness of domestic country                  | Shifts up to the left    |

### General Equilibrium in IS/LM/BP Model

Figure 7.13 shows that general equilibrium in goods and money markets as well as in balance of payments occurs at point A in a small open economy at the intersection of IS, LM and BP curves. The interest rate  $i_0$  and income level  $Y_0$  in Figure 7.13 satisfy equilibrium conditions in the goods market, the money market and the balance of payments. Note that as we have discussed above, equilibrium in the balance of payments does not necessarily imply trade balance, there may well be a trade deficit or a trade surplus at the economy's general equilibrium, which is compensated with a Capital & Financial Account surplus or deficit. Hence at point A, there is clearance in the goods market, clearance in the money market, and there may be a Current Account deficit with Capital & Financial Account Surplus or a Current Account surplus with a Capital & Financial Account deficit. Any point other than point A corresponds to a disequilibrium situation in at least one of the three: The goods market, the money market, or the balance of payments.

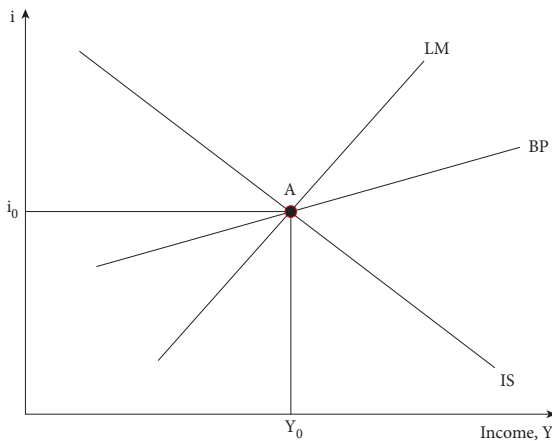


Figure 7.13 General Equilibrium in Goods and Money Markets and the Balance of Payments.

In what follows, we discuss the possible exogenous shocks to the general equilibrium and the course of adjustment by which a new equilibrium is established after these shocks. Exogenous shocks may stem from deliberate government policy, such as monetary, fiscal or exchange rate policy changes, internal shocks such as domestic price level shocks, or external shocks

such as a change in foreign income, foreign interest rate, or foreign price level. The impacts of these shocks on the equilibrium will be different under different exchange rate regimes, such as the fixed exchange rate regime and the flexible exchange rate regime, and also under different degrees of capital mobility in the economy.

### ADJUSTMENTS IN EQUILIBRIUM AND POLICY IN AN OPEN ECONOMY

Policy and other exogenous shock effects are different in an open economy under fixed exchange rate regime and flexible exchange rate regime. Therefore, in what follows, we will examine an open economy first with fixed exchange rates and then with flexible exchange rates. Also, in discussing the impact of policy and other exogenous shocks, the degree of capital mobility in the economy must be considered, hence we examine policy impacts under different capital mobility assumptions.

#### Adjustments in Equilibrium in Open Economy Under Fixed Exchange Rates

One important point we need to remember in an economy under a fixed exchange rate regime is that the value of the domestic currency is fully pegged to the value of another currency, most probably one of the stronger currencies in the world at the time. Under the fixed exchange rate regime, the country's monetary authority or the central bank will use official reserves and foreign exchange interventions to keep the exchange rate fixed whenever there is a pressure on the domestic currency to depreciate or appreciate. If the pressure is towards appreciation of domestic currency (with a balance of payments surplus), the central bank stands ready to buy foreign exchange and increase the domestic money supply. On the other hand, if the pressure is towards depreciation (with a balance of payments deficit), the central bank sells foreign currency out of official reserves and decreases the domestic money supply. However, if the depreciation pressure is too high, or if there are not enough official reserves to release the pressure, the central bank may decide to revalue the currency to reestablish balance of payments equilibrium in the economy.

### Fiscal Policy in an Open Economy with Fixed Exchange Rates

We first consider the equilibrium effects of expansionary fiscal policy in an open economy with a fixed exchange rate system under moderate capital mobility (the slope of the BP-curve is lower than the slope of the LM-curve) as given in Figure 7.14. Suppose that the initial equilibrium is at point A. The first impact of expansionary fiscal policy, such as an increase in government spending or a decrease in net taxes is in the goods market, and leads to a shift in the IS-curve to the right from  $IS_0$  to  $IS_1$ . The internal equilibrium is now at point  $A'$  with a higher interest rate and higher income level. Point  $A'$  lies to the right of the BP-curve and at point  $A'$  there is a balance of payments surplus (with the higher interest rate, the net inflow of capital more than compensates for the rise in income and imports and hence the deterioration in trade balance). Balance of payments surplus exerts an appreciation pressure on the value of domestic currency. To maintain the fixed exchange rate and to reestablish balance of payments equilibrium, the central bank stands ready to purchase the excess foreign exchange: As the central bank purchases foreign exchange from the economy, it increases the domestic money supply. With the increase in the money supply,  $LM_0$  shifts to  $LM_1$  up to point  $A''$  where the balance of payments is again in equilibrium.

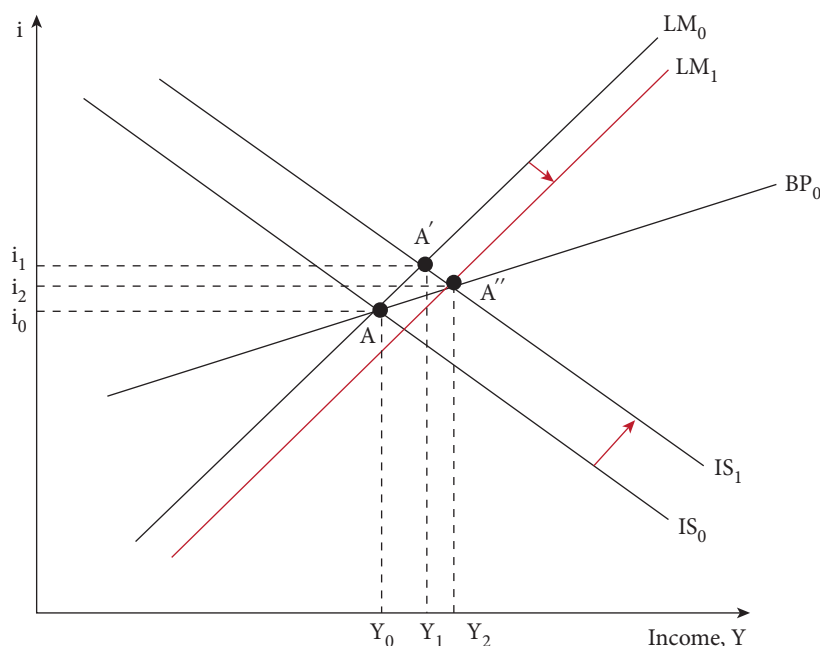


Figure 7.14 Expansionary fiscal policy under fixed exchange rates.

The new equilibrium following the one-time expansionary fiscal policy is at point  $A''$ . With the fixed exchange rate effect, the initial rise in the interest rate is somewhat dampened, but still there is some crowding out effect on domestic investments with the rise in interest rate from  $i_0$  to  $i_2$ . Also, at this new equilibrium central bank's official reserves have increased with the purchase of foreign exchange.

Now consider two extreme cases of capital mobility. We would like to examine these extreme cases because the same policy change may create different equilibrium outcomes under different capital mobility assumptions. First consider the case of perfect capital immobility in Panel (a) in Figure 7.15. With expansionary fiscal policy and the shift of IS-curve from  $IS_0$  to  $IS_1$ , the income level increases and the interest rate increases. But since there will be no response in the Capital & Financial Account to this increase in the interest rate, with the increase in income, imports increase and trade balance worsens, leading to a balance of payments deficit. Balance of payments deficit puts a depreciation pressure on the domestic currency, hence the central bank intervenes and sells foreign exchange in foreign exchange market and reduces domestic money supply. The LM-curve starts shifting from  $LM_0$  to  $LM_1$ . The sale

of foreign exchange by the central bank and the fall in money supply continues until there is no more depreciation pressure on the exchange rate, and the income level returns to original. Although the level of income is the same as before, its composition is now different: With higher interest rates, investment is fully crowded out by higher government spending.

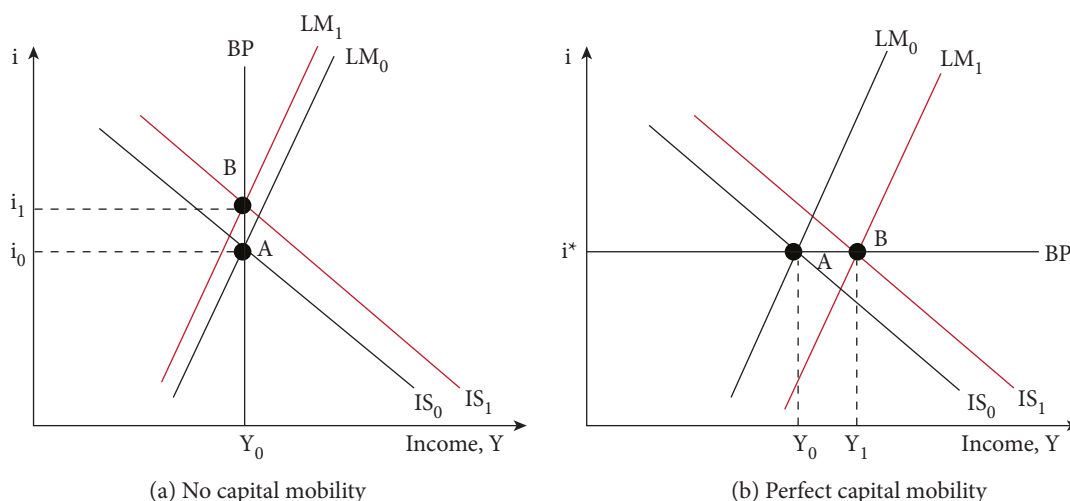


Figure 7.15 Fiscal Policy under two extreme capital mobility assumptions with fixed exchange rates.

At the other extreme there is full capital mobility with no restrictions on international capital and financial flows as given in Figure 7.15 Panel (b). With expansionary fiscal policy, the domestic interest rate increases above the foreign interest rate  $i^*$  at the intersection of IS<sub>1</sub> and LM<sub>0</sub> curves. Since there is full capital mobility, international capital immediately responds to this increase in domestic interest rate and there will be a net inflow of capital, and hence a balance of payments surplus. Balance of payments surplus puts an appreciation pressure on domestic currency, in order to stop the appreciation pressure and keep the exchange rate fixed, the central bank buys foreign exchange and increases money supply. The purchase of foreign exchange and the increase in money supply continues until the pressure on the exchange rate dissipates. As the central bank increases money supply, interest rate tends to fall back to its original level at  $i^*$ . Since the interest rate is the same as before, the fiscal policy has created a full multiplier effect on income, with no crowding out of investment.

## Monetary Policy in an Open Economy with Fixed Exchange Rates

We now turn to implementation of monetary policy in an open economy with fixed exchange rates. We again start from the case of moderately mobile capital where the slope of the BP-curve is lower than the slope of the LM-curve (Figure 7.16). Starting from an initial equilibrium at point A with income  $Y_0$  and interest rate  $i_0$ , suppose the central bank implements expansionary monetary policy and increases the domestic money supply, shifting the LM<sub>0</sub> curve to LM<sub>1</sub>. With an increase in the money supply, domestic interest rate falls and income level increases, which leads to a net outflow of capital as well as a deterioration in trade balance, leading to a balance of payments deficit at point A'. With a balance of payments deficit, the domestic currency tends to depreciate against the foreign currencies, and to stop the depreciation pressures on domestic currency and to maintain a fixed exchange rate, the central bank reduces the domestic money supply and stands ready to sell foreign currency in the foreign exchange market. The economy will return to the original equilibrium at point A after the central bank's foreign exchange intervention. However, although the domestic interest rate and income are the same as before the implementation of expansionary monetary policy, the central bank's official reserves are lower after the effort to keep the exchange rate fixed. In summary, the implementation of expansionary monetary policy has proven to be completely ineffective to stimulate the economy, but at the same time has led to a loss in the central bank's official reserves.



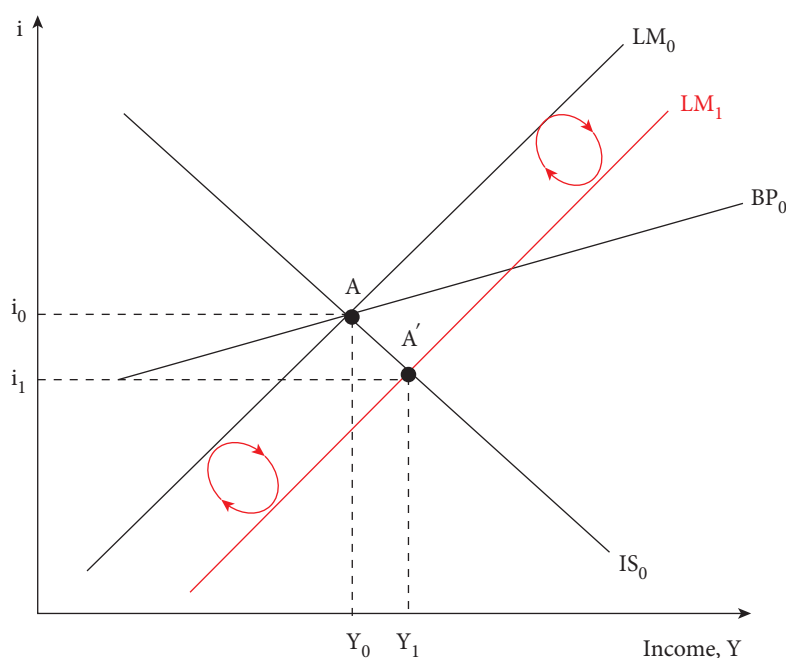


Figure 7.16 Expansionary monetary policy under fixed exchange rates.

As given in Figure 7.17 in panels (a) and (b) under the special cases of perfect capital immobility and perfect capital mobility, implementation of expansionary monetary policy creates the same effects as above in the fixed exchange rate system. Hence, regardless of the degree of capital mobility, monetary policy is fully ineffective. That is to say, under fixed exchange rates, the country loses the power of discretionary monetary policy. Alternatively, the central bank may choose to stop committing to a fixed exchange rate.

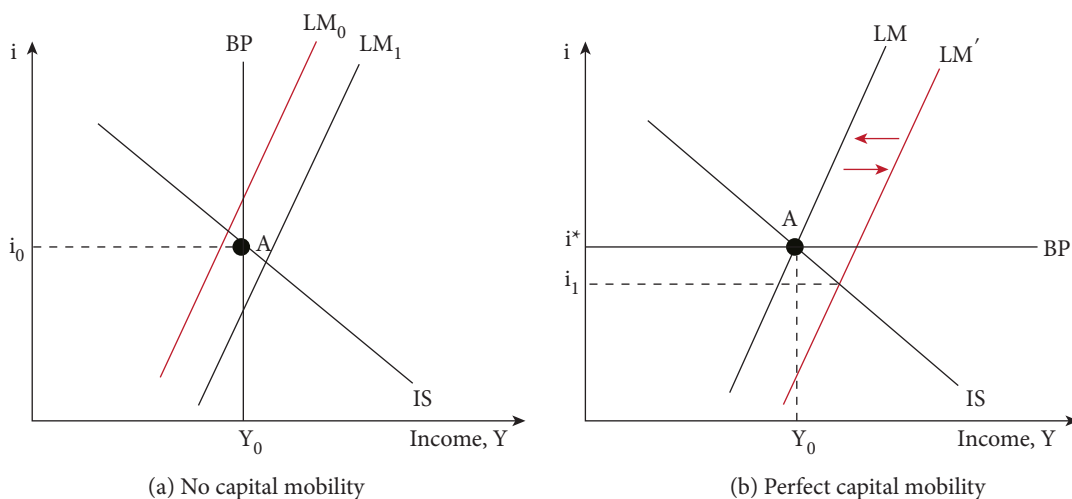
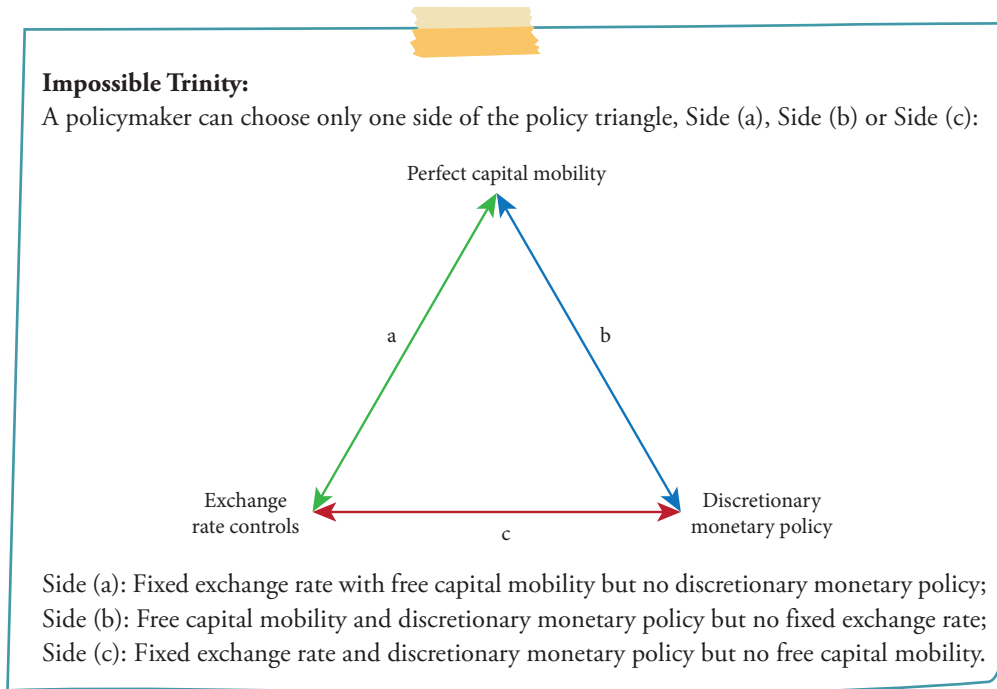


Figure 7.17 Monetary policy under two extreme capital mobility assumptions with fixed exchange rates.

In international macroeconomics, the situation that a fixed exchange rate, an independent monetary policy and free capital mobility cannot exist all at the same time is called “*impossible trinity*” or the “*impossible trilemma*”. It implies that the government of a small open economy cannot have objectives set in place for all of the three at the same time, at most two of the following three can exist simultaneously: (1) a fixed exchange rate; (2) free capital mobility; and (3) a discretionary monetary policy. As we have



seen above, under fixed exchange rate and free capital mobility, the monetary authority loses the power of a discretionary or an independent monetary policy. If discretionary monetary policy is to be pursued with free capital mobility, the fixed exchange rate objective must be given up. Finally, if the government wants to implement monetary policy and control the exchange rate at the same time, it cannot allow free capital mobility as it would put further pressure on the fixed exchange rate.



### Equilibrium Effects of a Change in Official Exchange Rate

As a policy change, the central bank may decide to devalue or revalue the domestic currency. First consider the devaluation in domestic currency. Assuming that the Marshall-Lerner condition holds, devaluation leads to an improvement in trade balance, and net foreign demand for domestic goods increases, leading to a rightward shift in the IS-curve from  $IS_0$  to  $IS_1$  (Figure 7.18). Simultaneously with the improvement in the trade balance, the BP-curve starts shifting rightwards, towards  $BP_1$ . Note that at the intersection of the LM-curve and the  $IS_1$  curve, there is a balance of payments surplus, and the surplus further increases with the rightward shift of the BP-curve to  $BP_1$ . The balance of payments surplus puts an appreciation pressure on the domestic currency, at the new fixed exchange rate. To release this appreciation pressure, the central bank buys foreign currency and increases the domestic money supply, until both the internal balance and the external balance are achieved at point C, at the intersection of IS-LM and BP-curves. We can see that devaluation in domestic currency has led to an expansion in the economy with lower interest rate and higher income level. But again, this expansion holds true under the assumption that Marshall-Lerner condition holds and trade balance is positively affected by devaluation in domestic currency.

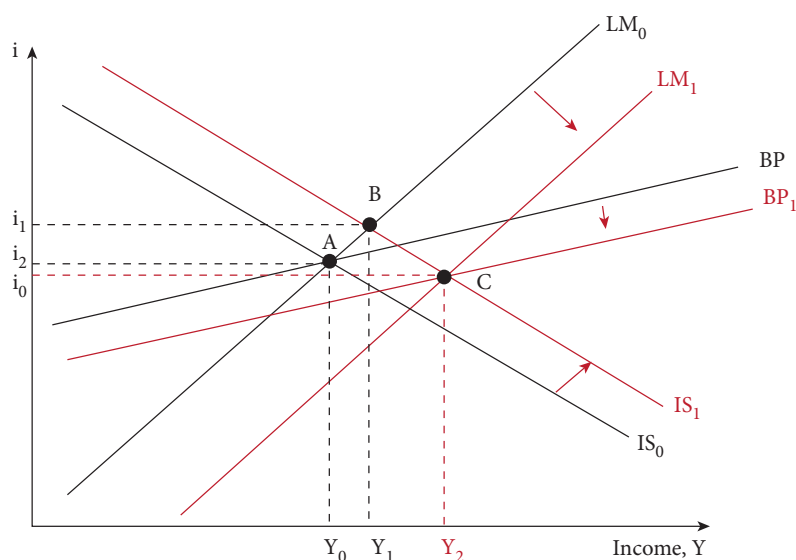


Figure 7.18 Equilibrium effects of a devaluation in domestic currency.

Revaluation in domestic currency has opposite effects (Figure 7.19). In this case, with revaluation, we assume that trade balance is negatively affected. With the decrease in net exports, net foreign demand for domestic goods decreases, hence the IS-curve shifts leftwards. With the shift of the IS-curve and the decrease in domestic interest rate, there will emerge a balance of payments deficit. Simultaneously the BP-curve shifts from  $BP_0$  to  $BP_1$  to accommodate the deterioration in trade balance. With the simultaneous leftward shift in the BP-curve, the balance of payments deficit problem is now more severe. The balance of payments deficit puts a depreciation pressure on the domestic currency. To release the depreciation pressure and to reestablish internal and external balance in the economy, the central bank stands ready to sell foreign currency and reduce domestic money supply in the economy. The sale of foreign currency continues until internal and external equilibria are simultaneously reestablished at point C. Note that at the new equilibrium interest rate is higher and the income level is lower than their respective initial values, and the central bank has lost some of its official reserves while trying to keep the new exchange rate fixed.

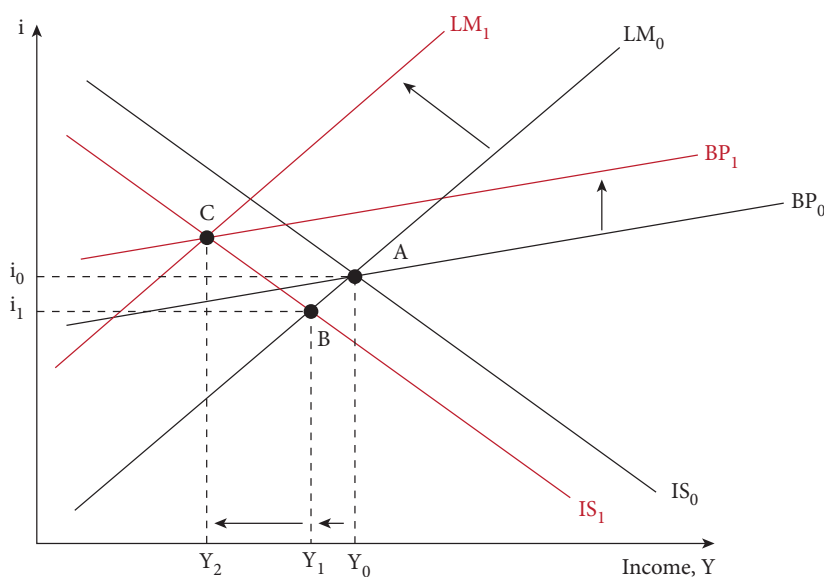


Figure 7.19 Equilibrium effects of a revaluation in domestic currency.

### Equilibrium Effects of a Change in Foreign Income

An increase in foreign income directly and exogenously improves the home country's trade balance as exports increase holding all else the same. As shown in Figure 7.20, with the increase in net foreign demand for domestic goods, the IS-curve shifts to the right, from  $IS_0$  to  $IS_1$ . With this increase in aggregate demand, domestic interest rate increases, leading to a net inflow of capital and hence a balance of payments surplus. Simultaneously, as trade balance and hence the current account balance improves, the BP-curve shifts to the right, further reinforcing the balance of payments surplus. This balance of payments surplus puts an appreciation pressure on the domestic currency, in order to keep the fixed exchange rate and to relax the pressure, the central bank purchases foreign exchange and increases domestic money supply, leading to a rightward shift in LM. Central bank's purchase of foreign currency and the increase in money supply continues until IS-LM and BP equilibrium is achieved at new interest rate  $i_1$  and income level  $Y_1$ .

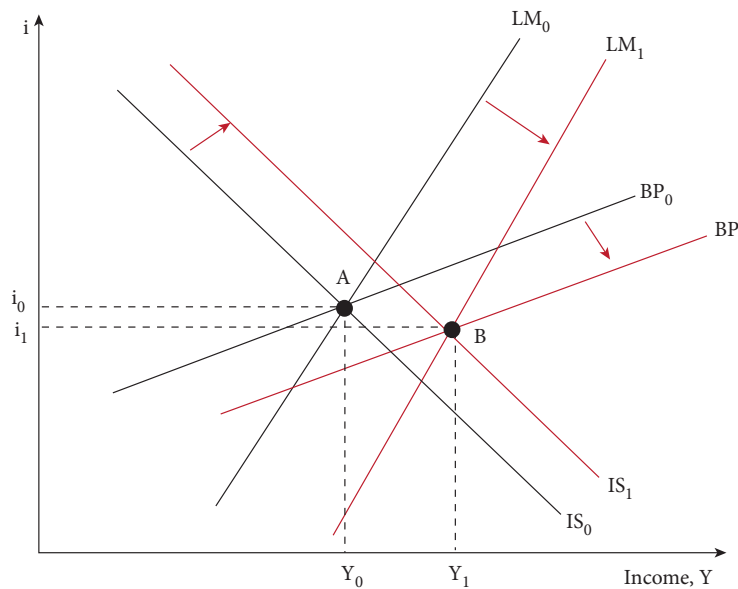


Figure 7.20 Equilibrium effects of an increase in foreign income.



#### your turn 4

We have seen that under fixed exchange rates and no capital mobility, monetary and fiscal policies are not effective in raising the domestic income. Under what exogenous circumstances would a country under a fixed exchange rate regime and perfect capital controls (no capital mobility) experience growth in domestic income? Explain using the IS-LM-BP model.

### Adjustments in Equilibrium in an Open Economy Under Flexible Exchange Rates

So far, we have considered the adjustment in equilibrium in an open economy under a fixed exchange rate regime. The equilibrium effects of fiscal and monetary policies, and the exogenous shocks such as a foreign income shock or a foreign interest rate shock will be different in an economy under a flexible or floating exchange rate regime than that under a fixed exchange rate regime. Under the flexible exchange rate regime, the central bank does not intervene and lets the exchange rate float, which will have further repercussions in the economy. As such, the equilibrium consequences of policy or other exogenous shocks will vary from what we have shown in the previous analysis.

### Fiscal Policy in Open Economy with Flexible Exchange Rates

Suppose in an economy with flexible exchange rates and moderate mobility of capital, the government increases government spending. In Figure 7.21, the first impact of expansionary fiscal policy is in the internal equilibrium with an increase in domestic demand and therefore a shift in the IS-curve from  $IS_0$  to  $IS_1$ . With the increase in demand and therefore the increase in domestic interest rate from  $i_0$  to  $i'$ , there will be a net inflow of capital into the economy, implying a balance of payments surplus. This emerging or incipient balance of payments surplus triggers an appreciation in domestic currency. This time, with a flexible exchange rate, the central bank does not intervene in the foreign exchange market and lets the exchange rate float. Appreciation in domestic currency leads to a deterioration in trade balance (decreasing exports and increasing imports), simultaneously shifting the BP-curve to the left from  $BP_0$  to  $BP_1$  and the IS-curve from  $IS_1$  to  $IS_2$ . Note that since the central bank does not intervene, there is no change in the domestic money supply and no change in the position of the LM-curve. Appreciation of the domestic currency continues until both internal balance and external balance are simultaneously achieved in the economy, at point B.

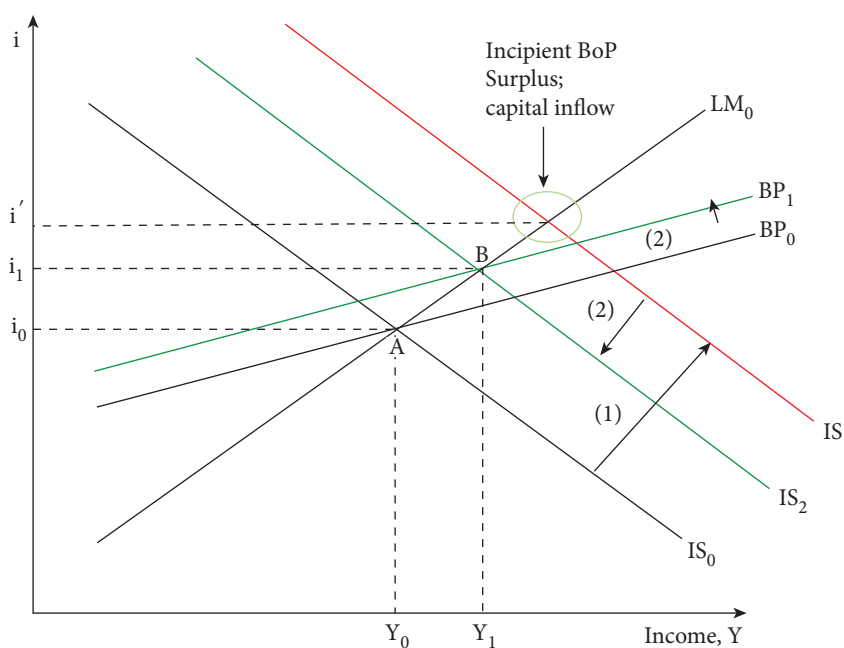


Figure 7.21 Fiscal policy effects under flexible exchange rates.

Now let's examine the impact of the same fiscal expansion under two extreme capital mobility assumptions. In Figure 7.22 Panel (a), under no capital mobility, fiscal expansion shifts the IS-curve from  $IS_0$  to  $IS_1$  and increases the interest rate and the income level. Since capital is perfectly immobile, the increase in the domestic interest rate has no consequence in external balance but the increase in income increases imports and hence reduces trade balance. The deterioration in trade balance and thus the Current Account leads to a balance of payments deficit, and triggers depreciation in domestic currency. Since the central bank lets the exchange rate float, depreciation leads to an improvement in trade balance, assuming that Marshall-Lerner condition holds. With the increase in net exports, the IS-curve starts shifting to the right towards  $IS_2$ , and the BP-curve starts shifting to the right towards  $BP_1$ . The movement in both curves continues until both internal balance and external balance are achieved at a new equilibrium, point B.

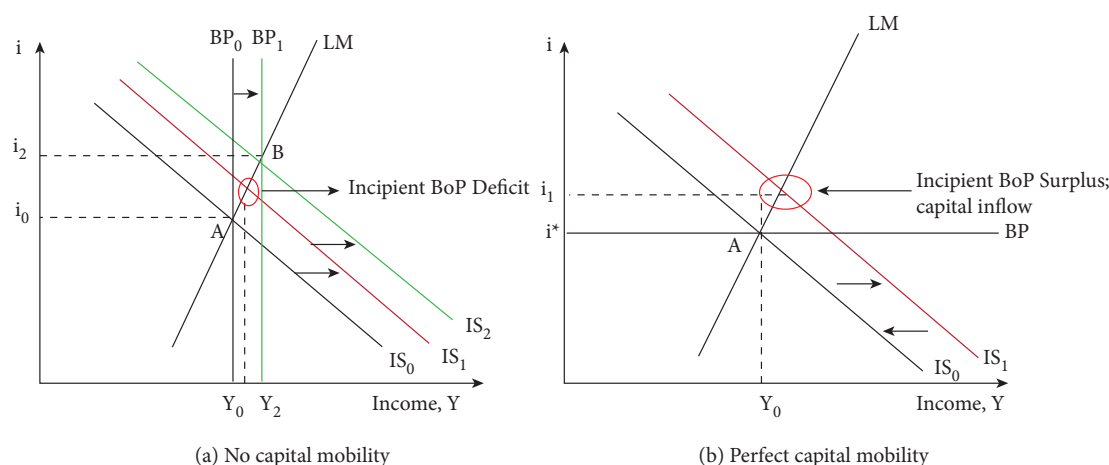


Figure 7.22 Fiscal Policy under two extreme capital mobility assumptions with flexible exchange rates.

Under perfect capital mobility, the impact of expansionary fiscal policy is quite different (Figure 7.22 Panel b). With fiscal expansion, domestic interest rate rises above the foreign interest rate and causes an immediate net inflow of capital into the country. This net inflow of capital and financial resources and the resulting balance of payments surplus leads to an appreciation of domestic currency. Since the central bank lets the exchange rate float, appreciation of domestic currency eventually deteriorates the trade balance (a decrease in exports and an increase in imports), reduces net foreign demand for domestic goods, and shifts the IS-curve back to its original position. In this case, any increase in income due to expansionary fiscal policy has been cancelled out by appreciation in domestic currency and deterioration in trade balance.

### Monetary Policy in an Open Economy Under Flexible Exchange Rates

Unlike in the case of fixed exchange rates where monetary policy was fully ineffective and could not be used as a discretionary policy, in the case of flexible exchange rates monetary policy will prove to be effective. Consider an increase in money supply which first leads to a shift in LM-curve from  $LM_0$  to  $LM_1$  (Figure 7.23). The immediate effect of an increase in money supply is to reduce the domestic interest rate which leads to a net outflow of capital and a balance of payments deficit. Since balance of payments equilibrium is disturbed, now the economy will try to reestablish balance of payments equilibrium via adjustments in exchange rate. Balance of payments deficit will tend to put a downward pressure on the value of domestic currency and domestic currency will tend to depreciate to reestablish external balance. As domestic currency depreciates, net exports improve (assuming Marshall-Lerner condition holds), and shift the IS-curve from  $IS_0$  to  $IS_1$ . At the same time, as trade balance improves and Current Account balance improves, BP-curve starts shifting from  $BP_0$  to  $BP_1$ . Depreciation of domestic currency stops at the new equilibrium where domestic balance and external balance are both achieved, at the

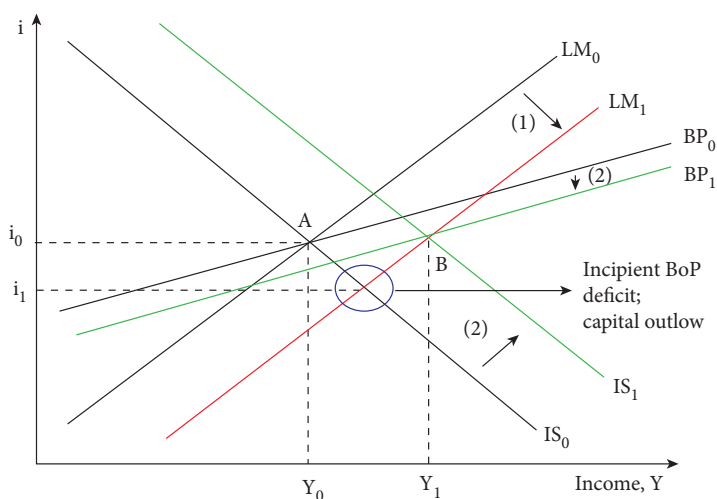


Figure 7.23 Expansionary monetary policy with flexible exchange rates.

intersection of new IS-LM and BP-curves. At this new equilibrium, income is definitely higher, indicating that the initial implementation of expansionary monetary policy has been effective in stimulating a higher income in the economy.

In Figure 7.24 we present the implementation of expansionary monetary policy under two extreme capital mobility assumptions. Under no capital mobility as in Panel (a), with expansionary monetary policy, LM-curve shifts from  $LM_0$  to  $LM_1$ , leading to an increase in domestic income level and therefore raising imports. Remember that capital flows therefore the Capital & Financial Account does not respond to the fall in interest rate. With the rise in imports and therefore deterioration in trade balance and Current Account, there emerges a balance of payments deficit. In this case, the domestic currency starts to depreciate in order to reestablish balance of payments equilibrium. As domestic currency depreciates (under the assumption that Marshall-Lerner condition holds) trade balance starts to improve, the  $IS_0$  curve starts shifting rightwards towards  $IS_1$  and the  $BP_0$  curve moves rightwards towards  $BP_1$ . At the intersection of  $BP_1$ ,  $IS_1$  and  $LM_1$ , the economy reaches a new equilibrium with a higher income level at  $Y_2$ . The change in the interest rate depends on the relative shifts in BP, LM and IS curves. In this case, monetary expansion has resulted in depreciation of domestic currency, and the initial impact of expansionary monetary policy on income is reinforced by depreciation and the increase in net exports.

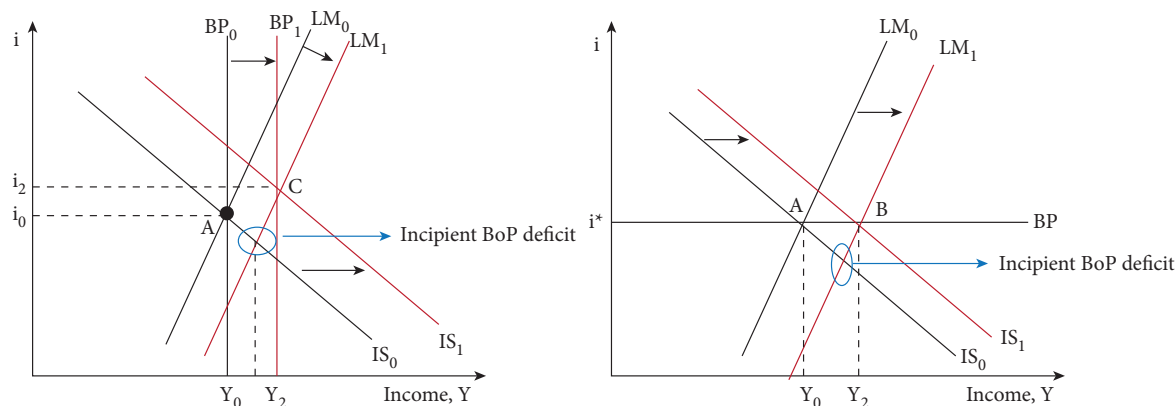


Figure 7.24 Monetary Policy under two extreme capital mobility assumptions with flexible exchange rates.

In the case of perfect capital mobility, with an increase in domestic money supply, domestic interest rate falls below the foreign interest rate and hence triggers a net outflow of international capital from the economy as given in Figure 7.24 Panel (b). With the net outflow of capital, there emerges a balance of payments deficit, which prompts a depreciation in domestic currency against foreign currencies. With depreciation and under the Marshall-Lerner condition, trade balance improves and the IS-curve shifts to the right. The depreciation of domestic currency and the improvement in trade balance continue until the domestic interest rate is again equal to the foreign interest rate,  $i^*$  at the new equilibrium point B. As in the previous case, the monetary expansion has led to the depreciation of domestic currency, which has led to an increase in net foreign demand for domestic goods, and a rise in domestic income level.

Examining all different scenarios of capital mobility, under the flexible exchange rate regime, monetary policy is effective in raising the income level regardless of the degree of capital mobility. In all cases, monetary expansion causes depreciation in domestic currency, and thus stimulates an improvement in net exports, leading to an increase in aggregate demand for domestic goods. But we can say that with higher degrees of capital mobility, monetary policy is more effective in raising the income level. This happens because the more mobile the capital is, and the more responsive the capital is to changes in interest rate, a larger depreciation thus a larger response from trade balance will be required to reestablish general equilibrium.

### Equilibrium Effects of Exogenous Shocks in an Open Economy

So far, we have examined the effects of deliberate policy changes by the government, holding a number of exogenous variables constant, which also may create important changes on the balance of payments equilibrium. These exogenous effects may include a change in foreign income, a change in domestic prices, a change in foreign prices, a change in foreign interest rate, a change in expected depreciation or appreciation in domestic currency, and a change in perceived risk of domestic or foreign country. Below, we examine some of these exogenous shocks and their impacts on the domestic economy.

First consider a domestic price shock (Figure 7.25). Suppose that there is a rise in domestic prices relative to foreign prices. Using our real exchange rate knowledge, we know that holding all else the same, a rise in domestic prices relative to foreign prices lead to a real appreciation in domestic currency:

$$\downarrow \varepsilon = \frac{E \times P^*}{P \uparrow}$$

A real appreciation of domestic currency brings about a deterioration in trade balance, and hence moves the IS and the BP curves simultaneously to the left. At the same time, the rise in domestic price level reduces the real money supply, and shifts the LM-curve to the left. With the simultaneous leftward shifts in IS, LM and BP curves, a new equilibrium will be established at point B with a lower income level and a higher interest rate (although the change in the interest rate depends on the relative shifts in these curves).

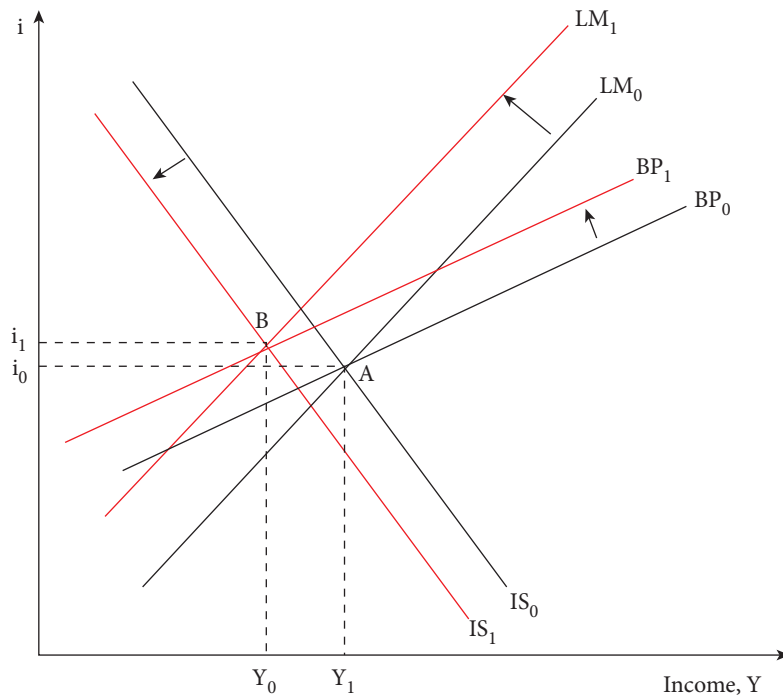


Figure 7.25 Domestic price shock in an open economy.

Secondly, suppose that there is a foreign price shock, or a rise in foreign prices relative to domestic prices (Figure 7.26). In this case, there is a real depreciation in domestic currency:

$$\uparrow \varepsilon = \frac{E \times P^* \uparrow}{P}$$

With real depreciation in domestic currency, now under Marshall-Lerner condition, trade balance and Current Account will improve, and there will be a rightward shift in both IS and BP curves, leading to a balance of payments surplus. Balance of payments surplus will trigger an appreciation in domestic currency, and the BP and IS curves will start shifting back to their original positions:

$$\varepsilon = \frac{\downarrow E \times P^* \uparrow}{P}$$

Thus, if the flexible exchange rate fully responds to (relative) changes in foreign prices, the domestic economy will not be affected by foreign price fluctuations.

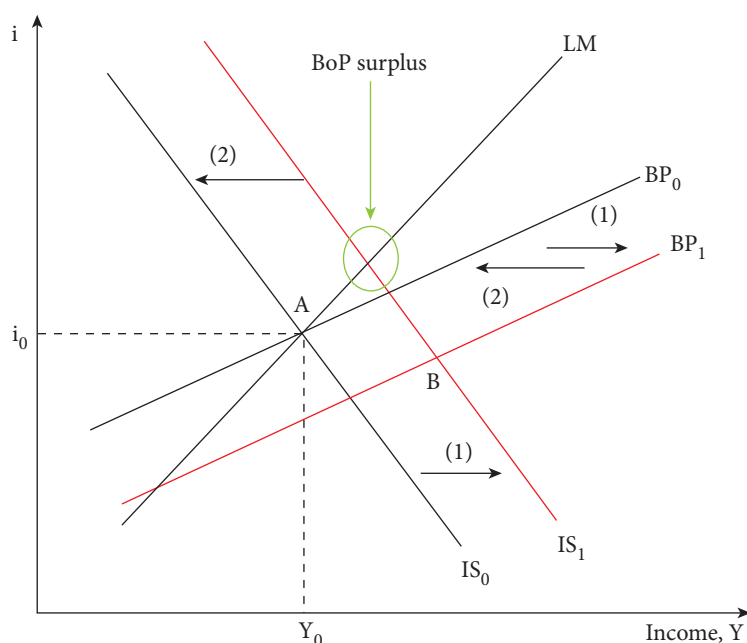


Figure 7.26 Foreign price shock in an open economy.

As a final example, let's consider a foreign interest rate shock in Figure 7.27. An increase in foreign interest rate makes foreign capital and financial investments more attractive, and therefore maintaining balance of payments equilibrium in the domestic economy requires a higher domestic interest rate, and the BP-curve shifts leftwards. With the leftward shift of the BP-curve from  $BP_0$  to  $BP_1$ , now the domestic equilibrium (at the intersection of  $IS_0$  and LM curves) falls to the right of the  $BP_1$ -curve, indicating a balance of payments deficit. The balance of payments deficit triggers a depreciation in domestic currency, improving the trade balance under Marshall-Lerner condition, and shifting  $IS_0$  and  $BP_1$  curves to the right. The adjustment will continue until a new equilibrium is reached at the intersection of the LM and the new  $IS_2$  and  $BP_2$  curves.



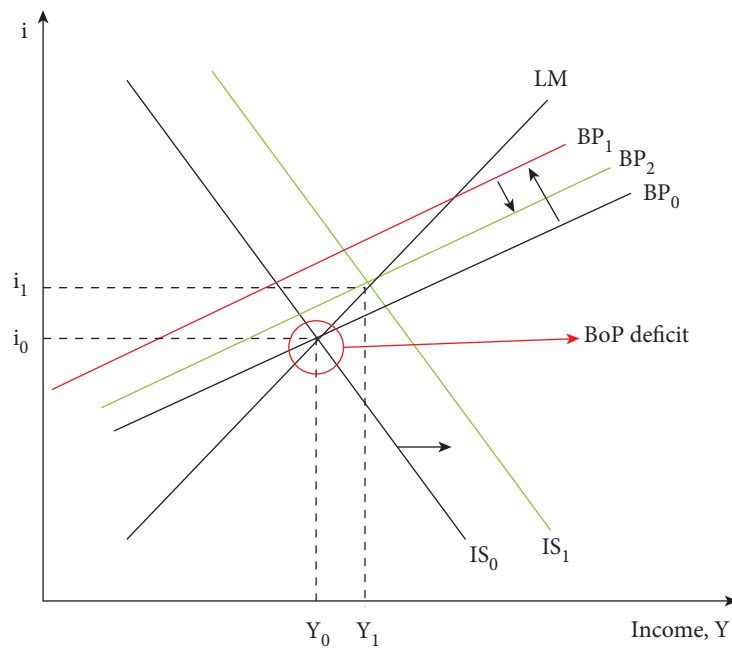


Figure 7.27 Foreign interest rate shock in an open economy.



#### your turn 5

Consider a small open economy with flexible exchange rates. Under what extreme capital mobility condition (no mobility or perfect mobility) do you think a positive foreign income shock will be most effective in raising the domestic economy's income level. Explain using the IS-LM-BP model.

## LO1

Understand the concept of trade balance and elaborate on its determinants

In open economies, aggregate demand for domestic goods is not limited to domestic demand: There may be domestic demand for foreign goods (called imports) and there may be foreign demand for domestic goods (called exports) in an open economy. In the equilibrium it must be that domestic income or GDP is equal to the sum of domestic and foreign demand for domestic goods,  $[C + I + G - M] + X$ . Here,  $X - M$  is the country's net exports, or the trade balance. The country's trade balance with the rest of the world depends on many factors including the domestic income level, the foreign income level, and the real exchange rate. Since imports are determined by domestic demand, domestic income is a major determinant, in addition to consumer tastes and sectoral composition in production, which have an influence on the composition of imports. Exports, on the other hand, are affected by the incomes of the trade partners, since exports are the demand of the trade partners for domestic goods. Both exports and imports are determined by the real exchange rate, which is the relative price of foreign goods in terms of domestic goods and this relative price depends on the nominal exchange rate as well as domestic and foreign price levels, such as the Consumer Price Index.

## LO2

Understand how equilibrium is attained in international financial markets and derive the uncovered interest parity (UIP) condition

When we describe an open economy, not only the goods markets, but also capital and financial markets are open to international transactions. While the degree of openness in goods markets is determined by the imposition of tariffs and quotas, the degree of openness in financial markets is given by the severity of capital restrictions and the country's risks. If capital and financial resources are free to flow across economies, then financial investors make decisions based on the highest expected return on their financial investments: In equilibrium, or at the point of indifference, the expected return in terms of domestic currency on domestic assets and foreign assets must be equal to each other. This equilibrium condition implies that the difference between the domestic interest rate and the foreign interest rate is approximately equal to the rate of expected depreciation in domestic currency. This is called the uncovered interest parity (UIP) condition. Further implication is that if the UIP condition does not hold, there will be arbitrage opportunities for the financial investor in foreign exchange markets.

## LO3

Examine the components of Balance of Payments and construct the BP-curve

The balance of payments account records a country's transactions with the rest of the world both in goods and services and financial flows. The reasoning behind the balance of payments accounts comes from the goods market equilibrium condition in an open economy. The balance of payments has two main components: The Current Account and the Capital & Financial Account. Current Account balance is given by the sum of trade balance, net income received from the rest of the world and the Net current transfers received from the rest of the World. The Capital & Financial Account balance is the net flow of Capital & Financial assets from the rest of the World. The balance of payments equilibrium means that a Current Account deficit must be balanced with a Capital & Financial Account surplus, or a Current Account surplus must be balanced with a Capital & Financial Account deficit. The BP-curve is the locus of alternative combinations of interest rate and domestic income satisfying balance of payments equilibrium. The slope or the shape of the BP-curve is given by the degree of capital mobility in the home country: Higher capital controls imply a steep BP-curve, while relatively free capital flows imply a flatter BP-curve. The position of the BP-curve depends on several exogenous factors such as the foreign income, the foreign interest rate, real exchange rate, and perceived riskiness in domestic or in foreign countries.

## LO 4

Determine the general equilibrium in a small open economy

The general equilibrium in goods and money markets and the balance of payments is achieved at the intersection of IS, LM and BP-curves. At the general equilibrium, the interest rate and the income level simultaneously satisfy equilibrium conditions in the goods market, money market and the balance of payments. This general equilibrium is a short-run equilibrium, and it is determined under given demand-side factors including domestic monetary, fiscal and exchange rate policies, foreign income, foreign interest rate, as well as given the degree of capital mobility. As such, the equilibrium will respond to demand-side policy changes (monetary, fiscal and exchange rate policy changes) as well as other exogenous demand-side shocks to the goods market, the money market and/or the balance of payments, such as a change in foreign income.

## LO 5

Analyse adjustments in equilibrium in response to policy changes and other exogenous shocks under fixed and flexible exchange rate regimes

The response to demand-side policy changes (fiscal and monetary) and other exogenous shocks in an open economy will vary under fixed exchange rate regime and under flexible exchange rate regime. The equilibrium responses will also differ depending on the degree of capital mobility that a country has. In that sense, for example a particular fiscal policy change will create different outcomes in equilibrium under a fixed exchange rate with full capital mobility and under a flexible exchange rate with full capital mobility. Similarly, the equilibrium outcome of a particular monetary policy change will be different under a fixed exchange rate with no capital mobility and under a flexible exchange rate with no capital mobility. Therefore, it is the policymaker's task to choose among different exchange rate regimes and to determine the optimal degree of capital controls suitable for the economy's well-being.

1 The price of one currency in terms of another currency is called .....

Which of the following completes the sentence above?

- A. Real exchange rate      B. Nominal exchange rate  
C. Interest rate              D. Terms of trade  
E. Inflation rate

2 If there is a 10 percent nominal depreciation in domestic currency, foreign inflation rate is 2 percent and domestic inflation rate is 15 percent, then .....

Which of the following completes the sentence above?

- A. Real depreciation in domestic currency is 3 percent  
B. Real depreciation in foreign currency is 3 percent  
C. Real appreciation in domestic currency is 3 percent  
D. Real appreciation in foreign currency is 3 percent  
E. Both b and c

3 Consider the following information for an open economy:

$$C = c_0 + c_1 Y_d$$

$$T = t_0 + t_1 Y$$

$$I = b_0 + b_1 Y$$

$$G = G_0$$

$$X = X_0$$

$$M = m_0 + m_1 Y$$

What is the correct expression for the multiplier for this economy?

- A.  $1 - \frac{1}{c_1(1 - m_1 - b_0)}$       B.  $\frac{1}{c_1(1 - b_1 - t_1 - m_1)}$   
C.  $\frac{1}{1 - c_1(t_1 - m_1) + b_1}$       D.  $\frac{1}{1 - [c_1(1 - t_1) + b_1 - m_1]}$   
E.  $\frac{m_1}{1 - c_1(1 - t_1) + b_1}$

4 Which of the following statements about the balance of payments is false?

- A. Current Account components are the trade balance, net income received from abroad and net transfers from abroad  
B. If Current Account is in deficit, there is a surplus in the Capital and Financial Account  
C. If Current Account is in deficit, the home country is a net lender to the rest of the world  
D. If Current Account is in surplus, there is a deficit in the Capital and Financial Account  
E. Surplus in Capital and Financial Account implies that the home country is a net borrower from the rest of the world

5 According to the Marshall-Lerner condition, .....

Which of the following completes the sentence above?

- A. with real depreciation of domestic currency, trade balance deteriorates as long as the sum of price elasticities of exports and imports is larger than one  
B. with real depreciation of domestic currency, trade balance improves as long as the sum of price elasticities of exports and imports is larger than one  
C. with real depreciation of domestic currency, trade balance improves as long as the sum of price elasticities of exports and imports is smaller than one  
D. with real appreciation of domestic currency, trade balance improves as long as the sum of price elasticities of exports and imports is larger than one  
E. with real appreciation of domestic currency, trade balance improves as long as the sum of price elasticities of exports and imports is smaller than one

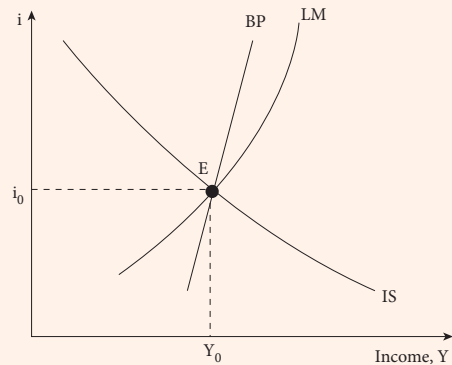
6 The BP-curve is upward sloping .....

Which of the following completes the sentence above?

- A. because of the positive relationship between domestic interest rate and foreign interest rate in international financial markets  
B. because of the positive relationship between domestic income and domestic interest rate in home country's balance of payments  
C. because of the positive relationship between domestic income and foreign income in international goods markets  
D. because of the positive relationship between exchange rate and domestic income in home country's balance of payments  
E. because of the positive relationship between the domestic price level and foreign price level in international goods markets

7 In an economy with fixed exchange rates and severe capital controls as given on the right, what is the impact of a decrease in government spending?

- A. There is no effect of fiscal policy change under this scenario
- B. The central bank sells foreign exchange and decreases domestic money supply to maintain the fixed exchange rate
- C. The central bank buys foreign exchange and increases domestic money supply to maintain the fixed exchange rate
- D. The domestic interest rate increases
- E. The BP-curve shifts to the right



8 In an economy with fixed exchange rates and perfect capital controls (no capital mobility), .....

Which of the following completes the sentence above?

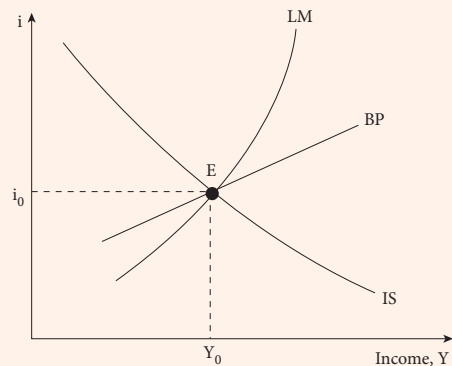
- A. An increase in money supply has no effect on domestic income level
- B. An increase in money supply leads to an increase in domestic income level
- C. An increase in government spending increases domestic income level
- D. A decrease in net taxes increases domestic income level
- E. An increase in net taxes increases the domestic interest rate

9 Consider an open economy with a flexible exchange rate system and moderate capital mobility as given on the right.

In this economy, following contractionary monetary policy, .....

Which of the following completes the sentence above?

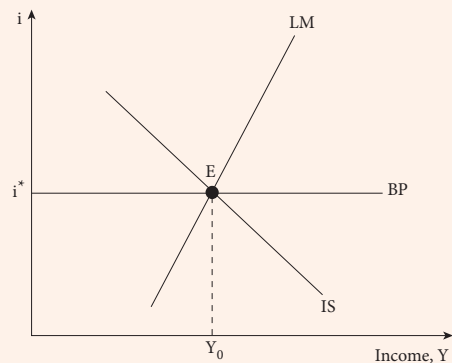
- A. LM curve shifts to the left and there will be an incipient balance of payments deficit
- B. LM curve shifts to the left and there will be an incipient balance of payments surplus
- C. LM curve shifts to the right and there will be an incipient balance of payments deficit
- D. LM curve shifts to the right and there will be an incipient balance of payments surplus
- E. The domestic currency depreciates in the new equilibrium of IS-LM-BP



10 Consider an open economy with a flexible exchange rate system and full capital mobility as given on the right.

In this economy, if the government decreases net taxes which of the following will occur?

- A. There will be a net outflow of foreign currency
- B. Domestic income level will increase
- C. Domestic currency will appreciate
- D. Exports will increase
- E. Central bank's official reserves will increase



1. B

If your answer is wrong, please review the “Nominal and Real Exchange Rates” section.

6. B

If your answer is wrong, please review the “Equilibrium in the Balance of Payments or External Balance in an Open Economy” section.

2. E

If your answer is wrong, please review the “Nominal and Real Exchange Rates” section.

7. C

If your answer is wrong, please review the “Fiscal Policy in an Open Economy with Fixed Exchange Rates” section.

3. D

If your answer is wrong, please review the “Simple Multiplier in an Open Economy” section.

8. A

If your answer is wrong, please review the “Monetary Policy in an Open Economy with Fixed Exchange Rates” section.

4. C

If your answer is wrong, please review the “The Balance of Payments” section.

9. B

If your answer is wrong, please review the “Monetary Policy in an Open Economy with Flexible Exchange Rates” section.

5. B

If your answer is wrong, please review the “Depreciation, Trade Balance and the Marshall-Lerner Condition” section.

10. C

If your answer is wrong, please review the “Fiscal Policy in an Open Economy with Flexible Exchange Rates” section.

Suppose that foreign inflation rate is 6 percent, and the domestic inflation rate is 10 percent. What must be the rate and direction (depreciation or appreciation) of the change in nominal exchange rate in order to achieve an 8 percent real depreciation in domestic currency?

your turn 1

First let's show that the rate of change in real exchange rate  $\left(\frac{\Delta \epsilon}{\epsilon}\right)$  is the sum of the rate of change in nominal exchange rate  $\left(\frac{\Delta E}{E}\right)$  and foreign inflation rate  $\left(\frac{\Delta P^*}{P^*}\right)$  minus the domestic inflation rate  $\left(\frac{\Delta P}{P}\right)$ .

We know that the real exchange rate is given by

$$\epsilon = \frac{E \times P^*}{P}$$

Then,

$$\begin{aligned} \Delta \epsilon &= \frac{\Delta(E P^*) P - E P^* \Delta P}{P^2} = \frac{(\Delta E P^* P + E P \Delta P^*) - E P^* \Delta P}{P^2} \\ &= \frac{P^* \Delta E}{P} + \frac{E \Delta P^*}{P} - \frac{E P^*}{P} \times \frac{\Delta P}{P} \times \frac{\Delta \epsilon}{\epsilon} \\ &= \frac{P^* \Delta E}{P} \times \frac{1}{\epsilon} + \frac{E \Delta P^*}{P} \times \frac{1}{\epsilon} - \frac{\Delta P}{P} \\ &= \frac{P^* \Delta E}{P} \times \frac{P}{E P^*} + \frac{E \Delta P^*}{P} \times \frac{P}{E P^*} - \frac{\Delta P}{P} \\ &= \frac{\Delta E}{E} + \frac{\Delta P^*}{P^*} - \frac{\Delta P}{P} \end{aligned}$$

Suppose that foreign inflation rate is 6 percent, and the domestic inflation rate is 10 percent. What must be the rate and direction (depreciation or appreciation) of the change in nominal exchange rate in order to achieve an 8 percent real depreciation in domestic currency?

### your turn 1

In the question, it is given that

$$\frac{\Delta P^*}{P^*} = 6\%; \frac{\Delta P}{P} = 10\%$$

In order to achieve

$$\frac{\Delta \epsilon}{\epsilon} = 8\%,$$

it must be that

$$8\% = \frac{\Delta E}{E} + 6\% - 10\% \Rightarrow \frac{\Delta E}{E} = 12\%$$

There must be a 12 percent nominal depreciation in domestic currency to achieve an 8 percent real depreciation in domestic currency.

You are given the following information regarding an open economy:

$$C = 180 + 0,75 Y_d$$

$$T = 60 + 0,2Y$$

$$I = 195$$

$$G = 300$$

$$X = 200$$

$$M = 30 + 0,1Y$$

$$\epsilon = 1$$

- For this economy, calculate the equilibrium income level.
- Calculate the net exports at the equilibrium income level. Is the economy running a trade deficit or a trade surplus at equilibrium?
- Calculate the open economy multiplier.
- When the government increases government spending to 400 from 300, what happens to the trade balance?

### your turn 2

Consider following information regarding an open economy:

$$C = 180 + 0,75 Y_d$$

$$T = 60 + 0,2Y$$

$$I = 195$$

$$G = 300$$

$$X = 200$$

$$M = 30 + 0,1Y$$

$$\epsilon = 1$$

- For this economy, calculate the equilibrium income level.

$$\begin{aligned} Y &= C + I + G + NX \\ &= 180 + 0,75 (Y - T) + 195 + 300 + 200 - (30 + 0,1Y) \\ &= 180 + 0,75(Y - 60 - 0,2Y) + 695 - (30 - 0,1Y) \\ &= 800 + 0,5Y \\ Y^E &= 1600 \end{aligned}$$

You are given the following information regarding an open economy:

$$C = 180 + 0,75 Y_d$$

$$T = 60 + 0,2Y$$

$$I = 195$$

$$G = 300$$

$$X = 200$$

$$M = 30 + 0,1Y$$

$$\varepsilon = 1$$

- For this economy, calculate the equilibrium income level.
- Calculate the net exports at the equilibrium income level. Is the economy running a trade deficit or a trade surplus at equilibrium?
- Calculate the open economy multiplier.
- When the government increases government spending to 400 from 300, what happens to the trade balance?

your turn 2

- b) Calculate the net exports at the equilibrium income level. Is the economy running a trade deficit or a trade surplus at equilibrium?

$$\begin{aligned} NX &= X - M = X - (30 + 0,1Y) = X - (30 + 0,1Y^E) \\ &= 200 - (30 + 0,1 \times 1600) = 200 - 190 = 10 \end{aligned}$$

There is a trade surplus at equilibrium.

- c) Calculate the simple open economy multiplier.

In our case,

$$C = c_0 + c_1 (Y - T)$$

$$T = t_0 + t_1 Y$$

$$I = I_0$$

$$G = G_0$$

$$X = X_0$$

$$M = m_0 + m_1 Y$$

Then,

$$\begin{aligned} Y &= c_0 + c_1 (Y - t_0 - t_1 Y) + I_0 + G_0 + X_0 - m_0 - m_1 Y \\ &= c_0 - c_1 t_1 + I_0 + G_0 + X_0 - m_0 + [c_1 - c_1 t_1 - m_1] \end{aligned}$$

$$Y^E = \frac{1}{1 - [c_1(1 - t_1) - m_1]} \times (c_0 - c_1 t_1 + I_0 + G_0 + X_0 - m_0)$$

In our case,

$$c_1 = 0,75; t_1 = 0,2; m_1 = 0,1$$

Open economy multiplier is calculated as

$$\frac{1}{1 - c_1(1 - t_1) + m_1} = \frac{1}{1 - 0,75(1 - 0,2) + 0,1} = \frac{1}{0,5} = 2$$

The open economy multiplier is equal to 2. Whenever there is a change in autonomous spending components, we multiply the change by 2 and find the change in equilibrium income.

- d) When the government increases government spending to 400, it means that the change in  $G$  is 100,  $\Delta G = 100$ . Then, using the open economy multiplier,

$$\Delta Y^E = 2 \times \Delta G = 2 \times 100 = 200$$

Which implies that the new equilibrium income level is 1,800. At the new equilibrium income level,

$$NX = X - M = 200 - (30 + 0,1 \times 1800) = 200 - 210 = -10$$

At the new equilibrium, now there is a trade deficit with higher levels of income and higher levels of imports.



Consider the summary table of Balance of Payments for Türkiye for the year 2013 from the Central Bank of the Republic of Türkiye Statistics. Fill in the blanks marked with X, then answer the following questions below.

|     | (Million US Dollars)                                   | 2013    |
|-----|--------------------------------------------------------|---------|
| A-  | CURRENT ACCOUNT                                        | X       |
| 1.  | Exports (f.o.b.)                                       | 167.397 |
| 2.  | Imports (f.o.b.)                                       | 249.282 |
|     | Balance on Goods                                       | X       |
| 3.  | Services: Credit                                       | 58.870  |
| 4.  | Services: Debit                                        | 25.500  |
|     | Balance on Goods and Services                          | -48.515 |
| 5.  | Primary Income: Credit                                 | 5.289   |
| 6.  | Primary Income: Debit                                  | 13.907  |
|     | Balance on Goods, Services and Primary Income          | -57.133 |
| 7.  | Secondary Income (current transfers)                   | 1.277   |
| B.  | CAPITAL & FINANCIAL ACCOUNT (borrowing net of lending) | 65.651  |
|     | Current, Capital and Financial Accounts                | X       |
| D.  | NET ERRORS AND OMISSIONS                               | X       |
|     | GENERAL BALANCE                                        | -10.763 |
| E.  | RESERVE ASSETS                                         | 10.763  |
| 14. | Official Reserves                                      | X       |
| 15. | Credit and loans with the IMF                          | 852     |
| 16. | Exceptional Financing                                  | 0       |

- Did Türkiye run a trade deficit or a trade surplus in 2013?
- What is the change in official reserves in the BoP above? Did the official reserves of Türkiye increase or decrease in 2013?

your turn 3

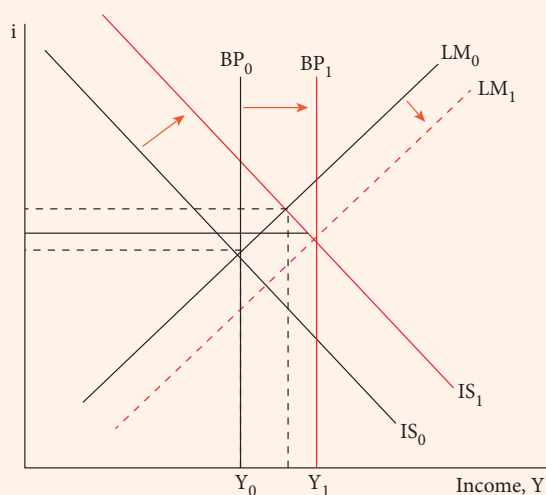
|     | (Million US Dollars)                                   | 2013           |
|-----|--------------------------------------------------------|----------------|
| A-  | CURRENT ACCOUNT                                        | <b>-55.856</b> |
| 1.  | Exports (f.o.b.)                                       | 167.397        |
| 2.  | Imports (f.o.b.)                                       | 249.282        |
|     | Balance on Goods                                       | <b>-81.885</b> |
| 3.  | Services: Credit                                       | 58.870         |
| 4.  | Services: Debit                                        | 25.500         |
|     | Balance on Goods and Services                          | -48.515        |
| 5.  | Primary Income: Credit                                 | 5.289          |
| 6.  | Primary Income: Debit                                  | 13.907         |
|     | Balance on Goods, Services and Primary Income          | -57.133        |
| 7.  | Secondary Income (net current transfers)               | 1.277          |
| B.  | CAPITAL & FINANCIAL ACCOUNT (borrowing net of lending) | 65.651         |
|     | Current, Capital and Financial Accounts                | <b>9.795</b>   |
| D.  | NET ERRORS AND OMISSIONS                               | <b>968</b>     |
|     | GENERAL BALANCE                                        | -10.763        |
| E.  | RESERVE ASSETS                                         | 10.763         |
| 14. | Official Reserves                                      | <b>9.911</b>   |
| 15. | Credit and loans with the IMF                          | 852            |
| 16. | Exceptional Financing                                  | 0              |

- Türkiye ran a trade deficit of 55.9 billion US dollars in 2013.
- Official reserves of the Central Bank have increased by 9.9 billion US dollars in 2013.

We have seen that under fixed exchange rates and no capital mobility, monetary and fiscal policies are not effective in raising the domestic income. Under what exogenous circumstances would a country under a fixed exchange rate regime and perfect capital controls (no capital mobility) experience growth in domestic income? Explain using the IS-LM-BP model.

your turn 4

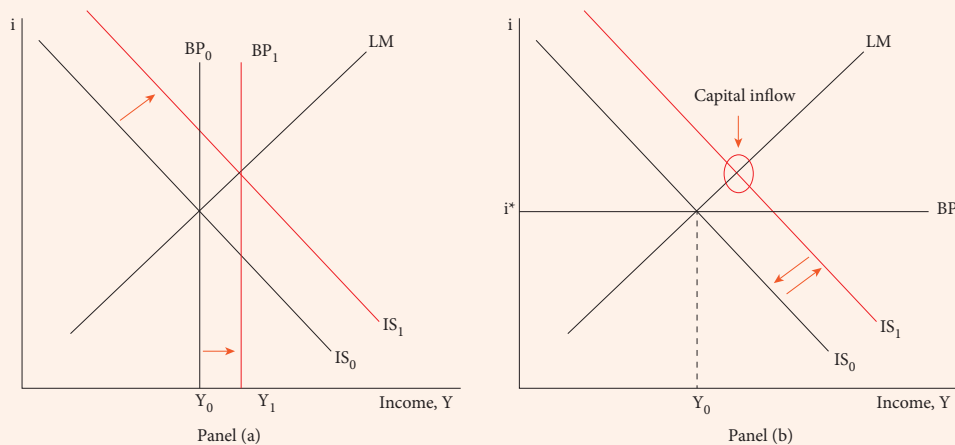
When there is perfect capital immobility, the government relies on an exogenous improvement in Current Account (such as an exogenous improvement in exports with a rise in foreign income, a revaluation, or a net inflow of foreign aid). With an exogenous improvement in exports or a net inflow of foreign aid, the IS-curve shifts to the right and the BP-curve shifts to the right. Now with an inflow of foreign currency as a result of improvement in Current Account, there will be an appreciation pressure on domestic currency. In order to release the appreciation pressure on the official fixed exchange rate, the central bank buys foreign exchange and increases domestic money supply. The intervention continues until the goods market, the money market and the balance of payments are all in simultaneous equilibrium at the intersection of  $IS_1$ ,  $LM_1$  and  $BP_1$  curves at a higher income level, as shown in figure below.



Consider a small open economy with flexible exchange rates. Under what extreme capital mobility condition (no mobility or perfect mobility) do you think a positive foreign income shock will be most effective in raising the domestic economy's income level. Explain using the IS-LM-BP model.

### your turn 5

Consider a small open economy with flexible exchange rates. Figures below show that a positive foreign income shock is effective under perfect capital immobility. As shown in figure below in Panel (a), an increase in foreign income under perfect capital immobility leads to an exogenous increase in exports, and hence improves trade balance and Current Account. This improvement in trade balance shifts the IS-curve to the right, and the BP-curve to the right. The simultaneous shift of both curves come to a stop when simultaneous equilibrium is reached in balance of payments, the goods market and the money market at the intersection of BP, IS and LM curves at a higher income level  $Y_1$ . In Panel (b), we show the case of perfect capital mobility. In this case, only the IS-curve shifts to the right with an improvement in trade balance. With the rightward shift of the IS-curve, there will be a net capital inflow into the home country, which will lead to an appreciation of domestic currency, and hence the trade balance will start to deteriorate. As trade balance deteriorates, the IS-curve will shift back to its original position. Therefore, any positive effect caused by a positive foreign income shock will be cancelled out by currency appreciation, and there will be no change in the home country's income level.



## References

- Appleyard, D. R. & Field, Jr., A. J. (2014). *International Economics*. 8th Ed., New York: McGraw-Hill/Irvin.
- Blanchard, O. & Johnson, D. R. (2013). *Macroeconomics (Global Edition)*. 6th Ed., Essex: Pearson Education Limited.
- Central Bank of the Republic of Türkiye Statistics. <https://tcmb.gov.tr>.
- Turkish Statistical Institute (TURKSTAT) Foreign Trade Statistics. <https://data.tuik.gov.tr/Kategori/GetKategori?p=dis-ticaret-104&dil=1>.
- World Bank World Development Indicators. <https://databank.worldbank.org/source/world-development-indicators>.







# Chapter 8 Economic Growth

After completing this chapter, you will be able to;

## Learning Outcomes

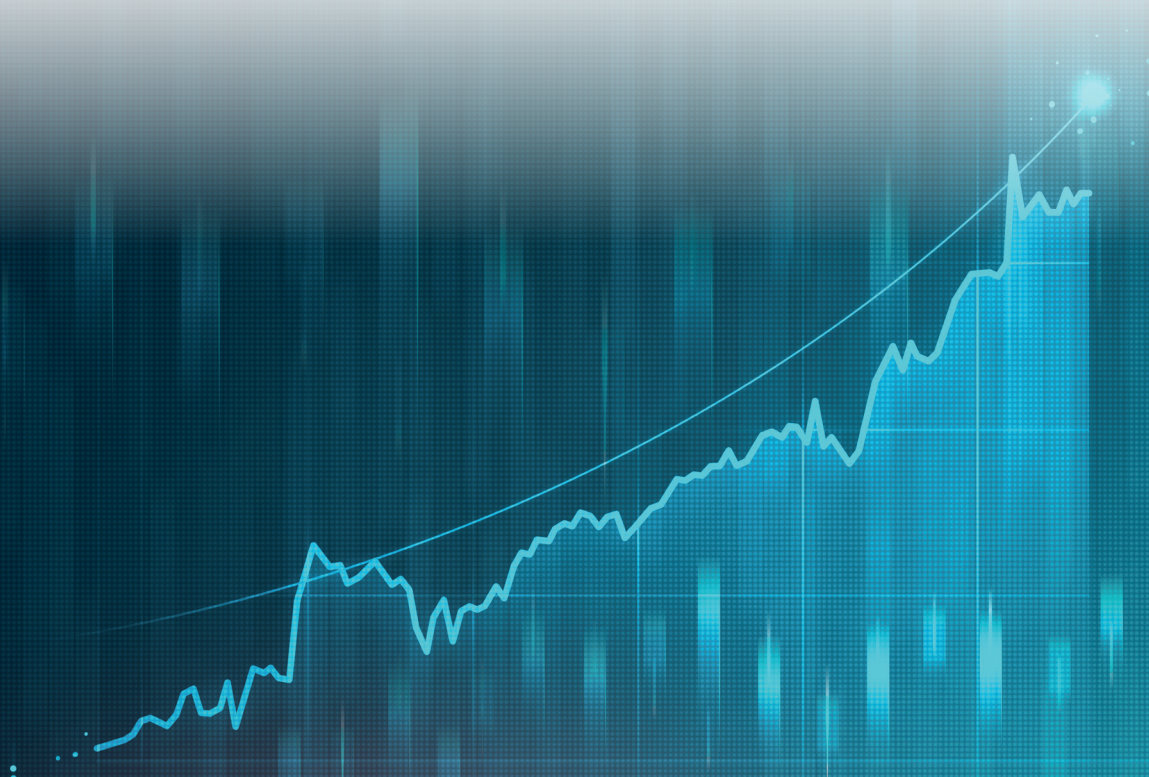
- 1 Provide a brief explanation of economic growth and how it is measured
- 2 Show a clear understanding of the literature on exogenous and endogenous growth models
- 3 Understand the key differences between exogenous and endogenous growth models

## Chapter Outline

Introduction  
Definition and Measurement of Economic Growth  
Neoclassical Exogenous Growth Models  
New Growth Theory: Endogenous Growth Models

## Key Terms

Economic growth  
Nominal and Real GDP  
GDP per capita  
Real GDP per capita  
Growth rate  
The Harrod-Domar model  
Solow model  
Convergence hypothesis  
Marginal product of capital and labor  
Golden rule level of capital accumulation  
AK model



## INTRODUCTION

Income inequalities between and within the countries have long been of great interest in the discipline of economics and these inequalities are mainly due to the differences in growth rates. In this regard, understanding economic growth is important because it is believed that economic growth can bring increased living standards, and therefore generate continuous prosperity and development. The remaining part of the chapter proceeds as follows: It begins with the definition and measurement of economic growth. It then goes on to neoclassical exogenous growth models, where the basic and human capital-augmented Solow model are discussed elaborately. Finally, it discusses endogenous growth models, where a brief overview of endogenous growth models in the literature, and then a simple endogenous growth model, the AK model, are addressed.

## DEFINITION AND MEASUREMENT OF ECONOMIC GROWTH

Economic growth is an increase in aggregate economic activities. More precisely, it is the rate of an increase in gross domestic product (GDP). Alternatively, economic growth can also be defined as the rate of an increase in real GDP per capita. As discussed in the previous chapters, nominal GDP is the value of goods and services given in current prices (not adjusted for inflation albeit), whereas real GDP refers to the value of goods and services adjusted for price changes. GDP per capita is calculated by dividing a country's GDP by its total population. As a result, GDP per capita (and real GDP per capita) are generally considered to provide an accurate measure of a country's average living standards or economic well-being.

According to the World Bank's country classification by income level, countries are categorised into high income, upper-middle income, lower-middle income, and low income. Figure 8.1 shows the average real GDP per capita of country groups over the period 1982-2020.

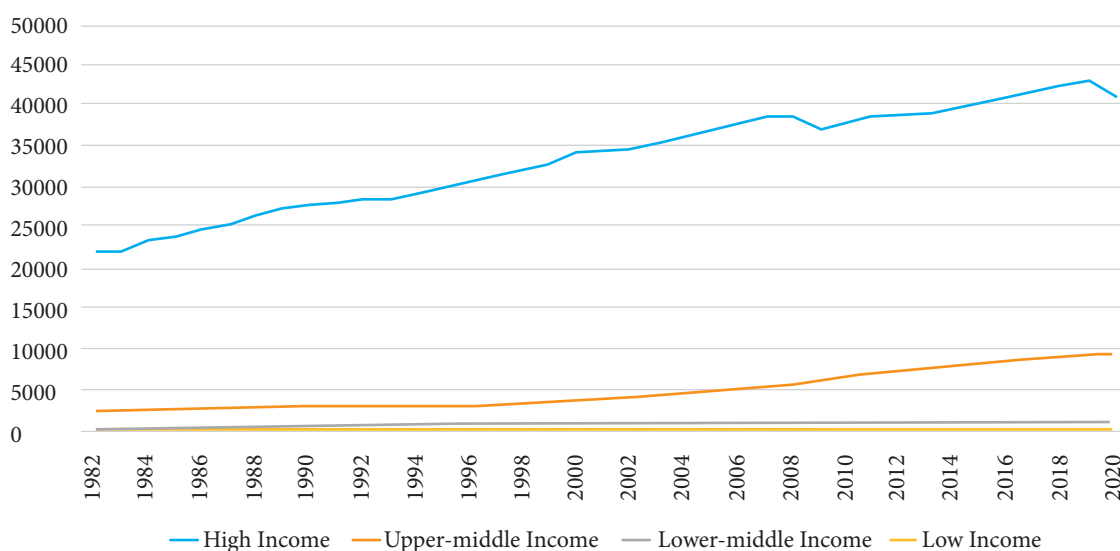
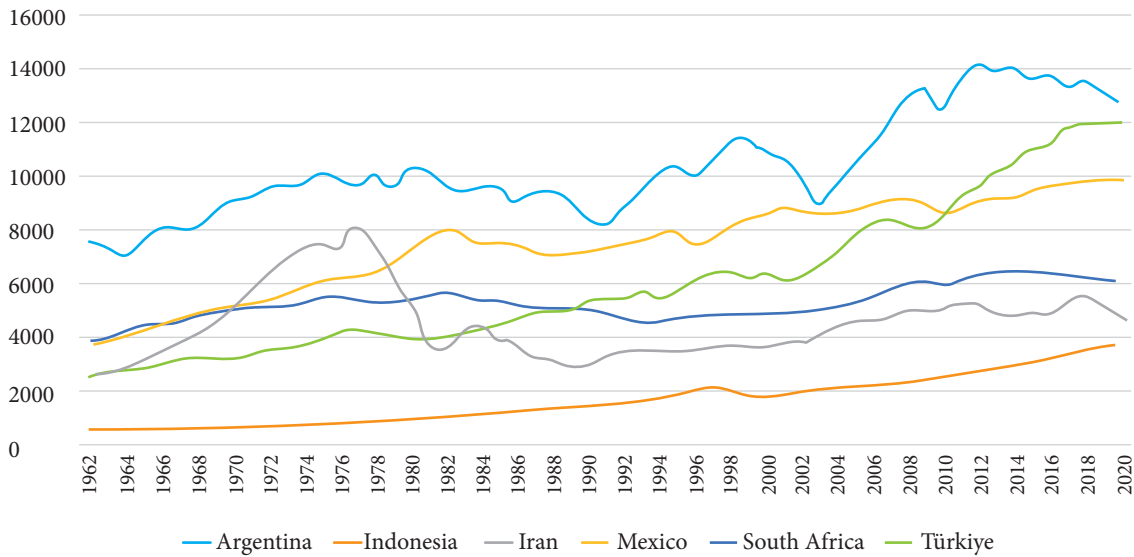


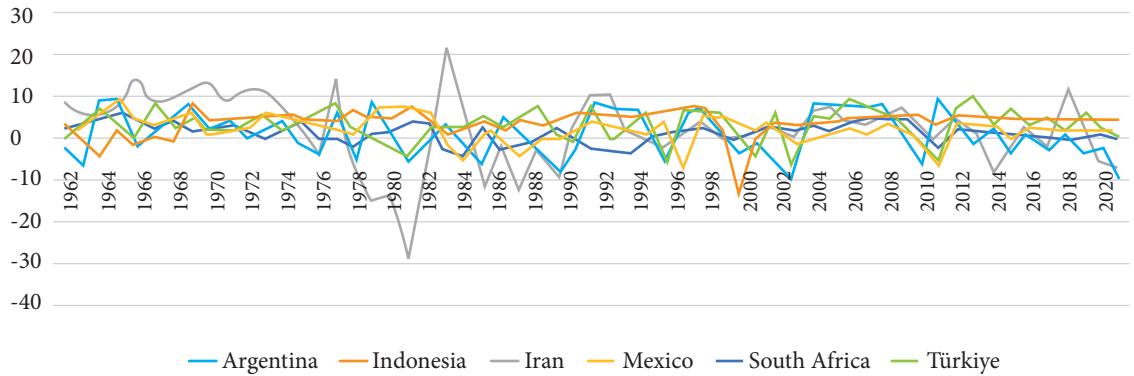
Figure 8.1 Average Real GDP per capita of Country Groups (Constant 2015 US\$).

Source: World Bank Data, available at <https://data.worldbank.org/> accessed on June 3<sup>rd</sup>, 2022.



**Figure 8.2** Real GDP per capita of Selected Upper-Middle Income Countries (Constant 2015 US\$).

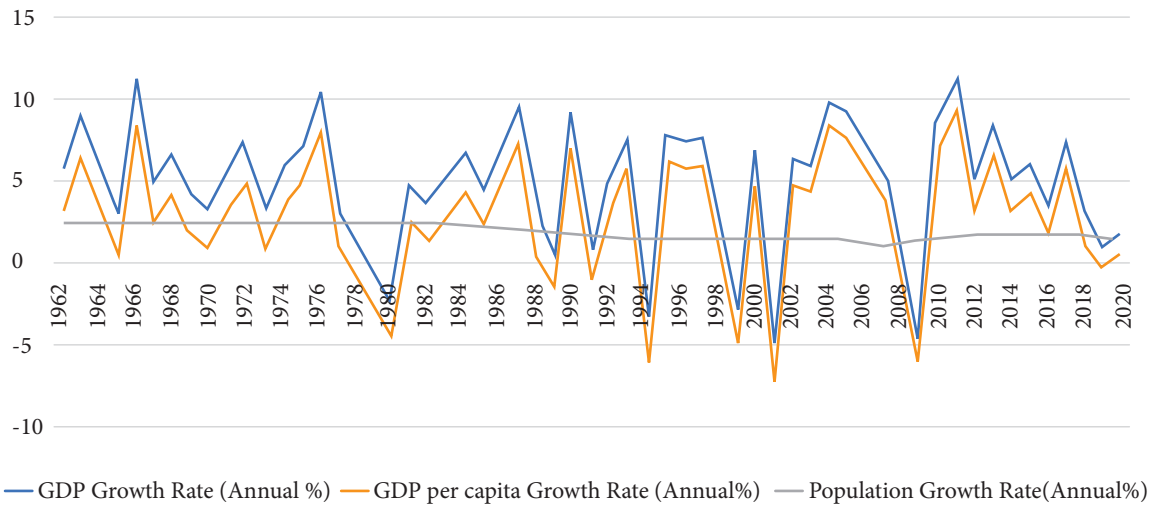
**Source:** World Bank Data, available at <https://data.worldbank.org/> accessed on June 3<sup>rd</sup>, 2022.



**Figure 8.3** Annual Growth Rates of Real GDP per capita by Selected Upper-Middle Income Countries.

**Source:** World Bank Data, available at <https://data.worldbank.org/> accessed on June 3<sup>rd</sup>, 2022.

Based on this classification, Türkiye is considered to be an upper-middle income country. In order to give an idea of where Türkiye is placed among its peers, Figures 8.2 and 8.3 indicate the real GDP per capita and annual growth rates of GDP per capita of selected upper-middle income countries, such as Argentina, Indonesia, Iran, Mexico, South Africa over the years (1962-2020). In particular, Türkiye's annual GDP growth rate, GDP per capita growth rate, and population growth rate over the same period can be seen from Figure 8.4.



**Figure 8.4** Türkiye's GDP Growth Rate, GDP per capita Growth Rate, and Population Growth Rate.

**Source:** World Bank Data, available at <https://data.worldbank.org/country/Türkiye> accessed on June 3<sup>rd</sup>, 2022.

## NEOCLASSICAL EXOGENOUS GROWTH MODELS

The Harrod-Domar model is of great importance in neoclassical exogenous growth models as it marks the first attempt to explain an economy's long-run growth rate within the Keynesian framework. However, this model has several limitations. First, it is assumed that an economy operates at full employment. Second, capital-output and capital-labor ratios are both assumed to be constant. Third, there is a lack of factor substitution; in other words, there is no substitution of capital for labor or the other way around. Last, despite its important role in long-run growth, technological progress is not considered in the model. These limitations have then formed a basis for the Solow model.



### In Practice

Seminal contributions by two economists, Harrod (1939) and Domar (1946), marked the beginning of the modern growth theory. *The Harrod-Domar model* is a Keynesian model of economic growth where an economy's growth rate is explained by the level of saving and capital.

In a simple macroeconomics model, let us recall the following equation:

$$Y_t = C_t + S_t \quad (8.1)$$

where  $Y_t$ : aggregate income,  $C_t$ : aggregate consumption, and  $S_t$ : aggregate savings, respectively.

Equation (8.1) implies that in a closed economy, all income is either consumed or saved.

However, we also know that in equilibrium, all earnings are spent on consumption and investment:

$$Y_t = C_t + I_t \quad (8.2)$$

where  $I_t$ : aggregate investment.

Combining Equations (8.1) and (8.2) yields the savings-investment equation:

$$S_t = I_t \quad (8.3)$$



Let  $K_t$  denote capital stock, which is, however, subject to depreciation at the rate of  $\delta \in (0, 1)$ . Then, the capital stock evolves over time as follows:

$$K_{t+1} = (1 - \delta) K_t + I_t$$

which can be rewritten in an equivalent form:

$$K_{t+1} = (1 - \delta) K_t + S_t$$

or

$$\theta Y_{t+1} = (1 - \delta) \theta Y_t + s Y_t \quad (8.4)$$

where saving rate,  $s = S_t / Y_t$  and capital-output ratio,  $\theta = K_t / Y_t$ .

Dividing both sides of Equation (8.4) by  $\theta Y_t$  gives:

$$\frac{Y_{t+1}}{Y_t} = (1 - \delta) + \frac{s}{\theta} \quad (8.5)$$

And then by subtracting 1 from both sides of Equation (8.5):

$$\frac{Y_{t+1}}{Y_t} - 1 = (1 - \delta) + \frac{s}{\theta} - 1$$

which can be rearranged to yield:

$$g = \frac{Y_{t+1} - Y_t}{Y_t} = \frac{s}{\theta} - \delta \quad (8.6)$$

Equation (8.6) implies that the growth rate,  $g$ , is determined by the saving rate, capital-output ratio, and depreciation rate. While the growth rate is positively related to the saving rate, it is negatively related to the capital-output ratio and depreciation rate.

## Basic Solow Model

Solow (1956) is the first study that developed an exogenous model of long-run growth and it is considered to be the basis of all the subsequent growth models in the literature. There are several assumptions of this model. First, there are two factors to be considered: labor and capital. Second, the production function has constant returns to scale. Third, output increases as labor and capital increase but there are diminishing returns to each factor. Last, technological change is exogenously given.

## Main Predictions

First, an increase in capital relative to labor may create economic growth because more capital is believed to enhance labor productivity. Second, due to the diminishing returns to capital, poor countries with less per capita capital will grow faster. This is because each investment in capital in these countries will produce a higher return when compared to rich countries. Third, again due to the diminishing returns to capital, economies will eventually reach a point where an increase in capital may not generate any growth. This point is called “steady-state”, which is a long-run equilibrium growth rate in the Solow model. Also, in the long run, output per capita depends on the saving rate; however, the output growth rate is not determined by the saving rate. Finally, long-run growth can be achieved only if countries improve their level of technology. However, given that technology is exogenous in this model, any technological change does not make any contribution to economic growth.

**Convergence** is the hypothesis suggesting that poor countries grow faster than rich countries. There are two important types of convergence in the neoclassical model: conditional and unconditional (absolute) convergence. **Conditional convergence** suggests that countries converge to their own steady-state level of income. However, according to **unconditional convergence**, all countries converge to the same steady-state level.

## Model Description

In the Solow model, growth occurs only through factor accumulation. As noted earlier, there are two factors: labor and capital. While labor grows exogenously through population growth, capital stock is determined by the saving rate. In the model, the production function is in the form of a Cobb-Douglas production function:

$$Y = F(K, L) = AK^\alpha L^{1-\alpha} \quad (8.7)$$

where  $A$  is a technology coefficient or productivity measure,  $K$  is capital stock,  $L$  is labor, and  $\alpha$  and  $(1 - \alpha)$  are the elasticities that indicate how much capital and labor can contribute to output.  $\alpha$  lies between 0 and 1.

As noted earlier, there are three main assumptions of the Solow model; each will be discussed in detail as follows:

**Assumption 1:** There are diminishing returns to each factor,  $K$  and  $L$ .

**Proof 1:** The first derivative of output,  $Y$ , in terms of  $K$  and  $L$  shall be positive but its second derivative shall be negative:

$$\frac{\partial Y}{\partial K} = \alpha AK^{\alpha-1} L^{1-\alpha} > 0, \frac{\partial Y}{\partial L} = (1-\alpha) AK^\alpha L^{-\alpha} > 0$$

$$\frac{\partial^2 Y}{\partial K^2} = \alpha(\alpha-1) AK^{\alpha-2} L^{1-\alpha} < 0, \frac{\partial^2 Y}{\partial L^2} = -\alpha(1-\alpha) AK^\alpha L^{-\alpha-1} < 0$$

Diminishing returns to  $K$  and  $L$  implies that if the amount of capital for a given amount of labor (or the other way around) is increased, their contribution to output will increase at a decreasing rate, and then will eventually become zero. Diminishing returns to  $K$  and  $L$  can be ensured by the assumption of  $\alpha < 1$ .

Figure 8.5 shows a graphical illustration of diminishing returns to capital. As can be seen from the figure, as  $K$  increases for a given amount of  $L$ , its contribution to output decreases over time and it becomes zero as a result of diminishing returns to capital.

Now, let us show how to calculate the marginal products of capital ( $MP_K$ ) and of labor ( $MP_L$ ).  $MP_K$  and  $MP_L$  can be obtained by taking the first derivative of Equation (8.7) with respect to capital and labor, respectively:

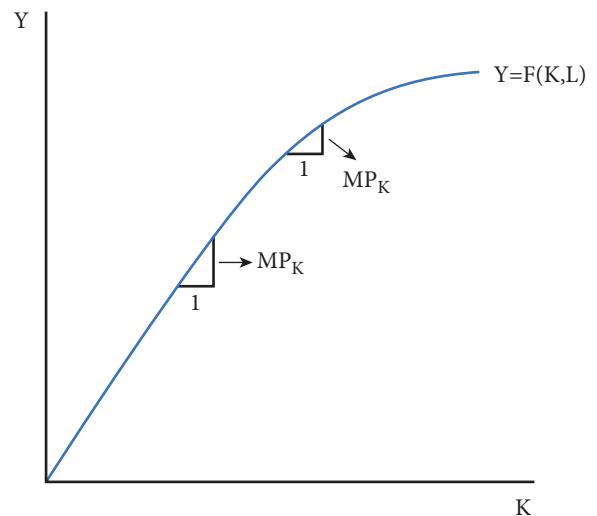


Figure 8.5 Diminishing Returns to Capital.

$$MP_K = \frac{\partial Y}{\partial K} = \alpha AK^{\alpha-1} L^{1-\alpha} = \alpha A \left( \frac{K}{L} \right)^{\alpha-1}$$

$$MP_L = \frac{\partial Y}{\partial L} = (1-\alpha) AK^{\alpha} L^{-\alpha} = (1-\alpha) A \left( \frac{K}{L} \right)^{\alpha}$$

**Marginal product of capital (labor)** is the production output that results from an additional unit of capital (labor).

**Assumption 2:** The production function has constant returns to scale.

**Proof 2:** If  $K$  and  $L$  are doubled,  $Y$  will also double.

In Equation (8.7), let us multiply  $K$  and  $L$  by 2, then the right-hand side of the equation becomes as follows:

$$A(2K)^{\alpha} (2L)^{1-\alpha}$$

which can be rewritten in an equivalent form without any parentheses:

$$A2^{\alpha} K^{\alpha} 2^{1-\alpha} L^{1-\alpha}$$

This expression can then be rearranged to give:

$$2(AK^{\alpha} L^{1-\alpha}) = 2Y$$

which implies that if inputs,  $K$  and  $L$ , are doubled, output,  $Y$ , will also double. This is because the elasticities of  $K$  and  $L$  add up to 1.



#### your turn 1

Consider the following aggregate production function:  $Y = \sqrt{K}\sqrt{L}$

- Calculate when  $K$  and  $L$  are both set equal to 200.
- Calculate if both  $K$  and  $L$  increase by 100%. What is the percentage of the increase in  $Y$  compared to part (a)?
- Does the above production function exhibit constant returns to scale? If so, explain briefly.
- If both  $K$  and  $L$  increase by 2%, what will be the percentage increase in  $Y$ ? Explain briefly.

**Assumption 3:** Although the Solow model is one of the first models that address the importance of technological change in the long-run growth rate of output, technological progress is assumed to be exogenous in the model.

Now, let us recall Equation (8.7) to obtain per capita output. If we divide both sides of this equation by labor ( $L$ ) in order to write the production function in per capita terms, our equation becomes

$$\frac{Y}{L} = \frac{F(K, L)}{L} = \frac{AK^{\alpha} L^{1-\alpha}}{L}$$

which can then be rearranged to obtain:

$$y = f(k) = A \left( \frac{K}{L} \right)^{\alpha}$$

or alternatively,

$$y = f(k) = Ak^{\alpha} \quad (8.8)$$

On the other hand, the output function from the demand side is equal to the sum of consumption and investment. In per capita terms, they can be written as follows:

$$y_d = c + i \quad (8.9)$$

$$i = sy = sf(k) \quad (8.10)$$

$$c = (1-s)y = (1-s)f(k) \quad (8.11)$$

where  $c$  is consumption per capita,  $i$  is investment per capita, and  $s$  is saving rate.

Equations (8.10) and (8.11) can be substituted into Equation (8.9):

$$y_d = sy + (1-s)y$$

which can be rearranged to obtain:

$$y_d = y \quad (8.12)$$

Equation (8.12) implies that in equilibrium, the output demanded ( $y_d$ ) is equal to the output supplied ( $y$ ). Figure 8.6 shows a graphical illustration of the output function.



Please note that per capita terms are denoted by lower-case letters.

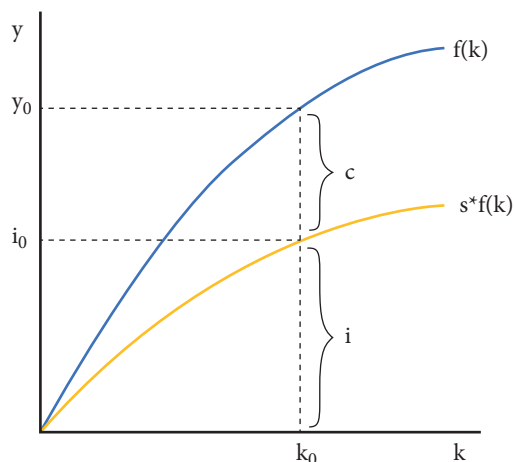


Figure 8.6 Graphical Illustration of Output Function.

Given that the capital stock is the main determinant of output per worker, it is important to show how it evolves over time. In this regard, what we know is that capital is equal to the sum of the current investment and the past year's capital, which is, however, subject to depreciation because a certain amount of capital stock is consumed each period. As a result, per capita capital stock evolves according to:

$$k_t = i_t + k_{t-1} - \delta k_{t-1} \quad (8.13)$$

Alternatively, we can rewrite Equation (8.13) in terms of the change in capital stock:

$$\Delta k_t = i_t - \delta k_{t-1} \quad (8.14)$$

where  $\Delta k_t = k_t - k_{t-1}$  and  $\delta$  is the depreciation rate.



Please note that  $\Delta$  shows a change or difference.

We also know that

$$i = s f(k) = s A k^\alpha \quad (8.15)$$

which can then be substituted into Equation (8.14):

$$\Delta k = s A k^\alpha - \delta k$$

The steady-state level of capital stock is the stock of capital at which investment and the amount of capital that is consumed are equal so that the change in capital stock is equal to 0, that is,  $\Delta k = 0$ . Therefore, the steady-state condition is

$$sAk^{\alpha} = \delta k \quad (8.16)$$

From Equation (8.16), we can derive the steady-state level of capital:

$$k^* = \left( \frac{sA}{\delta} \right)^{1/(1-\alpha)} \quad (8.17)$$

Equation (8.17) can then be substituted into Equation (8.8)

$$y^* = A^{1/(1-\alpha)} \left( \frac{s}{\delta} \right)^{\alpha/(1-\alpha)} \quad (8.18)$$

Equation (8.18) implies that countries with a higher saving rate will have a higher steady-state level of output and capital stock, both in aggregate and per capita terms, that is,  $k^*$ ,  $K^*$ ,  $y^*$  and  $Y^*$  will all be higher in a country with a higher saving rate.



attention

Please note that the steady-state solutions are denoted by the superscript asterisk (\*).



your turn 2

Consider two countries with different saving rates: country  $i$  has a saving rate of 0.20, while country  $j$  has a saving rate of 0.05.  $\alpha$  is equal to  $1/3$ . The following equation is also given:

$$\frac{y_i^*}{y_j^*} = \left( \frac{s_i^*}{s_j^*} \right)^{\frac{\alpha}{1-\alpha}}$$

Compare two countries' steady-state levels of per capita output.

As can be seen from Figure 8.7,  $y^*$  and  $k^*$  refer to the steady-state values of output and capital. In the steady state,  $y$  and  $k$  do not grow over time, assuming that technology is constant and does not change over time. If  $k < k^*$ , then  $i > \delta k$ ,  $k$  increases towards  $k^*$ . However, if  $k > k^*$ , then  $i < \delta k$ ,  $k$  decreases towards  $k^*$ .

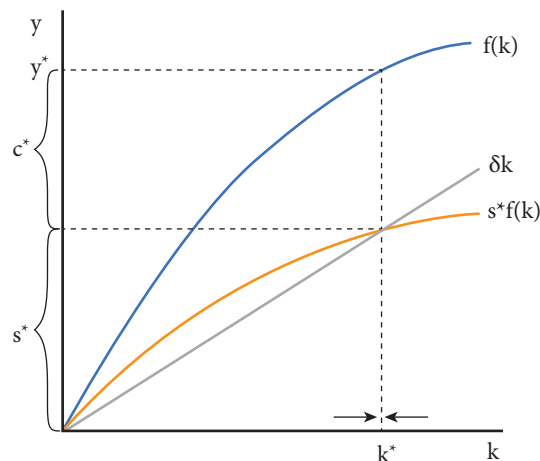


Figure 8.7 Steady-State Level of Output and Capital Stock per Worker.

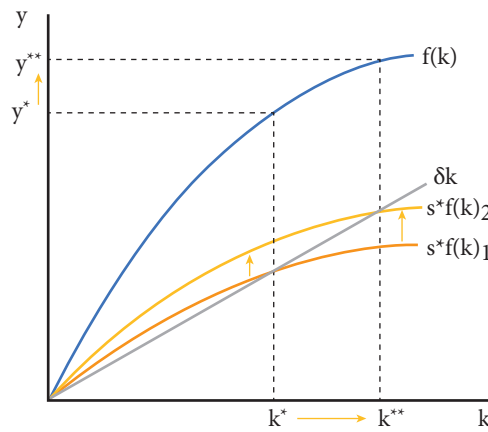


Figure 8.8 Effect of an Increase in the Saving Rate on Output.

Now let us consider a scenario in which the saving rate increases: investment curve,  $s^*f(k)_1$  shifts upward because investment exceeds the depreciation rate at the initial steady-state level of capital. Then, the capital stock increases until it reaches its new steady-state level ( $k^{**}$ ). As can be seen from Figure 8.8, the steady-state level of output increases until its new steady-state level ( $y^{**}$ ) because the higher the level of capital stock, the higher the level of output is. However, this increase in the saving rate has no permanent impact on the growth rate of per capita income.

Equation (8.11) can be rewritten in an equivalent form without any parentheses:

$$c = f(k) - sf(k) \quad (8.19)$$

However, in the steady-state:

$$c^* = f(k^*) - \delta k^* \quad (8.20)$$

This is because  $\Delta k = sf(k) - \delta k = 0$ , which implies that  $sf(k) = \delta k$ .

Because we want to maximise Equation (8.19) after substituting Equation (8.8) into Equation (8.20), we take its first derivative and then set it equal to zero to find out the golden rule level of consumption:

$$c^* = A(k^*)^\alpha - \delta k^*$$

$$\frac{\partial c^*}{\partial k^*} = \alpha A(k^*)^{\alpha-1} - \delta = 0$$

which implies that

$$\alpha A(k^*)^{\alpha-1} = \delta$$

The left-hand side of this expression gives the definition of the marginal product of capital. Therefore,

$$MP_K = \delta \quad (8.21)$$

Equation (8.21) implies that at the golden rule level of capital, the marginal product of capital must be equal to the depreciation rate. In other words, as can be seen from Figure 8.9, the slope of  $f(k)$  line must be equal to the slope of the depreciation line ( $\delta k$ ).

**The golden rule level of capital accumulation** was first articulated by Edmund Phelps and it is the level of capital that maximizes the level of consumption in the steady state. In other words, the economy moves to a new steady-state at which consumption is maximized.

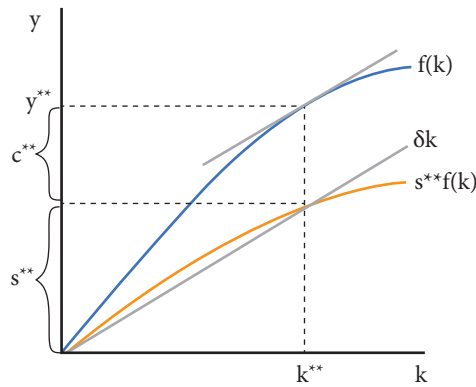


Figure 8.9 Golden Rule Level of Capital Accumulation.

### Solow Model with Exogenous Population Growth

Let us now define  $n$  as the growth rate of the labor force. As the population grows at the rate  $n$ , per capita capital stock and output per capita, that is,  $k$  and  $y$ , will decline. As labor grows, the change in per capita capital stock is as follows:

$$\Delta k = sf(k) - \delta k - nk$$

which can be rearranged to obtain:

$$\Delta k = sf(k) - (\delta + n)k$$

where  $nk$  shows the decrease in capital stock per unit of labor.

Our steady-state condition is then:

$$\Delta k = sf(k) - (\delta + n)k = 0$$

which implies that

$$sf(k) = (\delta + n)k \quad (8.22)$$

In the steady-state, there is no change in per capita capital stock and output per capita, implying that output per worker and capital per worker are both constant.

Equation (8.15) can be substituted into Equation (8.22):

$$sAk^\alpha = (\delta + n)k$$

which allows us to obtain the steady-state level of capital stock and output in per capita terms:

$$k^* = \left( \frac{sA}{\delta + n} \right)^{1/(1-\alpha)} \quad (8.23)$$



Equation (8.23) can be substituted into Equation (8.8):

$$y^* = A^{1/(1-\alpha)} \left( \frac{s}{\delta+n} \right)^{\alpha/(1-\alpha)}$$

The golden rule condition is

$$MP_K = \delta + n$$



your turn 3

Consider two countries with different population growth rates: country  $i$  has a population growth rate of 0%, while country  $j$  has a population growth rate of 4%. Assume that the depreciation rate for both countries is set equal to 5% and  $\alpha = 0.3$ . The following equation is also given:

$$\frac{y_i^*}{y_j^*} = \left( \frac{\delta + n_j}{\delta + n_i} \right)^{\alpha/(1-\alpha)}$$

Compare two countries' steady-state levels of per capita output.



your turn 4

Consider the Solow model in which the per worker production function is defined as:

$$y = 10\sqrt{k}$$

Saving rate ( $s$ ), population growth ( $n$ ), and depreciation rate ( $\delta$ ) are equal to 0.08, 0.03, and 0.05, respectively. Calculate the steady-state equilibrium levels of capital stock per worker, output per worker, and consumption per worker.

efficiency increases, each period more output is produced than the previous period:

$$Y = F(K, AL) = K^\alpha (AL)^{1-\alpha} \quad (8.24)$$

where  $A$  represents the efficiency of labor.

Assuming constant returns to scale in inputs, our production function can now be written in terms of per unit of effective labor:

$$Y / AL = \left[ K^\alpha (AL)^{1-\alpha} \right] / AL$$

which can be rearranged to obtain:

$$Y / AL = K^\alpha / (AL)^\alpha = \left( \frac{K}{AL} \right)^\alpha$$

or alternatively,

$$y = f(k) = k^\alpha \quad (8.25)$$

Our steady-state condition can then be written by the following equation that reflects the technological progress:

$$\Delta k = sf(k) - (\delta + n + g)k = 0$$

which implies that

$$sf(k) = (\delta + n + g)k \quad (8.26)$$

where it is assumed that  $A$  grows at the rate  $g$ .

Equation (8.25) can be substituted into Equation (8.26)

$$sk^\alpha = (\delta + n + g)k$$

which can be rearranged to obtain the steady-state level of capital per effective worker

$$k^* = \left( \frac{s}{\delta + n + g} \right)^{1/(1-\alpha)} \quad (8.27)$$

Equation (8.27) can be substituted into Equation (8.25) to obtain the steady-state level of output per effective worker

$$y^* = \left( \frac{s}{\delta + n + g} \right)^{\alpha/(1-\alpha)}$$

## Solow Model with Exogenous Technological Progress

Now, let us assume that technological progress takes place as a result of the increased efficiency of labor. This idea can then be reflected upon our production function by assuming that as labor

In the steady-state, while output and capital per effective worker,  $y^*$  and  $k^*$ , are constant, that is, they do not grow, aggregate output and capital,  $Y$  and  $K$ , grow at the rate of  $g$  and  $n$ .

Then, the golden rule level of capital accumulation is determined at the following condition:

$$MP_K = \delta + n + g$$

### Implications of the Solow Model

- The steady-state levels of output and capital stock per worker are positively related with the saving rate ( $s$ ) and technological progress ( $g$ ), whereas they are negatively related with population growth ( $n$ ) and depreciation rate ( $\delta$ ).
- The steady-state levels of output and capital stock per effective worker are positively related with the saving rate ( $s$ ), whereas they are negatively related with technological progress ( $g$ ), population growth ( $n$ ), and depreciation rate ( $\delta$ ).
- The steady-state levels of aggregate output and capital stock are positively related with the saving rate ( $s$ ), technological progress ( $g$ ), and population growth ( $n$ ), whereas they are negatively related with the depreciation rate ( $\delta$ ).
- With positive population growth ( $n$ ) and technological progress ( $g$ ), in the steady-state, it is assumed that economy's aggregate capital stock ( $K^*$ ) and output ( $Y^*$ ) grow at the rate  $n+g$ , and that capital stock and output per worker increase at the rate  $g$ ; however, capital stock and output per effective worker do not grow.
- An increase in the saving rate has a temporary effect on the growth rates of capital stock and output, implying that it has no effect on their growth rates in the steady state. However, it has a permanent (increasing) effect on the steady-state levels of aggregate capital stock and output, capital stock per worker and output per worker, and capital stock per effective worker and output per effective worker.

### Shortcomings of the Solow Model

- Although the growth rate in the model is determined by the rate of technological progress, the model cannot account for long-run growth because technological progress is assumed to be exogenous in the model.
- The Solow model cannot explain per capita income differences across countries.
- In the model, the absolute (unconditional) convergence hypothesis is assumed, implying that poor countries grow faster than rich countries until they reach their steady state. However, there is no empirical evidence supporting this hypothesis.

### Human Capital-Augmented Solow Model (Mankiw-Romer-Weil Model)

One can see from the previous discussions, the Solow model fails to explain growth rates of per capita income or differences in living standards. Therefore, Mankiw et al. (1992) developed the augmented Solow model by introducing human capital into the basic Solow model.

Assuming constant returns to scale in inputs, our Cobb-Douglas production function is now

$$Y = K^\alpha H^\beta (AL)^{1-\alpha-\beta} \quad (8.28)$$

where  $0 < \alpha + \beta < 1$ , implying that there are diminishing returns to physical and human capital.

Equation (8.28) can be rearranged to obtain output per effective worker:

$$\frac{Y}{AL} = \left( \frac{K}{AL} \right)^\alpha \left( \frac{H}{AL} \right)^\beta$$

or alternatively,

$$y = k^\alpha h^\beta \quad (8.29)$$

where  $y$ ,  $k$ , and  $h$  are defined as  $Y/AL$ ,  $K/AL$ , and  $H/AL$ , respectively.

The evolution of physical and human capital per effective worker is then:

$$\dot{k} = s_k y - (\delta + n + g)k \quad (8.30)$$

$$\dot{h} = s_h y - (\delta + n + g)h \quad (8.31)$$

where  $s_k$  and  $s_h$  are saving rates for physical capital and human capital, respectively. The depreciation rate is assumed to be the same for both physical and human capital.

Setting Equation (8.31) equal to 0 and then substituting Equation (8.29) into this equation yields

$$s_h k^\alpha h^\beta = (\delta + n + g)h$$

which can be rearranged to obtain

$$h^{\beta-1} = \left( \frac{\delta + n + g}{s_h} \right) k^{-\alpha}$$

or

$$h = \left( \frac{s_h}{\delta + n + g} \right)^{\frac{1}{1-\beta}} k^{\frac{\alpha}{1-\beta}} \quad (8.32)$$

Setting Equation (8.30) equal to 0 and then substituting Equation (8.29) into this equation yields

$$s_k k^\alpha h^\beta = (\delta + n + g)k \quad (8.33)$$

And then, substituting Equation (8.32) into Equation (8.33) yields

$$s_k k^\alpha \left[ \left( \frac{s_h}{\delta + n + g} \right)^{\frac{1}{1-\beta}} k^{\frac{\alpha}{1-\beta}} \right]^\beta = (\delta + n + g)k$$

which can then be rearranged to obtain the steady-state value of physical capital per effective worker:

$$k^* = \left( \frac{s_k}{\delta + n + g} \right)^{\frac{1-\beta}{1-\alpha-\beta}} \left( \frac{s_h}{\delta + n + g} \right)^{\frac{\beta}{1-\alpha-\beta}}$$

or

$$k^* = \left( \frac{s_k^{1-\beta} s_h^\beta}{\delta + n + g} \right)^{\frac{1}{1-\alpha-\beta}} \quad (8.34)$$

Equation (8.34) can then be substituted into Equation (8.32)

$$h = \left( \frac{s_h}{\delta + n + g} \right)^{\frac{1}{1-\beta}} \left[ \left( \frac{s_k^{1-\beta} s_h^\beta}{\delta + n + g} \right)^{\frac{1}{1-\alpha-\beta}} \right]^{\frac{\alpha}{1-\beta}}$$

which can then be rearranged to obtain the steady-state value of human capital per effective worker:

$$h^* = \left( \frac{s_h}{\delta + n + g} \right)^{\frac{1-\alpha}{1-\alpha-\beta}} \left( \frac{s_k}{\delta + n + g} \right)^{\frac{\alpha}{1-\alpha-\beta}}$$

or

$$h^* = \left( \frac{s_k^\alpha s_h^{1-\alpha}}{\delta + n + g} \right)^{\frac{1}{1-\alpha-\beta}} \quad (8.35)$$

As a result, Equations (8.34) and (8.35) can be substituted into Equation (8.29) to obtain the steady-state level of output per effective worker

$$y^* = \left( \frac{s_k^{1-\beta} s_h^\beta}{\delta + n + g} \right)^{\alpha/(1-\alpha-\beta)} \left( \frac{s_k^\alpha s_h^{1-\alpha}}{\delta + n + g} \right)^{\beta/(1-\alpha-\beta)}$$

which can be rearranged to give:

$$y^* = \left( \frac{s_k}{\delta + n + g} \right)^{\alpha/(1-\alpha-\beta)} \left( \frac{s_h}{\delta + n + g} \right)^{\beta/(1-\alpha-\beta)} \quad (8.36)$$

Equation (8.36) implies that although human capital allows us to explain cross-country differences in income levels, the model still cannot account for long-run growth because technological progress is constant.

## NEW GROWTH THEORY: ENDOGENOUS GROWTH MODELS

Although the Solow model was the first attempt to model long-run growth analytically, it has failed to provide compelling evidence about why some countries grow faster than others because it has several shortcomings, as discussed earlier. Most importantly, productivity growth, that is, technological progress, is the only determinant of an increase in the long-run per capita income but the Solow model cannot explain how technological progress is determined because it is assumed to be exogenous in the model. Despite its shortcomings, the Solow model has, however, paved the way for endogenous growth models.

### Brief Overview of Endogenous Growth Models

Frankel (1962)'s AK model is one of the first endogenous growth models. This model suggests that capital accumulation can partly contribute to technological progress. However, in the model, the saving rate is constant. Later, Romer (1986)'s study is crucial to our wider understanding of endogenous growth models. In his study, he suggested that long-run growth is determined

by the saving and investment rate of a country, rather than technological progress which is exogenously determined in the model. In a similar vein, Lucas (1988) suggested that technological progress is endogenous and that human capital is a contributing factor for economic growth. However, innovation-based growth models have gone beyond these discussions. In reviewing the literature, there are two strands of research on these types of models. Firstly, Romer (1990) developed a product-variety model where innovation can create new varieties of products, which in turn leads to productivity growth. Secondly, Aghion and Howitt (1992) developed the Schumpeterian version of endogenous growth theory, commonly referred to as "Schumpeterian growth theory" this is because Schumpeter's (1942) idea of "creative destruction" is a key term in their model, suggesting that quality-improving innovations make old products obsolete. In reviewing the literature on endogenous growth models, there are also other studies but they lie beyond the scope of this chapter and therefore will not be discussed here. However, we will move on to discuss a simple endogenous growth model, namely, the AK model.

## AK Model

As discussed earlier, the AK model is one of the first endogenous growth models. There are several assumptions of this model. First, the production function is linear in capital stock. Second, there is no labor in the production function. Third, capital exhibits constant returns. Fourth, a constant, exogenous saving rate is assumed. Also, there is a fixed level of technology. Finally, population growth is assumed to be constant so the growth rate of aggregate output,  $Y$ , is equal to the growth rate of per capita output,  $y$ .

### Model Description

The production function of the AK model is the special case of the Cobb-Douglas production function in the basic Solow model. In the case where  $\alpha=1$ , Equation (8.7) becomes linear in capital stock:

$$Y=AK \quad (8.37)$$

where  $Y$  is total production,  $K$  is capital stock, and  $A$  is a constant that indicates the level of technology. However, capital stock includes not only physical capital but also human capital.

Assuming that capital is accumulated as individuals save and invest some of the output produced in the economy, gross investment is then:

$$I=sY \quad (8.38)$$

which can be alternatively written by substituting Equation (8.37) into Equation (8.38)

$$I=sAK$$

where  $s$  is a fixed saving rate.

Capital stock grows according to:

$$\dot{K}=sY - \delta K \quad (8.39)$$

where  $\delta$  is the depreciation rate.

Figure 8.10 shows a graphical illustration of Equations (8.37), (8.38), and (8.39) in the AK model.

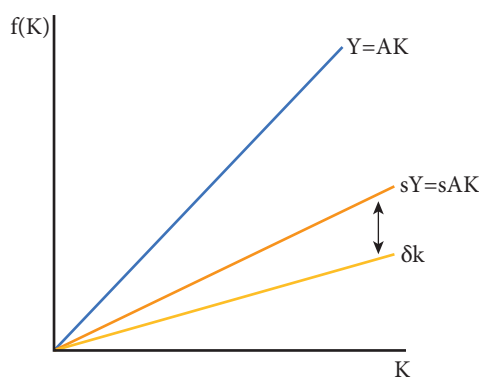


Figure 8.10 Dynamics of the AK Model.

Both sides of Equation (8.39) can be divided by  $K$  to obtain the growth rate of capital:

$$\frac{\dot{K}}{K} = s \frac{Y}{K} - \delta \quad (8.40)$$

From Equation (8.37), we also know that

$$\frac{Y}{K} = A$$

which can be substituted into Equation (8.40):

$$g = \frac{\dot{K}}{K} = sA - \delta$$

Given that output is proportional to capital,  $g$  is also equal to the growth rate of output.

## Comparison with the Solow Model

In the AK model:

- Capital exhibits constant returns.
- Even without technological progress and population growth, growth of per capita income can be achieved.
- There is no convergence of per capita income levels across countries.
- The growth rate of per capita income is an increasing function of the saving rate.
- An increase in the saving rate has a permanent effect on the growth rate of per capita income.

However, in the Solow model:

- Capital exhibits diminishing returns.
- Growth of per capita income can only be achieved with technological progress.
- In line with the absolute (unconditional) convergence hypothesis, it is assumed that poor countries grow faster than rich countries until they reach their steady state. This is also the case with the human capital-augmented Solow model.
- The growth rate of per capita income is not dependent on the saving rate due to the diminishing returns to capital.
- An increase in the saving rate has no permanent effect on the growth rate of per capita income.

## LO 1

Providing a brief explanation of economic growth and of how it is measured



Economic growth is the rate of an increase in GDP. In the literature, it is also defined as the rate of an increase in real GDP per capita.

## LO 2

Showing a clear understanding of the literature on exogenous and endogenous growth models



Harrod (1939) and Domar (1946) marked the beginning of the modern growth theory. Their model is of great importance in neoclassical exogenous growth models as it marks the first attempt to explain an economy's long-run growth rate within the Keynesian framework. In their model, the growth rate is determined by the saving rate, capital-output ratio, and depreciation rate. While the growth rate is positively related to the saving rate, it is negatively related to the capital-output ratio and depreciation rate. However, this model has several limitations. First, it is assumed that an economy operates at full employment. Second, capital-output and capital-labor ratios are both assumed to be constant. Third, there is a lack of factor substitution; in other words, there is no substitution of capital for labor or vice versa. Last, despite its important role in long-run growth, technological progress is not considered in the model. These limitations have then formed a basis for the Solow model.

Solow (1956) is the first study that developed an exogenous model of long-run growth and it is considered to be the basis of all the subsequent growth models in the literature. The main assumptions of this model are as follows. First, there are two factors: labor and capital. Second, the production function has constant returns to scale. Third, output increases as labor and capital increase but there are diminishing returns to each factor. Last, technological change is exogenously given. However, just like the Harrod-Domar model, this model has several limitations as well. Although the growth rate in the model is determined by the rate of technological progress, the model cannot account for long-run growth because technological progress is assumed to be exogenous in the model. Besides, it cannot explain per capita income differences across countries. In the model, the absolute (unconditional) convergence hypothesis is assumed, implying that poor countries grow faster than rich countries until they reach their steady state. However, there is no empirical evidence supporting this hypothesis. Later, Mankiw et al. (1992) developed the augmented Solow model by introducing human capital into the basic Solow model. This is because ignoring human capital in the theoretical model has not only theoretical but also empirical implications. Despite its shortcomings, the Solow model has, however, paved the way for endogenous growth models.

Frankel (1962)'s AK model is one of the first endogenous growth models. This model suggests that capital accumulation can partly contribute to technological progress. However, in the model, the saving rate is constant. Later, Romer (1986)'s study is crucial to our wider understanding of endogenous growth models. In his study, he suggested that long-run growth is determined by the saving and investment rate of a country, rather than technological progress which is exogenously determined in the model. In a similar vein, Lucas (1988) suggested that technological progress is endogenous and that human capital is a contributing factor for economic growth. However, innovation-based growth models have gone beyond these discussions. In reviewing the literature, there are two strands of research on these types of models. Firstly, Romer (1990) developed a product-variety model where innovation can create new varieties of products, which in turn leads to productivity growth. Secondly, Aghion and Howitt (1992) developed the Schumpeterian version of endogenous growth theory, commonly referred to as "Schumpeterian growth theory" this is because Schumpeter's (1942) idea of "creative destruction" is a key term in their model, suggesting that quality-improving innovations make old products obsolete. As noted earlier, in reviewing the literature on endogenous growth models, there are also other studies but they have not been discussed in this chapter.



## LO 3

Understanding the key differences between exogenous and endogenous growth models

In neoclassical exogenous growth models:

- External factors outside of the economy, such as technological progress are considered to predict economic growth.
- Although constant returns to scale in all inputs (capital and labor) is assumed, capital exhibits diminishing returns. Neoclassical growth models cannot explain long-run economic growth due to the assumption of diminishing returns to capital. Therefore, the elimination of this assumption is the main idea behind endogenous growth models.
- The Solow model suggests that growth of per capita income cannot be achieved without technological progress.

In endogenous growth models:

- Factors that are internal to the economy, such as human capital and innovation are considered to predict economic growth because a high level of human capital and/or innovation may improve productivity, thereby promoting economic growth.
- Increasing returns to scale in all inputs (but constant returns to produced inputs) is assumed.
- The AK model suggests that even without technological progress and population growth, growth of per capita income can be achieved because internal factors can help generate economic growth.

1 Which of the following statements is **false**?

- A. Nominal GDP per capita is a good measure of economic well-being
- B. Economic growth is the rate of an increase in GDP
- C. Real GDP is the value of goods and services, adjusted for price changes
- D. GDP per capita can be computed by dividing a country's GDP by its total population
- E. Nominal GDP is the value of goods and services given in current prices

2 In the Solow model, what does the assumption of constant returns to scale imply?

- A. If the amount of capital for a given amount of labor increases, its contribution to output will increase at a decreasing rate and then will eventually become zero
- B. A doubling of all inputs would double output
- C. The steady-state level of output is constant
- D. All economies have the same amount of capital per worker
- E. The production output that results from an additional unit of capital is equal to the depreciation rate

3 In the Solow model, it is assumed that the aggregate production function has (\_\_\_\_\_) returns to scale and (\_\_\_\_\_) marginal productivity of labor and capital.

Which of the following completes the sentence above?

- A. Constant, increasing
- B. Decreasing, increasing
- C. Constant, diminishing
- D. Decreasing, constant
- E. Increasing, increasing

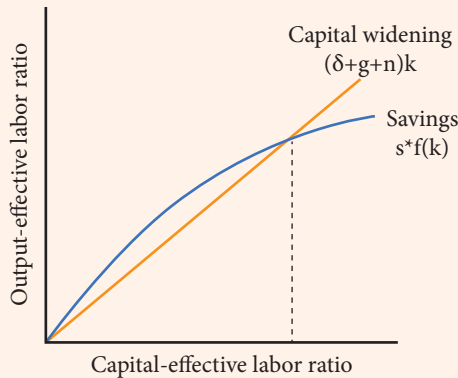
4 Which of the following statements is **false**?

- A. In the basic neoclassical growth model, equilibrium occurs at the point where investment per worker is equal to depreciation per worker
- B. The Solow model predicts that poor countries will grow faster than rich ones
- C. According to the neoclassical growth model, if the share of the population in the labor force increases, all other things being equal, output per worker will eventually be constant
- D. One of the main assumptions of the Solow model is increasing returns to capital and labor
- E. In the Solow model, growth of per capita income can only be achieved with technological progress

5 Which of the following statements is **false** for the golden rule level of capital accumulation?

- A. This term was first used by Edmund Phelps
- B. Equation  $MP_K = \delta$  implies that the slope of the production function line is equal to the slope of the depreciation line
- C. It is the level of capital that maximizes the level of consumption in the steady state
- D. An economic policy maker would choose the steady-state at which consumption is maximized because the well-being of the society depends on the consumption
- E. Equation  $c = f(k) - \delta k$  suggests that if the golden rule level of capital is higher than the actual capital stock, then consumption falls

6 The figure below represents an economy where a population growth rate is  $n$ , the rate of technological progress is  $g$ , and the depreciation rate is  $\delta$ . It is also assumed that there is no change in labor force participation rate.



Which of the following statements is true for output per unit of labor in the steady state?

- A. It will grow at the rate  $\delta$
- B. It will grow at the rate  $\delta+n$
- C. It will grow at the rate  $\delta+n+g$
- D. It will grow at the rate  $g$
- E. It will grow at the rate  $n$

7 Which of the following statements is true for endogenous growth models?

- A. Economic growth is determined by factors that are external to the economy
- B. Eliminating the assumption of increasing returns to capital is the main idea behind these models
- C. Government policies can have permanent effects on the per capita growth rate of output
- D. The rate of technological progress is constant in time
- E. Capital exhibits diminishing marginal returns

8 Which of the following statements is **false** for the AK model?

- A. There is no convergence of per capita income levels across countries
- B. A higher level of saving rate will not lead to sustained higher growth rates
- C. The production function of the AK model is the special case of a Cobb-Douglas production function in the Solow model
- D. The production function shifts upward if the stock of physical capital increases
- E. If the depreciation rate is lower than the level of investment, then there could be sustained growth

9 Which of the following statements is **false** for the Solow model?

- A. Capital exhibits constant returns
- B. It is a model of long-run growth, first proposed by Robert Solow
- C. Technological progress is assumed to be exogenous
- D. The model cannot explain growth rates of per capita income or differences in living standards
- E. The unconditional convergence hypothesis is assumed

10 Which of the following statements is **false**?

- A. In the Solow model, an increase in depreciation rate, all other things being equal, leads to a decrease in output per worker in the new steady state
- B. In the AK model, output grows continuously in equilibrium
- C. In the Solow model, diminishing marginal product of capital contributes to the growth slowdown in capital accumulation and output per worker
- D. In the AK model, growth of per capita income can be achieved without technological progress and population growth
- E. In the AK model, the growth rate of per capita income is a decreasing function of the saving rate

|      |                                                                                                     |       |                                                                                                                           |
|------|-----------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------|
| 1. A | If your answer is wrong, please review the “Definition and Measurement of Economic Growth” section. | 6. D  | If your answer is wrong, please review the “Endogenous Growth Models” section.                                            |
| 2. B | If your answer is wrong, please review the “Neoclassical Exogenous Growth Models” section.          | 7. C  | If your answer is wrong, please review the “Endogenous Growth Models” section.                                            |
| 3. C | If your answer is wrong, please review the “Neoclassical Exogenous Growth Models” section.          | 8. B  | If your answer is wrong, please review the “Endogenous Growth Models” section.                                            |
| 4. D | If your answer is wrong, please review the “Neoclassical Exogenous Growth Models” section.          | 9. A  | If your answer is wrong, please review the “Neoclassical Exogenous Growth Models” section.                                |
| 5. E | If your answer is wrong, please review the “Neoclassical Exogenous Growth Models” section.          | 10. E | If your answer is wrong, please review the “Neoclassical Exogenous Growth Models” and “Endogenous Growth Models” section. |

Consider the following aggregate production function:

$$Y = \sqrt{K} \sqrt{L}$$

- Calculate when  $K$  and  $L$  are both set equal to 200.
- Calculate if both  $K$  and  $L$  increase by 100%. What is the percentage of the increase in  $Y$  compared to part (a)?
- Does the above production function exhibit constant returns to scale? If so, explain briefly.
- If both  $K$  and  $L$  increase by 2%, what will be the percentage increase in  $Y$ ? Explain briefly.

your turn 1

- Substituting the given figures into the above production function:

$$Y = \sqrt{200} \sqrt{200} = 200$$

- If both  $K$  and  $L$  increase by 100%, then  $K=L=400$ . And then substituting these figures into the production function:

$$Y = \sqrt{400} \sqrt{400} = 400$$

As a result,  $Y$  also increases by 100%.

- As can be seen from the solution in part (b), if  $K$  and  $L$  are both doubled,  $Y$  will also double. This is because the elasticities of  $K$  and  $L$  add up to 1.

- $Y$  also increases by 2% due to the constant returns to scale.

Consider two countries with different saving rates: country  $i$  has a saving rate of 0.20, while country  $j$  has a saving rate of 0.05.  $\alpha$  is equal to  $1/3$ . The following equation is also given:

$$\frac{y_i^*}{y_j^*} = \left( \frac{s_i^*}{s_j^*} \right)^{\frac{\alpha}{1-\alpha}}$$

Compare two countries' steady-state levels of per capita output.

your turn 2

$$\frac{y_i^*}{y_j^*} = \left( \frac{0.20}{0.05} \right)^{\left( \frac{1}{2} \right)} = 4 \left( \frac{1}{2} \right) = 2$$

Consider two countries with different population growth rates: country  $i$  has a population growth rate of 0%, while country  $j$  has a population growth rate of 4%. Assume that the depreciation rate for both countries is set equal to 5% and  $\alpha = 0.3$ . The following equation is also given:

$$\frac{y_i^*}{y_j^*} = \left( \frac{\delta + n_j}{\delta + n_i} \right)^{\alpha/(1-\alpha)}$$

Compare two countries' steady-state levels of per capita output.

your turn 3

$$\frac{y_i^*}{y_j^*} = \left( \frac{0.05 + 0.04}{0.05 + 0} \right)^{0.3/0.7} \cong 1.29$$

Consider the Solow model in which the per worker production function is defined as:

$$y = 10\sqrt{k}$$

Saving rate ( $s$ ), population growth ( $n$ ), and depreciation rate ( $\delta$ ) are equal to 0.08, 0.03, and 0.05, respectively. Calculate the steady-state equilibrium levels of capital stock per worker, output per worker, and consumption per worker.

your turn 4

Let us recall Equation (8.22):

$$sf(k) = (\delta + n)k$$

or alternatively,

$$sy = (\delta + n)k$$

This is because  $y = f(k)$ . Therefore,

$$0.08 * 10\sqrt{k^*} = (0.03 + 0.05)k^*$$

$$k^* = 100$$

which can be substituted into:

$$y^* = 10\sqrt{100} = 100$$

From Equation (8.11), we also know that

$$c^* = (1 - s)y^*$$

Substituting the values for  $s$  and  $y$  into this equation yields

$$c^* = (1 - 0.08)100 = 92$$

## References

- Acemoglu, D., Laibson, D. I. & List, J. A. (2022). *Macroeconomics*. Pearson.
- Aghion, P. & Howitt, P. (1992). A Model of Growth through Creative Destruction. *Econometrica*, 60, 323–51.
- Aghion, P. & Howitt, P. (1997). *Endogenous Growth Theory*. The MIT Press.
- Dornbusch, R., Fischer, S. & Startz, R. (2018). *Macroeconomics*. McGraw-Hill Education.
- Domar, E. D. (1946). Capital Expansion, Rate of Growth, and Employment. *Econometrica*, 14(2), 137-147.
- Frankel, M. (1962). The Production Function in Allocation and Growth: A Synthesis. *The American Economic Review*, 52(5), 996-1022.
- Harrod, R. F. (1939). An Essay in Dynamic Theory. *The Economic Journal*, 49(193), 14-33.
- Lucas Jr, R. E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22(1), 3-42.
- Mankiw, N. G., Romer, D. & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*, 107(2), 407-437.
- Ranis, G., Stewart, F. & Ramirez, A. (2000). Economic Growth and Human Development. *World Development*, 28(2), 197-219.
- Rodrik, D. (2013). Unconditional Convergence in Manufacturing. *The Quarterly Journal of Economics*, 128(1), 165-204.
- Romer, P. M. (1986). Increasing Returns and Long-run Growth. *Journal of Political Economy*, 94(5), 1002-1037.
- Romer, P. M. (1990). Endogenous Technological Change. *Journal of Political Economy*, 98(5, Part 2), 71-102.
- Schumpeter, J. A. (1942). *Capitalism, Socialism and Democracy*. New York: Harper.
- Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, 70(1), 65-94.