Euro Area Economics

Basics – Methods – Applications

Prof. Dr. Dieter Gerdesmeier

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EURO AREA ECONOMICS

BASICS – METHODS – APPLICATIONS

Euro Area Economics: Basics – Methods – Applications
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Peer review by Prof. Dr. Horst Löchel, Programm Direktor MBA, Professor für Volkswirtschaftslehre, Frankfurt School of Finance & Management

CONTENTS

Dedicated to the memory of my father,
Hermann Gerdesmeier,
and to my family
(D.G.)

1 INTRODUCTION AND MOTIVATION

This book complements the earlier textbook entitled "Fundamentals of monetary policy in the euro area" insofar as it covers topics that are more of a macroeconomic nature. Against this background, the book is meant to serve as an introductory text for macroeconomics and for lectures that focus more on European issues. The textbook is further accompanied by the booklet entitled "Euro Area Economics – Exercises" which provides the interested reader with some exercises.[1]

Building on a number of sessions that describe the basic concepts and tools, the book continues by further deepening some selective issues and by supplementing the basic concepts with a number of practical real-world phenomena and problems using adequate statistical and econometric tools. Seen from that perspective, the book attempts to build bridges between the theory and practice of macroeconomics.

The concrete outline is as follows: Part I is foreseen to lay the foundations and to provide the reader with the basics. The key concepts are defined and some simple analysis is carried out in verbal and graphical form.

Part II continues by introducing the markets for goods and money and the labour market. Moreover, the respective equilibria constellations are derived in graphical form and analysed in more detail.

Part III expands the basic model in various respects. Consumption, investment, fiscal policy and money demand are more closely scrutinised.

Part IV takes some selected concepts up and makes an attempt to dig deeper into the relevant issues. In particular, the institutional foundations of the European Economic and Monetary Union (EMU) are summarised and the process of European monetary integration is described in more detail. Additional topics are the concepts of price indices and inflation, measures of real economic activity as well as unemployment issues and exchange rate determination.

Part V proceeds by shedding more light on specific areas such as, for instance, monetary theory and policy, Taylor rules, the financial crisis and related unconventional monetary policy measures.

Part VI finally concentrates on open economy issues and some growth aspects.

In the third version, a number of minor errors and omissions have been corrected and clarified. Additional paragraphs or new sections include a short description of New Keynesian Economics, some background information on the Presidents of the ECB and some considerations on the virtues of a policy mix. Moreover, the concept of optimal currency areas, the HARTZ reforms in Germany, the notion of eurosclerosis and the Brexit have been tackled. Finally, Keynes' animal spirits, the well-known dichotomy of hawks and doves and Rogoff's central banker have been mentioned.

I would like to thank my colleague Prof. Dr. Horst Löchel for his thorough review of the first edition of this book. At the same time, I am indebted to some colleagues inside and outside the ECB for very useful feedback. And finally, I have to thank my family for their patience.

PART I

2 UNDERSTANDING ECONOMICS

2.1 LEARNING OBJECTIVES

We start with some basic considerations and then proceed by outlining the key distinction between microeconomic and macroeconomic theory and their respective areas of expertise. We then briefly summarise some economic episodes and schools. Finally, we identify some key macroeconomic variables.

2.2 BASIC CONCEPTS

There is widespread agreement in the economic profession that the concept of "scarcity" is of crucial relevance for economics. Scarcity refers to the fact that resources are limited, whereas wants and needs are unlimited. This constellation implies that economic subjects have to take decisions regarding the goods and services they want to buy and the ones they must forgo. For instance, in order to buy a nice T-Shirt, it is necessary to give up on a visit to the cinema. Expressed in economic terms, one could state that economic subjects face the problem of how to best allocate resources and economics tries to explain, why these decisions are made and how they are made in an efficient way.

The problem of scarcity leads us to two other important concepts. The first one is the concept of "opportunity costs" and the second one is the concept of "supply and demand". By its very nature, every choice involves opportunity costs and the latter are usually measured in terms of the amount of one good that has to be given up to acquire more of another good. Moreover, while the interactions of supply and demand determine the price and quantity produced sold in a specific market, these considerations can more broadly be applied to a variety of markets.

2.3 MICROECONOMICS AND MACROECONOMICS

In carrying out economics, two different perspectives have to be distinguished. The expressions "microeconomics" and "macroeconomics" derive from the Greek words meaning "small" and "large". Accordingly, microeconomics takes the small view and focuses on questions like the decision-making of households and firms and the interaction in specific markets (such as, for instance, those for labour, money, goods and services, etc.). By contrast, macroeconomics deals with the large view and studies economy-wide phenomena such as, for instance, economic growth, business cycles, inflation, unemployment, interest rates and many things more.

Microeconomics and macroeconomics are of course closely interrelated. In light of the fact that economy-wide developments are ultimately based on decisions taken by many individuals, it would actually be hard to understand macroeconomic developments without a sound knowledge about the determinants driving the choices at the microeconomic level. Notwithstanding these commonalities, the two fields are quite distinct as they basically address different questions. Among other things, this is one of the reasons why microeconomics and macroeconomics are typically taught in different courses.

2.4 EX ANTE AND EX POST ANALYSIS

Ideally, an economic analysis should contain two elements. A first step consists of a descriptive analysis of the economic process. The latter is of an "ex post" nature and, thus, retrospective in nature. In a second step, an attempt should be made to explain these phenomena, that is to identify the determinants (or driving variables) of the economic process. This then necessitates an analysis of the behaviour of economic subjects. Insofar, this so-called "ex ante" analysis is, by its very nature, forward-looking or prospective. It is obvious that such an ex ante analysis is more demanding than its ex post counterpart. At the same time, a well conducted ex ante analysis constitutes a necessary precondition for a sound economic policy.

2.5 A SHORT HISTORY OF ECONOMICS

Over the past centuries, the economic profession has been confronted with various kinds of challenges. In response, the economic thinking has been continuously stimulated by new impulses which, in turn, often challenged the existing theories to a significant extent. Without going too much into detail, it is worth making already at this stage a first brief attempt to summarise the main differences in a systematic way.[2]

The so-called school of "classical economics" is rooted in the work of a number of economists, among them Adam Smith (1723–1790), David Ricardo (1772–1823) and Jean-Baptiste Say (1767–1832). While many economists would probably subscribe to the view that there is no such thing as "the" classical theory, it is fair to say that this paradigm has to be seen against the episode of the industrial revolution. In line with this historical background, some of the key issues consisted in the analysis of the reasons underlying an increase of the wealth of a nation through the emergence of new technologies and productivity increases, but also in distributional aspects. As a matter of fact, views were primarily dominated by a supply-side perspective. The main tenet of this school was that markets work best when they are left on their own and, therefore, governments should refrain from taking an active stance (i.e. they should follow a "laissez-faire approach"). While classical economists very well recognized that such a process would take time, they still held the view that the economy can do best on its own. Markets would then allocate resources in an efficient way through the price mechanism that would act as a powerful "invisible hand"', thereby ensuring the return to the full-employment level of real output through this automatic self-adjustment mechanism.

The so-called "neo-classical school of economic thought" is generally associated with the work of William Jevons (1835–1882), Carl Menger (1840–1921) and Leon Walras (1834–1910). In essence, these economists gave an impetus to turn economics into a more modern science. The use of assumptions, hypotheses and principles about the behaviour of firms and consumers ultimately led to a more rigid treatment of supply and demand and market equilibria. Another important contribution of neo-classical economics was the focus on key concepts, such as marginal values (i.e. marginal costs and marginal utility).

The advent of the Great Depression and the associated high unemployment rates cast serious doubts on the dominance of aggregate supply and the proper working of the self-adjusting forces of the private sector. In his work published in 1936, the British economist John Maynard Keynes (1883–1946) offered a new and radically different approach, which focused on the role of aggregate demand and its best use it for macroeconomic policy. Keynes' ideas became even more popular in the interpretation by Sir John Hicks (the so-called "neoclassical synthesis").[3] Moreover, being sceptical about the fact that free markets will inevitably move towards a full employment equilibrium (in the words of Keynes: "in the long run, we are all dead") and claiming that the self interest which governs micro-economic behaviour does not always lead to beneficial long-run macroeconomic developments or short-run macroeconomic stability, Keynesian economists generally advocated an "interventionist approach" by use of fiscal and monetary policy.

In the course of the 1960s, Keynesian economics emerged as the dominant school of macroeconomics thought. For many observers, the use of Keynesian fiscal and monetary policies in that period was a great success, if not a triumph. In the early 1970s, however, inflation and unemployment spiraled to even higher levels. This led a group of economists to the forefront that challenged the mainstream view and, instead, focused on the role of changes in money supply. Their "money matters" view gave rise to the name "monetarism". For instance, in stark contrast to the Keynesian doctrine, the US-economist Milton Friedman (1912–2006) attributed the outcome of the Great Depression to mistakes in the monetary policy of the Federal Reserve, the central bank of the United States.[4] Besides, advocates of monetarism generally held the view that variations in money supply could exert a strong impact on real economic developments in the short run and on the general price level in the long run (i.e. "inflation is always and everywhere a monetary phenomenon"). As a consequence, they preferred a targeting of the growth rate of money supply (for instance by means of the so-called "Friedman rule"), which they regarded as clearly superior to any kind of discretionary monetary policy.

Both Keynesian and monetarist economics put a clear emphasis on the role of aggregate demand. In light of the fact, however, that the supply side represents an equally important part of the macroeconomic picture, some economists turned to an entirely new way of looking at macroeconomic issues. As a consequence, the early 1970s saw a return to traditional macroeconomic topics using new concepts such as, for instance, rational behaviour (i.e. an analysis of behaviour based on individual optimization) and rational expectations. This school of "new classical economics" is closely linked to the work of the US-economists Robert Lucas and Thomas Sargent with the respective policy recommendations stemming mainly from the implications of the "rational expectations hypothesis" (which assumes that individuals form their expectations about the future based on the information available to them and they act on these expectations).

More recently, the so-called school of "New Keynesian economics" has gained more importance. While this school acknowledges the plausibility of rational expectations, it also takes note of the existence of a variety of market failures, such as, for instance, imperfect competition, coordination and labour market failures. This way of approaching economics is closely linked to the work of Robert Gordon, Jordi Gali and Gregory Mankiw.[5]

2.6 SOME KEY MACROECONOMIC VARIABLES

In this section, we take a first look at some key macroeconomic variables. The "Gross Domestic Product" ("GDP") corresponds to the market value of economic production of a particular country during a specified period. Without going too far at this early stage, a high GDP growth is often regarded as a measure of economic welfare and an indicator of the standard of living in a country, but as we will see at a later stage, there may be problems with this view.

Another key variable in macroeconomics is "inflation". Although different definitions of inflation exist, most economists would probably agree that inflation corresponds to a (more or less) continuous increase in the economy's general price level which, consequently, leads to an ongoing loss of the purchasing power of money.

While inflation tells us something about the internal value of money, the external value of money is mirrored in the "exchange rate". The exchange rate is usually defined as the amount of another nation's money that residents of a country can obtain in exchange for a unit of their own money. For instance, on 25 August 2017, euro area residents could roughly obtain $1.19 for one euro.

Another important macroeconomic variable is the "interest rate". It represents the price of money and provides important information about the borrowing costs and financial investment opportunities. At the same time, it plays an important role in determining the state and the level of economic activity.

If people are willing to work, but are unable to find a job at the existing wage, "unemployment" exists. Unemployment is usually expressed by means of the unemployment rate which, in turn, corresponds to the number of jobless individuals, who are actively looking for work divided by total employment plus unemployment.

The "government deficit" ("surplus") basically explains by how much public sector expenses fall below (exceed) tax revenues. Similarly, the government debt represents, broadly speaking, the sum of the public sector deficits accumulated over the past.

A country's "trade balance" tends to enjoy great attention among economists, politicians and the public. The trade balance is the difference between a country's exports and its imports. If the trade balance is positive (negative), a country is said to have a trade surplus (deficit), that is the country sells more (less) to other countries than it buys from them.

2.7 SOME KEY MACROECONOMIC ISSUES

Some key macroeconomic questions are: why are some countries growing very fast and others are not? Why do some countries have high savings ratios and what are their effects? What are the advantages and disadvantages of specific exchange rate regimes? Why did some countries fare relatively well in the course of the financial crisis and others did very bad? These and many other questions can be seen as being of relevance and we will try to tackle some of them in the course of this book.

2.8 SUMMARY

- Important concepts in economics refer to scarcity, opportunity costs as well as supply and demand.
- Within the economic field, a general distinction refers to the difference between micro- and macroeconomics. These expressions come from the Greek words meaning "small" and "large". While microeconomics analyses the decisions of individual households and firms, macroeconomics basically investigates the functioning of the overall economy.

- Ideally, an economic analysis contains two elements, namely an ex post, retrospective part as well as an ex ante, prospective part.
- From a historical perspective, various economic schools have to be mentioned, among them the classical school, the neo-classical school, the eras of Keynesianism and of monetarism, of new classical economics and, last but not least, of New Keynesian economics.
- Some key economic variables are the Gross Domestic Product, the inflation rate, the unemployment rate, the government surplus (or deficit), the government debt, the trade balance, the exchange rate and the interest rate.
- Some key macroeconomic issues relate to the different growth rates of countries, to the reasons for and the effects of different savings ratios and also to the performance of various countries in the course of the financial crisis.

🕮 Key Concepts

Scarcity, opportunity costs, supply and demand, microeconomics, macroeconomics, economic theory, economic policy, business cycle analysis, growth theory, monetary theory and policy, open economy macroeconomics, ex ante analysis, ex post analysis, classical economics, neo-classical economics, Keynesian economics, monetarist economics, new classical economics, new Keynesian economics, Gross Domestic Product, inflation, unemployment, exchange rate, interest rate, government surplus and deficit, government debt, trade balance.

☑ Questions for Review

- Why is the concept of scarcity of relevance?
- What is the essence of the concept of opportunity costs?
- What is the difference between microeconomics and macroeconomics?
- Which areas of macroeconomics do you know?
- What is the difference between an "ex post" and an "ex ante" analysis?
- Which different macroeconomic schools do you know? What are their key messages?
- Which key macroeconomic variables do you know? How are they defined?

3 A LOOK INTO THE TOOL BOX

3.1 LEARNING OBJECTIVES

We start with some basic considerations on models and variables before we reflect on various types of analysis. We then identify different types of equations used in the context of the mathematical analysis. Afterwards, we take a closer look at the concepts of supply and demand and the effects of disequilibria as well as on the effects caused by shifts in supply and demand. Finally, we outline the basic notions of the slope and the elasticity.

3.2 MODELS

In analysing real-world phenomena, economists are often said to make use of a sound dose of common sense. This notwithstanding, when trying to explain the reasons underlying the behaviour of macroeconomic variables, economists mostly derive their conclusions from simple representations of rather complex real-world phenomena, that is from "models". Such a model typically identifies the key variables of interest and their interrelationships with other variables by abstracting from reality when appropriate. In doing so, a model attempts to mirror the basic nature of the problem at stake. It is fair to say, however, that in macroeconomics, there is no such thing as the "correct" model but rather a suite of, possibly competing, models which differ according to their assumptions, the relevant time horizon and often (unfortunately) also with respect to their conclusions. As regards the time horizon, a common distinction refers to the "short-term", the "medium-term" and the "long-term" horizon.

In such a model world, an important issue relates to the difference between "endogenous" and "exogenous" variables. The expression "exogenous" derives from Greek and means "given from outside", which is equivalent to saying that these variables are determined outside the economic model. It is not uncommon, for instance, in many economic models to assume government expenditure to behave as an exogenous variable, since its determinants are often regarded as being quite different from the ones of other economic subjects. By contrast, "endogenous" variables are determined inside the model, typically, they can be found on the axes of the charts used in graphical analysis or as dependent (or left-hand) variables in the equations of such a model.

3.3 TYPES OF ANALYSIS

In carrying out such a macroeconomic analysis, in principle, a number of methodological approaches can be followed. More specifically, the "verbal analysis", the "graphical analysis" and the "mathematical analysis" need to be distinguished.

The verbal analysis is rather popular in economics with the only disadvantage consisting of the fact, that in the case of relatively complex phenomena, this kind of analysis often easily reaches its limits. This is clearly not the case if the mathematical analysis is selected. It has to be admitted, however, that not everybody is necessarily familiar with these rather technical procedures. Despite its limitations, in many cases a graphical analysis is rather helpful in illustrating complex situations. In the remainder of this book, we will mainly make use of the graphical and the verbal analysis, sometimes complemented by some easy mathematical elements, if deemed appropriate.

☑ The Mathematical Analysis of Equilibria

In this section, we want to briefly illustrate the algebraic derivation of equilibrium solutions. In doing so, we will focus on a specific example. Assume, the market for a particular good could be characterised by the following equations:[6]

$Q^D = a - b \cdot P$	Demand equation	(3.3.1)
$Q^S = -c + d \cdot P$	Supply equation	(3.3.2)
$Q^D = Q^S$	Equilibrium condition	(3.3.3)

where Q denotes the quantity and P the price of the good. Moreover, we assume $a, b, c, d > 0$. It is also worth noting that the specification of the supply equation assumes, that a positive supply of the good just starts to materialise from a certain price level onwards. As it stands, the model contains three endogenous variables (i.e. Q^S, Q^D, P) and one equilibrium solution, which then determine the equilibrium value for the price and the quantity (i.e. Q^*, P^*). It then follows:

$$Q^D = Q^S \tag{3.3.4}$$

$$a - b \cdot P = -c + d \cdot P \tag{3.3.5}$$

$$a + c = (b + d) \cdot P \tag{3.3.6}$$

$$\frac{a+c}{b+d} = P = P^* \tag{3.3.7}$$

where we assume that $b + d \neq 0$ since otherwise, we are not allowed to divide by this term. Following our earlier assumption (i.e. $a, b, c, d > 0$), the economic meaningful assumption of a positive value for the price will result. If this result is inserted into the demand equation, it follows that

$$Q^D = a - b \cdot P \tag{3.3.8}$$

$$Q^D = a - b \cdot \left(\frac{a+c}{b+d} \right) \tag{3.3.9}$$

$$Q^D = \frac{a \cdot (b+d) - b \cdot (a+c)}{b+d} \tag{3.3.10}$$

$$Q^D = \frac{a \cdot b + a \cdot d - b \cdot a - b \cdot c}{b+d} \tag{3.3.11}$$

$$Q^* = Q^D = \frac{a \cdot d - b \cdot c}{b+d} \tag{3.3.12}$$

Again, we assume that $b + d \neq 0$ in order to get the term well-defined. To get the economic meaningful assumption of a positive value for the quantity (i.e. $Q > 0$), we furthermore have to assume that $a \cdot d > b \cdot c$.

☑ Types of Equations

In the framework of mathematical analysis, various forms of equations can be distinguished, among them "behavioural equations", "technical equations", "institutional equations", "definitions" (or, alternatively, "identities") and "equilibrium conditions".

Behavioural equations are of crucial importance in economics. They basically mirror assumptions regarding the underlying motives of economic subjects by use of functions. Assume, for instance, that consumption is thought to depend on income. In this case, the respective behavioural assumption would read as follows:

$$C = C(Y) \tag{3.3.13}$$

where C stands for consumption and Y for income. It is clearly unrealistic to believe that income would represent the only determinant of consumption. Other factors such as, for instance, wealth and the general price level certainly also play a role in this respect. Very often, however, for the sake of the analysis, these variables are regarded as constant, following the so-called "ceteris paribus assumption".[7] This is in line with the general idea of modelling just the most important or dominant determinants of the variable under consideration.

Of equal importance are technological equations. The latter generally express technical relationships by means of an equation. One typical example could consist of the well-known "production function" derived from microeconomics. The latter could be expressed as follows:

$$Y = Y(N, K) \tag{3.3.14}$$

where Y represents output, N stands for employment and K for capital. Consequently, this equation basically describes the functional dependence of output from the input factors labour and capital.

Institutional equations in essence describe the behaviour of institutions in the economic process. Typically, some economic decision-makers, such as, for instance, the government or the central bank, set their parameters outside the economic process that is exogenously. Given the fact, that we often do not know the underlying considerations behind these decisions, we typically assume these variables to be given. It then follows:

$$G = \bar{G} \qquad \text{and} \qquad M^S = \bar{M}^S \tag{3.3.15}$$

where G denotes government expenditures and M^S stands for the money supply. The bar on top of the variable then expresses the fact that these variables are set by the government and the central bank respectively and, thus, outside the model.

Another type of equations are the so-called "definitions". The latter basically describe the essence of relationships and, therefore, can never be falsified. It is for this reason, that they are also called "identities". The following relationship, for instance, derives under certain assumptions from the framework of national accounting:

$$Y = C + S \tag{3.3.16}$$

This equation can never be wrong since, via definition, in a closed economy without government, income is either used for consumption or for savings purposes. Despite the fact, that these kinds of relationships can never be falsified, they are by no means redundant. By contrast, they must be seen as being of crucial importance since, as a rule, in a second step, the question for the determinants of the right-hand variables of the identity arises and has to be addressed.

Finally, equilibrium conditions are key features of macroeconomics. An equilibrium situation is a situation, in which no pressure for change exists, since economic subjects have no incentive to alter their behaviour. Therefore, an equilibrium often shows a certain degree of "stickiness". For instance, an equilibrium in the market for a specific good could read as follows:

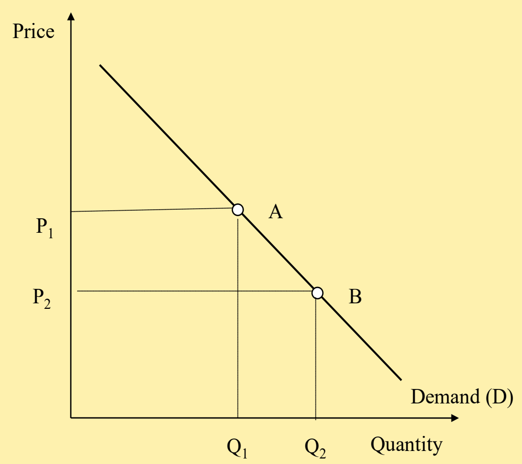
$$Supply = Demand \tag{3.3.17}$$

where "*Supply*" denotes the supply of the good and "*Demand*" denotes the demand for the good. The analysis of models also often differs with respect to the time perspective. If such a model is analysed at a certain point in time, this is often described as a "*static*" model. In case, the movements of the variables over time are investigated, the model can be characterised as being "dynamic". In the framework of the so-called "comparative-static" models, static models are compared at different points in time.

3.4 ANALYSIS OF SUPPLY AND DEMAND

In the framework of graphical analysis, supply and demand visualisations are of crucial relevance. In essence, the "law of demand" states that the higher the price of a good, the lower the quantity demanded, other things being equal. This result holds, since the higher the price of a good, the higher the opportunity costs of buying that good. Since people will try to forgo these higher opportunity costs, they will avoid buying the more expensive good. This logic can be graphically illustrated by means of the demand curve below:

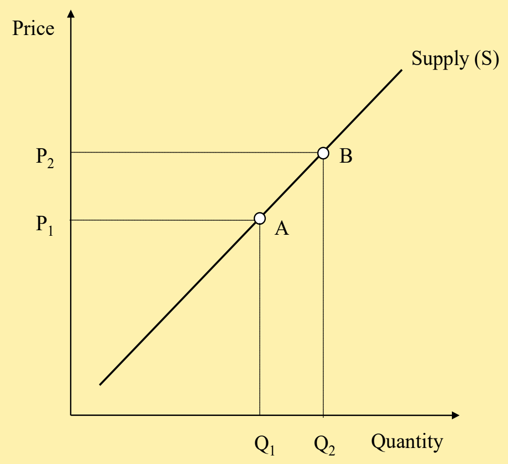
Figure 3.1: Demand Curve



In this illustration, points A and B represent two alternative combinations of price (P) and quantity (Q) demanded. It is easy to see that the higher the price of a good, the less quantity will be demanded. Combining the two points then yields the so-called "demand curve".

Similarly, the "law of supply" illustrates the relationship between the price of a good and the quantity supplied. In this case, however, the relationship has an upward slope, implying that the higher the price, the higher the quantity supplied. This is due to the fact that producers offer a higher quantity in case of a higher price, other things being equal, since this promises higher revenues.

Figure 3.2: Supply Curve

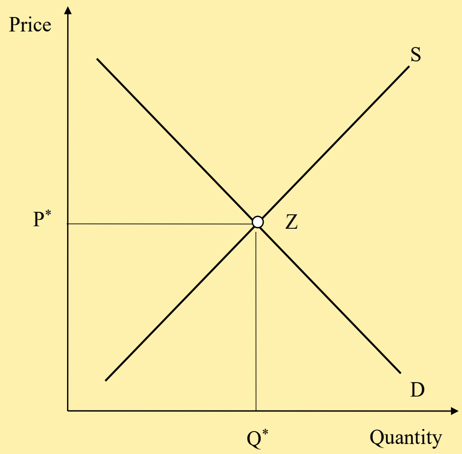


In the chart showing the supply curve, points A and B represent two combinations of price (P) and quantity (Q) supplied. It is easy to see that the higher the price of a good, the more quantity will be supplied. Combining the two points then yields the so-called "supply curve".

Combining both curves into one chart allows us to proceed further with the analysis. In such a chart, there is one specific point, in which the supply function and the demand function intersect and it is exactly at this point where the economy is said to be in equilibrium. The notion of "equilibrium" is of crucial importance in economic analysis since only in this point, everyone is satisfied with the outcome. At a given price, suppliers are selling all the goods they have produced and consumers are getting all the goods they are demanding.

The equilibrium is illustrated in the chart below by the point Z, where the (equilibrium) price of the good will be P^* and the (equilibrium) quantity will be Q^*. It goes without saying that, in reality, in most markets supply and demand conditions will be subject to continuous changes, thus necessitating ongoing changes in equilibrium prices and quantities.

Figure 3.3: Supply and Demand in the Market

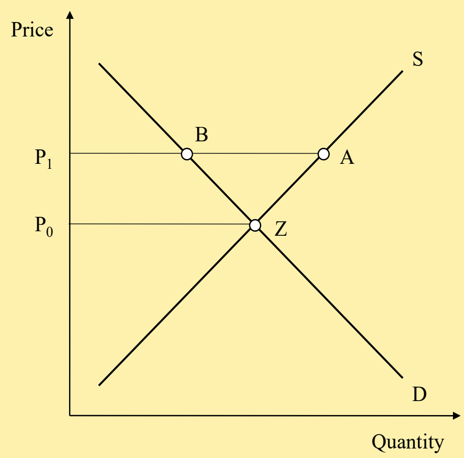


What happens in case of disequilibrium? Assume, for instance, that for some reason, the market price increases and is set at a too high level (as compared to equilibrium). In this case, changes along the supply and demand curves materialise. More specifically, demand will decrease along the demand curve, but – at the same time – supply will increase along the supply curve.

The chart below illustrates these changes in more detail. As a matter of fact, an excess supply situation occurs, which is illustrated by the horizontal distance AB. In case, the market is subject to competitive pressures, the excess situation will not prevail, as some suppliers will lower the price which, in turn, leads to a downward movement along the supply curve. In parallel, the decline in the price will lead to an increase in demand which, in turn, leads to a downward movement along the demand curve. Both movements tend to reduce the excess supply situation step by step.

By contrast, a decline in the market price to a value below its equilibrium will lead to a situation of excess demand. In such a case, some suppliers can be expected to raise prices. At the same time, the higher price will lead to a decrease along the demand curve. Both movements will tend to reduce the excess demand situation step by step.

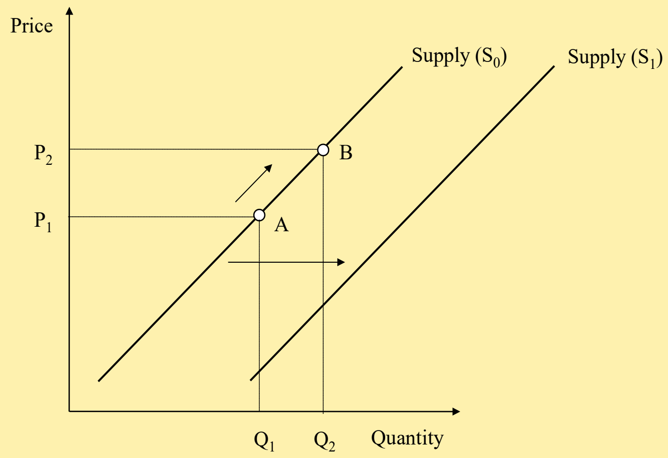
Figure 3.4: Disequilibrium



Another important distinction refers to the difference between a shift along a given curve versus a shift of the curve itself. As a rule, a change in the variables denoted on one of the axes will cause a shift along the curve. For instance, as we have just seen, if the price of a good changes, the quantity demanded will change along the given demand curve. By contrast, if a factor changes that is not shown in the chart, a shift in the curve will materialise. For instance, the emergence of cars has certainly changed the demand for horses. More specifically, the demand for horses must have declined (i.e. a leftward shift in the demand curve) since, for a given price, less demand for horses was expressed in the market.

The graphical analysis makes extensive use of charts. Against this background, it is of particular importance to distinguish between exogenous and endogenous factors. Endogenous variables will generally be found on the x- and y-axes, also often labelled as the "abscissa" and the "ordinate". Changes in the endogenous variables will cause shifts along the curves. Exogenous factors will never be found on the axes. Changes in exogenous variables will have an impact on the model by shifting the curves. In a typical model analysing the supply and demand for a specific good, the price and the quantity would be seen as endogenous factors.

Figure 3.5: Shifts Along a Given Supply Curve versus Shift of a Curve



The supply and demand model allows us to identify the effects of exogenous factors on prices and quantities. In order to derive the new equilibrium, a number of steps are necessary. First, the nature of the exogenous shock needs to be identified. Second, the exogenous shock needs to be assigned to one of the curves. Third, the direction of the shift of the curve needs to be derived. Fourth, the effects for the price and the quantity have to be investigated.

What are the factors leading to a shift in the supply curve? Assume for a moment, a new and better technology would be invented. Assuming unchanged costs for the firms, this would lead to an increase in supply. This, in turn, would lead to a lower price and a higher quantity in equilibrium. Other factors that could lead to a rightward shift in supply are, for instance, a decline in factor prices or the entry of new firms into the market.

Shift in demand	Shift in supply	Eq. price	Eq. quantity
to the right	constant	increases	increases
to the left	constant	decreases	decreases
constant	to the right	decreases	increases
constant	to the left	increases	decreases
to the right	to the right	increases or decreases	increases
to the right	to the left	increases	increases or decreases
to the left	to the right	decreases	increases or decreases
to the left	to the left	increases or decreases	decreases

Table: Supply and Demand Shifts

What are the factors leading to a shift in demand? For instance, an increase in income tends to raise demand for specific goods, thus raising the price and the quantity in equilibrium. Other factors that could initiate an increase in demand are changes in taste in favour of a specific good, an increase in population or an expected future price increase.

What are the effects of shifts in supply and demand? The table above summarises a variety of shifts in demand and supply and their implications for the equilibrium price and the equilibrium quantity.

3.5 COMPLEMENTARY AND SUBSTITUTE GOODS

For some of the following considerations, the exact form of the relationship among goods might also play an important role. In case, the goods are "substitutes", an increase in the price of one good will lead to a decrease in the demand for this good and, at the same time, to an increase in demand for the other good. Examples are butter and margarine, coffee and tea, euro area cars and US cars. In case, the goods complement each other, a decrease in the price of one good does not only raise the demand for this good but also for the complementary good. Examples are bread and butter or CD's and CD-players.[8]

3.6 SLOPE AND ELASTICITY

A measure of particular importance in economics is the "slope" of a curve. It basically shows how a variable reacts to changes in another variable. In a chart with Y on the vertical and X on the horizontal axis, the slope of the curve is defined as the change in Y (or, alternatively, the "rise" in Y) which results from a one-unit change in X (or, alternatively, the "run" in X). More formally, this can be expressed as follows:

$$Slope = \frac{\Delta Y}{\Delta X} \tag{3.6.1}$$

In case of a "straight line", it is particularly easy to derive the slope, since the latter is obviously equal in every point along this line. The slope of a "curve" is harder to calculate, as it varies from point to point along the curve. It is, therefore, necessary to draw a straight line from the origin to that point (i.e. the so-called "tangent"). The slope of the tangent then equals the slope of the curve in that point. In a purely mathematical perspective, the same result can be derived by differencing the curve and inserting the coordinates of the point.[9]

The degree with which a demand or supply curve reacts to a change in price is often dubbed as the curve's "price elasticity". Let us illustrate this concept in terms of the microeconomic framework of the demand for a certain good. In essence, such a price elasticity is calculated as the percentage change in quantity divided by the percentage change in prices. Calculating the elasticity, therefore, requires to know by how much the quantity demanded changes when the price changes. In numerical terms, we can calculate the precise number of price elasticity of demand (ε_D) according to the following formula:[10]

$$\varepsilon_D = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}} \tag{3.6.2}$$

How can such an elasticity be quantified? Keeping in mind that the definition of elasticity refers to percentage changes in price and demand rather than absolute changes, the correct formula would read as follows:[11]

$$\varepsilon_D = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} \tag{3.6.3}$$

This expression brings us to the next question. While the values of ΔQ and ΔP are quite obvious, it is not so clear which values should be used for P and Q. Is it, for instance, the original price or the new price or something in between? For smaller percentage changes, this question is not really of relevance. But for larger changes, the difference is quite significant. It is for this reason, that many practitioners make use of the average price. Then the exact formula will be:

$$\varepsilon_D = \frac{\frac{\Delta Q}{(Q_1 + Q_2)/2}}{\frac{\Delta P}{(P_1 + P_2)/2}} \tag{3.6.4}$$

where P_1 and Q_1 represent the original price and quantity and P_2 and Q_2 stand for the new price and quantity. Finally, given the fact that in case of a "normal" downward-sloping demand curve, the elasticity will always be negative, most practitioners often tend to drop the minus sign from all the numbers, thereby turning the elasticities into positive numbers.

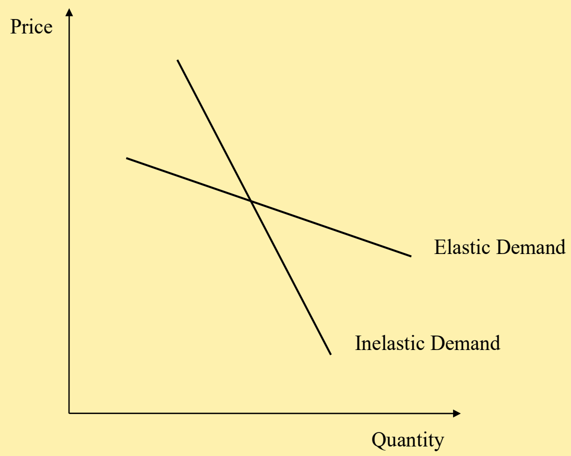
In line with this definition, a good is generally considered to be highly elastic, if a slight change in price has the effect of a large change in the quantity demanded or supplied. By contrast, an inelastic good is one, in which changes in price witness only modest changes in the quantity demanded or supplied, if any at all. In practical terms, an elasticity that is greater than one, points towards the fact that the demand for the item is considered to be elastic. If on the other hand the elasticity is less than one, the demand for that good. is said to be inelastic. A very important special case is a "unit-elastic" demand, which is said to be the case when the percentage change in the quantity is exactly the same as the percentage increase in the price. If, for instance, a one percent increase in the price results in a one percent decrease in demand, the effect will be a unit-elastic demand. It is easy to see that this condition implies that total expenditures in the commodity (which equals price times the quantity) stay the same when the price changes.

As just mentioned, the price elasticity varies among products because some products may be more essential to the consumer. Products that are of essential necessity to the consumer, are generally more insensitive to price changes because consumers would continue buying these products despite price increases. Conversely, a price increase of a good or service that is considered less of a necessity or even a luxury item, will deter more consumers from buying, because the opportunity cost of buying the product will become too high.

How can the elasticity be illustrated in graphical terms? As has been shown in previous sections, the demand curve has a negative slope, and if a large decrease in the quantity demanded is accompanied by a small increase in price, the demand curve must be rather flat or more horizontal. This flatter curve means that the good or service in question is elastic.

By contrast, an inelastic demand is represented with a much more vertical curve as quantity changes little with a large movement in price.

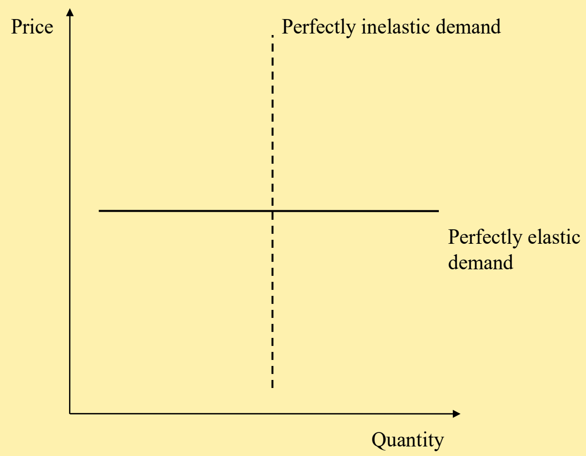
Figure 3.6: Elasticity of Demand



Similar considerations can be applied in the case of the elasticity of supply. If a change in price results in a big change in the amount supplied, the supply curve appears flatter and is considered to be elastic. The price elasticity in this case would be greater than or equal to one. If, on the other hand, a big change in price only results in a minor change in the quantity supplied, the supply curve is steeper, and its elasticity would be less than one.

The chart below illustrates two extreme cases, where the price elasticities of demand are infinite and zero, or "completely elastic" and "completely inelastic". A completely inelastic demand or one with zero elasticity is one where the quantity demanded does not respond at all to price changes. In graphical terms, such a demand can be shown by the vertical dashed curve in the chart below. By contrast, when demand is infinitely elastic, already a tiny change in prices will lead to an infinitely large change in quantity demanded, as shown by the solid line of the horizontal demand curve in the chart.[12]

Figure 3.7: Extreme Cases of Elasticities of Demand



☑ How to Calculate An Elasticity

In this box, we want to have a closer look on how such a price elasticity is calculated. Assume a starting situation, where a price of 80 and quantity of 130 are realised in a market for a specific good. When the price rises to 120, the quantity decreases to 70. What is the corresponding percentage change in price and quantity? Well, obviously.

(i) $percentage\ price\ increase = \frac{\Delta P}{P} = \frac{40}{100} = +40\%$

(ii) $percentage\ quantity\ increase = \frac{\Delta Q}{Q} = \frac{-60}{100} = -60\%$

Then the value for the price elasticity is equal to:

(iii) $\varepsilon_D = \frac{-60}{+40} = -1.5$

This price elasticity is (in absolute terms) larger than one and, therefore, this good is said to be price-elastic.

Finally, it is important to bear in mind that the concepts of the slope and of the elasticity are quite different. Again, this is easy to see in the chart depicted above. While the horizontal curve has a slope of zero, it shows a perfectly elastic demand.

3.7 SUMMARY

- The economic profession often makes use of a suite of, possibly, competing models which differ according to their assumptions, the relevant time horizon, and often also with respect to their conclusions. As regards the time horizon, a common distinction refers to the short-term, the medium-term and the long-term horizon.
- In macroeconomic analysis, a number of methodological approaches, such as the verbal analysis, the graphical analyis and the mathematical analysis can be followed. In the framework of mathematical analysis, various forms of equations can be distinguished, among them behavioural equations, technical equations, institutional equations, definitions or identities and equilibrium conditions.
- The analysis of models also often differs with respect to the time perspective. If such a model is analysed at a certain point in time, this is often described as a "static" model. In case, the movements of the variables over time are investigated, the model can be characterised as a being "dynamic". In the framework of the so-called "comparative-static" models, static models are compared at different points in time.
- Another important distinction refers to the difference between complementary goods and substitutes. In case, the goods represent substitutes, an increase in the price of one good will lead to a decrease in the demand for this good and, at the same time, to an increase in demand for the other good. In case, the goods complement

each other, a decrease in the price of one good does not only raise the demand for this good, but also for the complementary good.
- Two other key economic notions are the concept of the slope of a curve and the concept of elasticity.

🕮 Key Concepts

Models, verbal analysis, graphical analysis, mathematical analysis, behavioural equations, technical equations, institutional equations, definitions, identities, equilibrium conditions, static analysis, dynamic analysis, comparative-static analysis, law of supply, law of demand, equilibrium and disequilibrium, changes along the curves, shifts of the curves, complementary goods, substitutes, shifts in demand and supply, slope, elasticity.

☑ Questions for Review

- What are the basic features of a macroeconomic model?
- What is the difference between exogenous and endogenous variables?
- Which different kinds of analysis can be distinguished?
- Which kind of equations play a role in macroeconomics?
- What are the differences between a static, a dynamic and a comparative-static analysis?
- What is behind the concept of supply and demand? Which kind of disequilibria can occur and which correcting forces can be seen as being at work?
- What is the meaning of complementarity and substitutability between goods?
- Describe briefly the concept of elasticity. What can the concept be used for? In which way is the price elasticity of a good of relevance for demand and supply?

☑ Digging Deeper

In the beginning of the year 2015, after intense talks of officials from Iran with the United States, Britain, China, France, Russia and Germany in Vienna, it was decided that – after 10 years of isolation – the nuclear-related sanctions on Iran will be lifted after Iran had complied with an agreement discussed in July 2015. Considering that Iran was before one of the world's greatest oil exporters, whar would be your assessment regarding the foreseeable changes in supply and demand in the oil market? What would be your guess for the implications regarding the level of the oil price? Could there be additional aspects, if your analysis distinguishes more explicitly between the short run and the long run?

PART II

4 NATIONAL INCOME ACCOUNTING

4.1 LEARNING OBJECTIVES

This chapter is devoted to the basics of national income accounting. We start with some basic accounting conventions before passing on to the limitations of GDP measurement and the key distinction between nominal and real GDP. We then proceed with a simple circular flow analysis. Finally, we introduce Say's Law and Keynes' Law.

4.2 ACCOUNTING CONVENTIONS

In economics, a number of measures of national income and output are used to quantify the value of goods and services produced in an economy over a specific time period. These measures basically rely on a system of "national accounts" (or "national accounting") first developed during the 1940s. Some of the more common measures are the Gross National

Product (GNP), the Gross Domestic Product (GDP), the Gross National Income (GNI) and many more.

To begin with, following theoretical considerations, GDP is defined as "the total market value of all final goods and services produced in an economy in a given time period", usually that time period is one year. It is intuitively clear from this definition that GDP represents a flow variable that is an amount over a given unit of time, in contrast to a stock variable, which is a quantity at a given point in time.[13] In addition, GDP figures are not only a widely-accepted measure of economic performance, they also serve quite often as a basis for cross-country comparisons.

In this context, an important distinction refers to the difference between GDP and GNP. While euro area GDP measures the value of all final goods and services produced in the euro area irrespective of the ownership of the entity producing the good or the service, GNP measures the value of all final goods and services produced by euro area entities irrespective of their location. Hence, the cars produced by BMW in Spartanburg (USA) are, for instance, part of the GDP of the United States, but, at the same time, part of euro area GNP.

The market value of any good is calculated as the price of the good times the quantity of the good produced and, in the literature, the corresponding aggregate is generally labelled as "nominal GDP". There are, however, several different ways of calculating these GDP numbers. This notwithstanding, the various GDP definitions must be equivalent because the total income in an economy must equal the total amount of expenditure for goods and services in an economy, which must equal total production. It follows:

$$\text{Total production} = \text{total expenditure} = \text{total income} \tag{4.2.1}$$

In the literature, this equation is often called the "fundamental identity of national income accounting".[14] Against this background, the "expenditure approach" determines aggregate demand by summing consumption, investment, government expenditure and net exports. Similarly, the "income approach" and the closely related "value added approach" are alternative approaches, which follow their own lines of reasoning. With the exception of a few, but minor adjustments, the various ways to calculate GDP should all yield the same result.

More specifically, GDP is, first, equal to the sum of the values added at all stages of the production process (i.e. "value added approach"). Second, GDP corresponds to the value of expenditure on the final goods and services produced (i.e. "expenditure approach"). Third, GDP is equivalent to the sum of factor payments, such the wages, interest, profits, and rents paid to factors of production (i.e. "income approach"). Taken together, the three approaches of calculating GDP provide important information on the source and use of this measure.

4.3 NOMINAL AND REAL GDP

As already mentioned, euro area nominal GDP is calculated as the sum of the quantities of final goods produced times their current prices and is, thus, measured in euros (€).[15] As a consequence, an increase in nominal GDP over time can be due to two reasons, namely first, to the fact that the production of most goods has increased over time, and second, to the fact that the euro price of most goods has increased over time. In order to account exclusively for the rise in production and to eliminate the effect of increasing prices, economists generally make use of the concept of real GDP. By definition, real GDP (Y) equals the ratio of nominal GDP (Y^N) and the price level (P).

$$Y = \frac{Y^N}{P} \tag{4.3.1}$$

Nominal GDP is also called "euro GDP" or "GDP in current prices". Real GDP is called "GDP in terms of goods", "GDP in constant prices" or "GDP adjusted for inflation".

4.4 GDP AND WELFARE

In the public, measures of GDP – and thereby especially GDP per capita – are often interpreted as an indicator of people's welfare, well-being or even happiness. There are, however, serious limitations to the usefulness of GDP as such a measure. To begin with, GDP measures market activity and, therefore, measures of GDP typically exclude all activities not traded in the market, thus leading to distortions. Among those operations, unpaid economic activities, such as for example domestic work, have to be mentioned. For instance, the income paid to a childminder will contribute to GDP, whereas the time of a mother, which takes care of her children in a similar manner but remains unpaid will not. Similarly, a number of factors that are of relevance for the quality of life are not counted in the GDP, since they are not traded in the market. For instance, pollution and other negative environmental concomitants are excluded. By contrast, a case of death will add positively to GDP since the related economic transactions, such as hospital expenses, the funeral services and the execution of the will by lawyers and bankers all count as additional sales of goods and services.[16]

Finally, while GDP (by definition) represents a measure of total output, it does not take the inputs needed to produce the output into account. Assume, for example, that everyone would work for twice the number of hours. It can then be expected that this would lead to a GDP that broadly doubles. This notwithstanding, the workers are not necessarily better off as they would certainly have less leisure time. Moreover, an international comparison of GDP across various countries crucially hinges on the use of an appropriate equlibrium exchange rate in order to convert GDP measures.

☑ The Shadow Economy

The expression "shadow economy" (or, alternatively, "underground economy") is often used to describe the part of the economic activity that is not measured in economic statistics. The latter fact can be due to a number of reasons, among them the fact that the respective activity is illegal or not reported, for instance, to avoid paying taxes for these activities. Some empirical investigations have estimated the share of black market activities or illegal employment to GDP to be around 10–15% for Germany in the beginning of the nineties.[17] For some Southern and Eastern European countries, the respective figures are between 20% and 30%.

Source: Schneider and Enste (2000).

Because of these caveats, other measures of welfare such as, for instance, the "Index of Sustainable Economic Welfare" have been proposed.[18] These concepts are, however, beyond the scope of this introductory textbook. At the same time and notwithstanding these shortcomings, GDP will – at least for the time being – remain our best single indicator of macroeconomic performance.

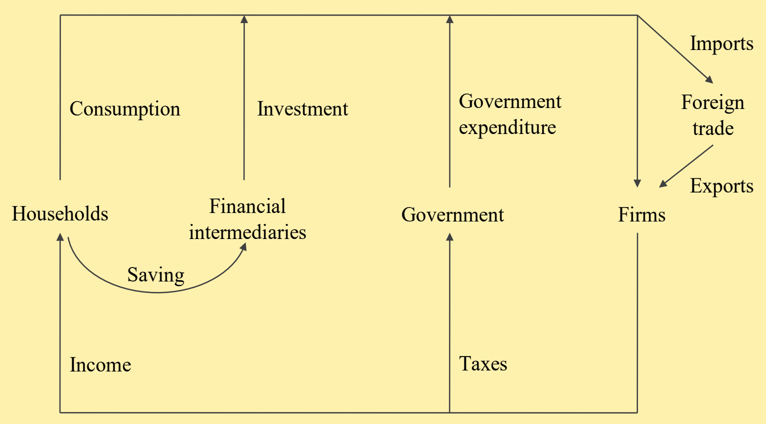
4.5 A CIRCULAR FLOW ANALYSIS

The following sections are foreseen to lay the foundations for all further chapters. We start with a discussion of the macroeconomic circular flow.

This methodology basically illustrates the connection between the income generated by the productive activities of firms and the demand for goods and services by consumers, investors, government and foreign trade. The economic subjects involved in this kind of analysis are consumers, firms, financial intermediaries and the government. The major expenditure categories include consumption, investment, government spending and foreign trade.

In principle, the arrows can either depict the flow of goods and services, or, what is more common, the monetary flows. Against this background, in order to produce output, firms will have to pay the factors of production an income, which is equal to the value of output produced. Part of this income is then usually transferred to the government in form of taxes, while the remaining part represents flows to consumers in the form of disposable income. Consumers will then spend part of their disposable income and save the rest. The portion spent translates into consumption expenditure, while savings are used by financial intermediaries to finance investment expenditure.

Figure 4.1: Circular Flow in the Economy



Taxes collected by the government are used to finance government expenditure. Part of consumption, investment and government expenditure flows out of the domestic economic system and is used to purchase imports. On the other hand, foreign demand for euro area products – i.e. exports – adds to total expenditure on domestic goods. With everything in balance, the value of expenditure on euro area goods will equal the value of GDP. The equivalence of GDP and the values of expenditure is consistent with the "final expenditure approach" to calculating GDP.

☑ Say's Law and Keynes' Law

When thinking in more detail about the starting point of the circular flow analysis, the question of "chicken or egg" inevitably arises. In other words, what comes first? Is it supply or demand? If we believe that production creates via the factor payments the income that finally allows for expenditure, then "supply would create its own demand". This is sometimes referred to as Say's Law after the famous French economist Jean Baptiste Say (1767–1832). The opposite view has been advocated by the famous British economist John Maynard Keynes (1883–1946). In his view, the demand for goods and services leads to their production, therefore "demand creates its own supply".

The sum of all expenditure categories derived from the circular flow is known as "aggregate demand" or, alternatively, as "aggregate expenditure". When spending is in balance, aggregate expenditure equals GDP. If we follow the standard practice used in economics and denote GDP by the letter "Y", in a closed economy without government, aggregate demand can be expressed as follows:

$$Y = C + I \tag{4.5.1}$$

where C equals consumption and I equals investment. In a closed economy with government, the relationship mutes to:

$$Y = C + I + G \tag{4.5.2}$$

with G standing for government expenditure. In an open economy with government, aggregate demand can be written as follows:

$$Y = C + I + G + EX - IM \tag{4.5.3}$$

where EX represents euro area exports (i.e. euro area goods purchased by foreigners) and IM stands for the imports (i.e. foreign goods purchased by euro area residents). In the following chapters, the driving forces behind each of these components will be investigated in more detail.

4.6 SUMMARY

- In economics, a number of measures of national income and output are used to quantify the value of goods and services produced in an economy over a specific time period. They basically rely on a system of national accounts (or national accounting) first developed during the 1940s.
- There are several different ways of calculating such measures, namely the expenditure approach, the income approach and the closely related value added approach.
- An important difference relates to the distinction between nominal and real GDP. While nominal GDP is calculated as the sum of the quantities of final goods produced times their current prices, real GDP eliminates the effect of increasing prices and, thus, accounts exclusively for the rise in production.
- Measures of national income are often interpreted as a measure of people's welfare. There are, however, serious limitations to such an interpretation.
- The popular macroeconomic circular flow analysis basically illustrates the connection between the income generated by the productive activities of firms and the demand for goods and services by consumers, investors, government and foreign trade.

📖 Key Concepts

National accounting, GDP, value added approach, final expenditure approach, factor payments approach, nominal GDP, real GDP, circular flow analysis, consumption, investment, government expenditure, taxes, exports, imports.

☑ Questions for Review

- How can the Gross Domestic Product be defined?
- Which different approaches to calculate GDP do you know?
- What is the difference between nominal and real GDP?
- How would a circular flow analysis including households, firms and the government look like?
- Which major expenditure categories do you know?

5 THE MARKET FOR GOODS

5.1 LEARNING OBJECTIVES

We start with some basic considerations on the market for goods and then proceed by taking a closer look at the consumption function. Afterwards, we dig deeper into the determinants of investment before we derive the equilibrium in the market for goods. Finally, we turn to the multiplier concept and the derivation of the IS curve.

5.2 BASIC CONSIDERATIONS

The market for goods is the place, where the supply of and the demand for goods meet. In this respect and, as already mentioned in earlier chapters, the supply of goods results from the combination of production factors in the production process. In the following sections, we will, however, concentrate on the demand for goods and its determinants.

The final expenditures approach to GDP and its major expenditure categories can be seen as a natural starting point for the following deliberations. In algebraic terms, the approach can be expressed as follows:

$$Y = C + I + G + EX - IM \tag{5.2.1}$$

where C denotes consumption, I represents investment, G stands for government expenditure and EX and IM stand for exports and imports, respectively.

Consumption expenditure (or, alternatively, consumption) constitutes by far the largest part of GDP. The latter terminology stands for the total spending for currently produced consumer goods and services. Three categories are worth mentioning in that respect. First, the biggest part of consumer spending is consumer services. Consumer services include – among other things – the rent, the rental value of owner-occupied housing, medical care, transportation, entertainment, and other items. Second, consumer spending on goods is often divided into consumer durables and nondurables. Durable goods are goods that last one year and more and they include, for instance, furniture and cars. By contrast, nondurables are short-lived consumer goods such as, for instance, food and clothing. From an economic perspective, consumption shows a rather stable behaviour.[19]

Investment refers to business expenditure on currently produced capital goods that are intended to produce goods and services in the future. In this context, business fixed investment (for instance, spending on equipment), residential investment (for instance, household spending on new houses and apartments) and inventory investment (changes in inventories held by firms) are distinguished.[20] Investment must be seen as the most volatile component of GDP and, quite often, fluctuations in GDP can directly be traced back to changes in investment.

☑ GDP and its Components – Some Figures

Already a first look at the data reveals some striking results on the relative importance of the various components in the euro area. In 2016, private consumption expenditures were around € 5875.7 billion, government expenditures were around € 2221.5 billion, gross investment was around € 2138.1 billion and inventories were around € -2.1 billion.[21] At the same time, exports and imports were around € 4902.6 billion and 4402.6 billion, respectively. Expressed in percentages, the relative share of private consumption expenditures to total GDP was around 54.7%, compared to 20.7% for government expenditures, 19.9% for gross investment (0.0% for inventories) and 4.7% for the contribution of exports and imports.

Source: ECB data.

Government purchases represent spending by the government on currently produced goods and services. They include purchases of new goods (i.e. highways) as well purchases of new services (i.e. police) and, therefore, add to GDP. Transfer payments are part of government spending, but they are not included in government purchases or GDP, since they are not made in exchange for currently produced goods and services. Transfer payments include welfare, social security, transfer interest payments on national debt, and other payments made by the government. Like investment, government purchases exhibit some volatility, albeit to a lesser degree. Net exports, referring to the difference between exports and imports, constitute the remaining major component of GDP.

At the same time, it is worth noting already at this stage that, given the fact, that aggregate demand and its components sometimes show quite considerable swings over time, the following considerations might also serve as a basis for a simple theory of the business cycle.[22]

For didactical reasons, it seems recommendable to start by analysing the situation of a closed economy without government. In such a case, aggregate demand consists of the sum of the (planned) demand for consumption goods (C) and the (planned) demand for investment goods (I). Expressed in terms of an equation, this yields:

$$Y = C + I \tag{5.2.2}$$

We will now proceed by further analysing the determinants of private consumption, before turning in more detail towards investment behaviour.

5.3 THE CONSUMPTION FUNCTION

Private consumption must be seen as a rather complex macroeconomic variable that is subject to the influence of a variety of factors. Among the latter factors, the level of interest rates, the price level (or, more precisely, the change in the price level that is the inflation rate), the tax rate, the income distribution and many more can be found.

Following the British economist John Maynard Keynes (1883–1946), income should be seen as the dominant determinant of consumption. Assuming the constancy of all other factors mentioned above (that is "ceteris paribus"), this leads to the following consumption function:

$$C = C(Y) \tag{5.3.1}$$

Quite obviously, this relationship constitutes a "behavioural assumption". It is also worth mentioning already at this stage that according to the budget constraint (i.e. $Y = C + S$), the level of consumption then also determines the level of savings, which again depends on the level of income. It then follows:

$$S = S(Y) \tag{5.3.2}$$

☑ Consumption and Saving – A Simple Example

In this box, we want to illustrate some of the terms explained below by means of an example. Assume, the values for income and consumption (i.e. columns (1) und (2)) are given as a starting point.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Y	C	S	c	s	c′	s′
1000	700	300	0.7	0.3	0.7	0.3
2000	1400	600	0.7	0.3	0.7	0.3
3000	2100	900	0.7	0.3	0.7	0.3
4000	2800	1200	0.7	0.3	0.7	0.3
…	…	…	…	…	…	…

Then, the level of saving (i.e. column (3)) can simply be derived by subtracting (2) from (1). The average propensity to consume (i.e. column (4)) follows from dividing (2) by (1). The average propensity to save (i.e. column (5)) can be derived in a similar way, namely by dividing (3) by (1). The marginal propensity to consume, shown in column (6), can be calculated by taking the changes in the time series for consumption (i.e. the difference of two adjacent observations in column (2)) divided by the changes in the time series for income (i.e. the difference of two adjacent observations in column (1)). In an analogous way, the marginal propensity to save can be derived (i.e. columns (3) and (1)).

This basic hypothesis of Keynes, stating in essence that the current level of consumption depends on the "current" level of income, has in the literature often been referred to as the "absolute income hypothesis". It is probably the most popular and, at the same time, by far the simplest consumption function in macroeconomics.

Is there anything that can be said about this dependence? Or, more specifically, what can we say about the sign and the size of this relationship? Indeed, it seems plausible to assume that an increase in income leads to an increase in consumption. It then follows that:

$$c = C/Y \qquad \text{with } dC/dY > 0 \tag{5.3.3}$$

Against this background, two specific measures turn out to be of particular relevance. The "average propensity to consume" is defined as the ratio of consumption expenditures to income. The "marginal propensity to consume" is defined as the change in consumption expenditures that results from an extra euro of income or, in other words, the fraction of an extra euro of income that households spend on consumption goods and services. Similar measures can be defined for savings. In algebraic terms, it follows:

$$C = C(Y) \quad = \text{average propensity to consume} \tag{5.3.4}$$

$$s = S / Y \quad = \text{average propensity to save} \tag{5.3.5}$$

$$c' = dC / dY \quad = \text{marginal propensity to consume} \tag{5.3.6}$$

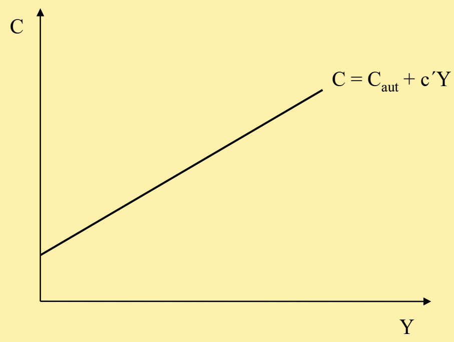
$$s' = dS / dY \quad = \text{marginal propensity to save} \tag{5.3.7}$$

In the next step, we can assume the existence of an autonomous level of consumption that is a part of consumption, which is independent of the level of income. In a way, this can be interpreted as a kind of "subsistence level". The latter assumption would imply that, when expressed in graphical terms, the consumption function would not go through the origin but, instead, would show a linear inhomogeneous shape. Explained in other words, if income equals zero, a positive value of consumption exists. It then follows:

$$C = C_{aut} + c' \cdot Y \qquad \text{with} \qquad C_{aut} > 0 \tag{5.3.8}$$

Expressed in graphical terms, this would lead to the following result:

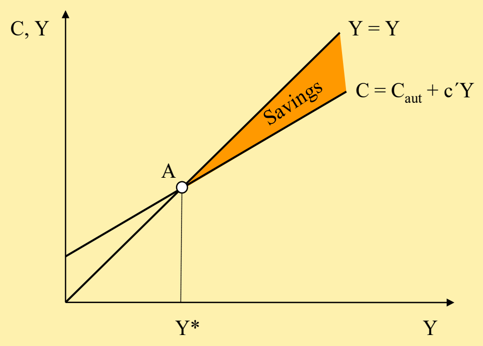
Figure 5.1: Consumption Function with Autonomous Consumption



It is then rather straightforward to extend this chart in order to account for additional considerations. In fact, when incorporating – in addition to the consumption function – the "income line" into the chart, the latter would take the shape of a 45-degree line. In every point along this line, the condition Y = Y holds.

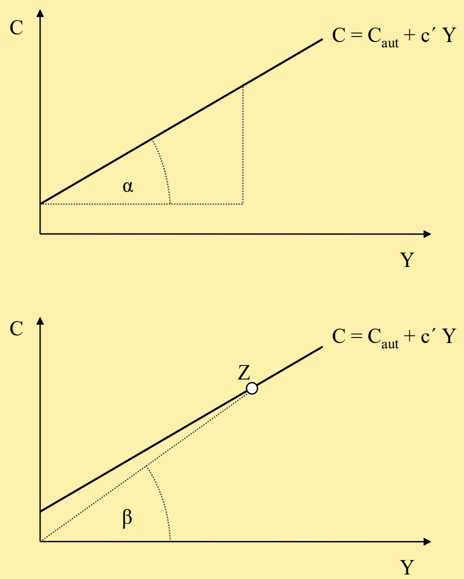
It is rather intuitive to see that to the left of point A – the location in which the consumption function crosses the income line – the level of consumption is higher than income. In such a case, the autonomous consumption can only be financed by means of dissaving, which means that savings accrued over past periods have to be used for the financing of consumption. By contrast, to the right of point A, consumption is lower than income. In this case, we can easily illustrate the level of savings, which corresponds exactly to the vertical distance between the 45-degree line and the consumption function.

Figure 5.2: Consumption Function and 45 Degree Line



How can we illustrate the average and the marginal propensity to consume in such a chart? In fact, the marginal propensity to consume (c') corresponds exactly to the slope of the consumption function, that is the tangent of the angle α. The average propensity to consume must be evaluated by means of a straight line starting from the origin and reaching the corresponding point on the consumption function. The tangent of the angle β then exactly corresponds to the average propensity to consume. Quite obviously, for such a type of function, the average propensity to consume always exceeds the marginal propensity to consume.

Figure 5.3: Average and Marginal Propensity to Consume



At this point, it seems useful to illustrate some further basic considerations in a more formal way. Recall, for instance, the following relationship:

$$Y = C + S \tag{5.3.9}$$

Taking the (partial) derivative for Y then yields:

$$dY/dY = dC/dY + dS/dY \tag{5.3.10}$$

Following some of the definitions outlined above, it follows that:

$$1 = c' + s' \tag{5.3.11}$$

As a result, the marginal propensities to consume and to save just add up to one. It is easy to show that the same holds for the respective average propensities, since:

$$Y = C + S \qquad \text{and thus} \tag{5.3.12}$$
$$Y/Y = C/Y + S/Y \tag{5.3.13}$$
$$1 = c + s \tag{5.3.14}$$

The additional empirical observation that an increase in income leads to a lower than proportional increase in consumption and a higher than proportional increase in savings has been labelled by Keynes as a “fundamental psychological law”. Quite obviously, this law would imply that an increase in income has to go along with a decline in the average propensity to consume and an increase in the average propensity to save. In the aftermath of the second World War, however, for various countries the data seemed to contradict this hypothesis. At the time, it could be observed that a considerable rise in income was not – as predicted by Keynes – accompanied by a decrease in the average propensity to consume. As a consequence, macroeconomists have started to develop alternative concepts describing the behaviour of consumption. Among the various income hypothesis discussed in the literature are the following:

- the “absolute income hypothesis” of John Maynard Keynes. This hypothesis states that current consumption is a function of current income. This hypothesis has also often been termed as the “theory of the day-labourer”.
- the “relative income hypothesis” of James Duesenberry. According to this hypothesis, consumption depends on the relative income position and, thus, on the social status of the individual (i.e. “to keep up with the Joneses”).
- the “permanent income hypothesis” of Milton Friedman. Friedman claimed that consumption decisions would not only be based on current, but also on expected future income.
- the “life cycle hypothesis” of Albert Ando and Franco Modigliani. Following this hypothesis, consumption is a function of income over the whole life.[23]

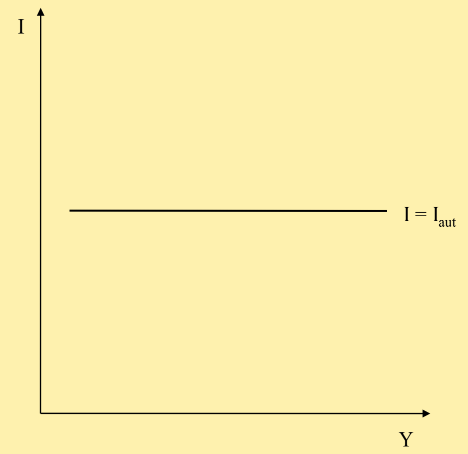
5.4 THE INVESTMENT FUNCTION

This section aims at shedding more light on investment and its determinants. Before going into more details, it should be noted, that the following considerations focus on physical investment (i.e. purchases of goods like installations, machines, inventory goods etc.) rather than financial investment (i.e. financial or portfolio investment). As in the case of consumption, we analyse the case of “planned investment”.

What are the determinants of investment? Just like consumer expenditures, investment must be seen as a variable that is subject to a variety of determinants such as, for instance, tax deductions, future profit prospects, interest rates and many more. In a first step, however, we neglect all determinants and assume that the entrepreneur plans a certain level of investment that is independent from the level of income (i.e. a certain amount of “autonomous investment”). It then follows:

$$I = I_0 = I_{aut} \qquad (5.4.1)$$

Figure 5.4: Autonomous Investment Function

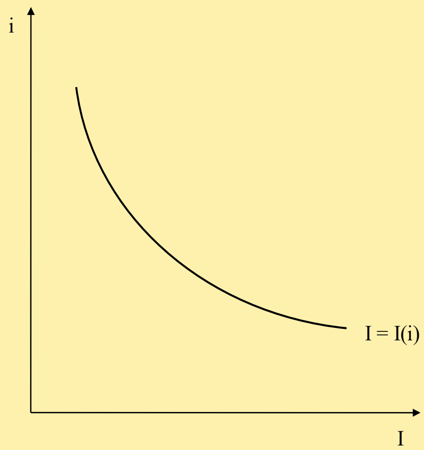


As a consequence, in a diagram that depicts income on the horizontal and investment on the vertical axis, such an equation would take the form of a straight line running in parallel to the income axis. In other words, independent of the level of income, a certain amount of investment would be realised.

It is easy to see, that this is an unrealistic assumption. In the next step, we, therefore, refer to a more realistic assumption, claiming that investment is related negatively to the market interest rate. It then follows:

$$I = I(i) \text{ with } dI/di < 0 \tag{5.4.2}$$

Figure 5.5: Interest Rate Dependent Investment Function



What could be the reasoning behind this? Let us illustrate the basic ideas by means of a simple example. Starting from the assumption that an investment is only realised when it yields a positive return in the end, our considerations focus on three key elements for the decision-making, namely, first the expected return of the investment, second the costs of the investment and third, the market interest rate. More precisely, we assume for the time being that the purchase of a machine would cost € 5000. The expected lifetime of the machine would be four years and the expected returns could be foreseen as € 1700 per year. Expressed in a simple timetable, this could look as follows:

Time	Costs (in €)	Revenues (in €)
T	+ 5000	
t+1		+ 1700
t+2		+ 1700
t+3		+ 1700
t+4		+ 1700
Sum	+ 5000	+ 6800

Table: Cost-Benefit Analysis

These rather simple calculations seem to show that the revenues exceed the costs, thus rendering the investment profitable. It should be noted, however, that future revenues are unknown and, thus, have to be estimated. It goes without saying that such estimates are usually surrounded by a high degree of uncertainty.

Moreover, our back-of-the-envelope calculations can very easily be criticized. This is due to the fact that, so far, we have completely ignored the effects of interest rates. The € 1700 that will be received next year do not correspond to the same amount this year, in fact, they do have a "present value" ("PV"). If this present value is invested and earns some interest payments, it yields € 1700 next year. This interest rate effect has to be taken into account appropriately.[24]

How can such a present value be calculated? Suppose, a certain amount (A_0) is invested for one period. One period later (i.e. $t=1$), this will lead to a "future value" ("FV") of:

$$FV = A_1 = A_0 \cdot (1+i) \tag{5.4.3}$$

And after two years ($t=2$), the investor would earn the following amount:

$$FV = A_2 = A_1 \cdot (1+i) = A_0 \cdot (1+i) \cdot (1+i) = A_0 \cdot (1+i)^2 \tag{5.4.4}$$

as can be shown by simple substitution. In the case of four years, the present value would correspond to $1700/(1+i)^4$. And more generally, it follows:

$$FV = A_t = A_0 \cdot (1+i)^t \tag{5.4.5}$$

This gives us the "future value" of an amount invested today. However, it does not fully answer our initial question, as we were looking for the "present value" of an amount to be received in the future. It is, however, easy to see that the following relationship would hold:

$$PV = A_0 = \frac{A_t}{(1+i)^t} \tag{5.4.6}$$

In other words, € 1700 which are going to be earned in one year's time then have a present value (G_0) of:

$$G_0 = \frac{1700}{(1+i)} \tag{5.4.7}$$

And € 1700, which are to be received in two year's time then have a present value (G_0) of:

$$G_0 = \frac{1700}{(1+i)^2} \tag{5.4.8}$$

Extending these considerations for a time horizon of four years then leads to the following relationship:

$$G_0 = \frac{1700}{(1+i)} + \frac{1700}{(1+i)^2} + \frac{1700}{(1+i)^3} + \frac{1700}{(1+i)^4} \tag{5.4.9}$$

Assuming an interest rate of 10%, this gives:

$$G_0 = \frac{1700}{(1+0.10)} + \frac{1700}{(1+0.10)^2} + \frac{1700}{(1+0.10)^3} + \frac{1700}{(1+0.10)^4} \tag{5.4.10}$$

$$G_0 \approx 1545 + 1405 + 1277 + 1161 \approx 5388 \tag{5.4.11}$$

The sum of the discounted revenues then equals € 5388, whereas the sum of the costs still corresponds to € 5000. This basically means that the investment should be realised as it would imply making a profit. The difference of € 388, we just calculated, is often called the "capitalised value" or "net present value". Summing up, we can say that an investment is profitable if the net present value is positive.

It is obvious from these deliberations that not only the net present value, but also the costs and estimated revenues depend to a crucial extent on the level of the interest rate. Moreover, as the interest rate can be found in the denominator, a negative relationship must exist.

We can thus summarise, that the interest rate seems to play a role for investment in the sense that, ceteris paribus, the lower the level of the interest rate, the more profitable is the investment and vice versa.

There is another way to determine the optimal level of investment. So far, we made use of the interest rate in order to calculate the net present value. Alternatively, we could search for the interest rate, for which the net present value just equals zero, given the costs and the expected revenues of the investment. More particularly, we are looking for the interest rate for which the discounted revenues just equal the costs. This can be called the "internal rate of return" or, following Keynes, the "marginal efficiency of capital". If we denote this internal rate by *r*, it follows that:

$$\left[\frac{1700}{(1+r)^1}+\frac{1700}{(1+r)^2}+\frac{1700}{(1+r)^3}+\frac{1700}{(1+r)^4}\right]=5000 \qquad (5.4.12)$$

$$\left[\frac{1700}{(1+r)^1}+\frac{1700}{(1+r)^2}+\frac{1700}{(1+r)^3}+\frac{1700}{(1+r)^4}\right]-5000=0 \qquad (5.4.13)$$

It then follows that the internal rate is around 13.5%. If the market interest rate were to be 10%, the investment would clearly turn out to be profitable, since the internal rate would exceed the rate charged for a loan or the return of a financial investment of the same amount. As a rule, it then follows that such an investment pays off when the internal rate is higher than the market interest rate.

Both methods then allow for the conclusion that an investment is all the more profitable, the lower the market interest rate in an economy. Following Keynes, investment will take place as long as:

$$r \geq i \tag{5.4.14}$$

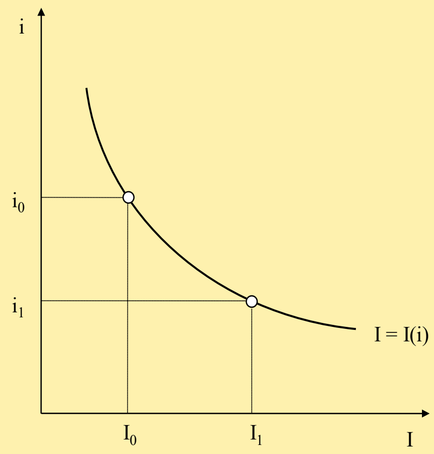
There are, of course, two assumptions underlying the analysis. First, it is assumed that the marginal efficiency of capital declines with an increasing number of investments. This can be justified by the fact that the more investment is realised, the higher the prices for investment goods and, ceteris paribus, the lower the marginal return of the investment. For this reason, the marginal efficiency of capital remains different from the market interest rate, but it can be expected to converge against the market interest rate. If the market interest rate rises, the lower bound of the equilibrium condition increases and only projects, whose marginal efficiency of capital is at least equal to the market interest rate get realised. It then follows:

$$I = I(i) \qquad \text{with } dI/di < 0 \tag{5.4.15}$$

The aforementioned considerations can be easily illustrated in a chart in which the investment projects are ordered according to their marginal efficiency of capital.

If the market interest rate is introduced into the same diagram, following the rule outlined above, all projects have a positive return that are higher than the market interest rate (i.e. I_0). If the market interest rate decreases to i_1, a movement along the curve (i.e. along a given investment function) will happen. As a consequence, more investment projects (i.e. I_1) are profitable. It is easy to see that the sensitivity of investment vis-à-vis changes in market interest rates depends obviously on the slope of the curve, or, expressed in economic terms, on the interest rate sensitivity of investment.

Figure 5.6: Investment Projects and Marginal Efficiency of Capital



In this respect, Keynes emphasised the view that investment sometimes does not only react in a rather unpredictable way to changes in interest rates, but over certain periods might even become interest-rate inelastic. How can that be explained? First, according to Keynes, psychological effects do play an important role. More particularly, pessimistic expectations are of relevance. If this is the case, investors will keep the same numbers for the costs but, ceteris paribus, assume lower values for the expected returns. Following this, the marginal efficiency of capital will decrease and, in line with this, also the number of investments realised. Against this background, waves of optimism and pessimism could lead to instabilities in the investment function.

Second, it might be plausible that investment does not react anymore to changes in interest rates, if for instance in a serious recession, already the available machinery is not used at its full capacity.

Third, as regards the estimation of the future revenues, in economically difficult times, investors often incorporate a risk premium, which is then added to the market interest rate. The riskier the project is perceived, the higher will be ceteris paribus the risk premium. Under certain circumstances, it could even be possible that, although the market interest rate decreases, the project is not realised due to a high risk premium.

Fourth, only under very restrictive assumptions, the investment function can be seen as stable over several periods. Suppose that in the current period (given an interest rate of i_0) all investment projects up to the amount of I_0 have been realised, so that the capital stock has been accordingly increased. Following this, and given the same interest rate i_0, net investment in the next period would be equal to zero. Only in the case of a decrease in the interest rate (to i_1), a net investment of $(I_1 - I_0)$ would become profitable. It should be noted, however, that so far we have been dealing with the analysis of just one period, so that we have excluded "dynamic" aspects, such as the growth of the capital stock and technical progress from our deliberations. Insofar, in a strict sense, this critique does not apply here.

Fifth, following the so-called "accelerator hypothesis", investment does not only depend on the level of interest rates, but also on changes in demand:

$$I = f(\Delta Y) \tag{5.4.16}$$

Since investment constitutes an important component of demand, fluctuations in investment lead to volatilities in demand which, then, in turn can lead to swings in the business cycle. Taken together, we can summarise that in case, expectations about the business climate and waves of optimism or pessimism (in the words of Keynes, "animal spirits") play a role for investment, the investment function can become rather unstable, at least over certain periods. This is equivalent to saying that, even in face of a stable relationship between interest rates and investment, investment can be subject to rather erratic shifts. For the following considerations, however, we will first assume the existence of an autonomous investment function.

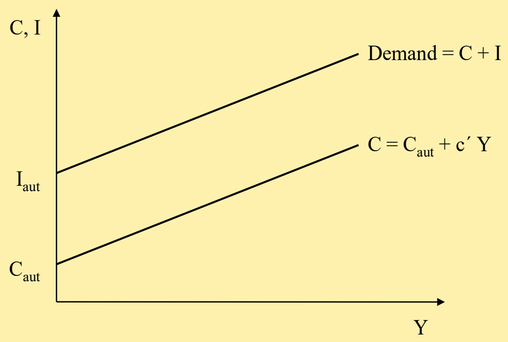
5.5 EQUILIBRIUM IN THE MARKET FOR GOODS

After having discussed the various modules individually, we are now in the position to derive the core of the Keynesian theory, namely the equilibrium in the market for goods (in form of the so-called "Keynesian Cross"). The various pieces needed for this concept are a typical Keynesian consumption function and an autonomous investment function. In short:

$$C = C_{aut} + c' \cdot Y \quad (5.5.1)$$

$$I = I_{aut} \quad (5.5.2)$$

Figure 5.7: Aggregate Demand in the Market for Goods



For the time being, we abstract from the existence of government and the external sector of the economy. Aggregate demand can then be expressed as follows:

$$Demand = C + I = C_{aut} + c' \cdot Y + I_{aut} \quad (5.5.3)$$

How can this relationship be illustrated in a chart? In essence, this represents a parallel shift in the consumption function, where the intercept of the new curve can be calculated as the sum of autonomous consumption and autonomous investment.

Setting supply equal to income ($Supply = Y$) allows us to express the equilibrium between aggregate supply and aggregate demand as follows:

$$Supply = Y \quad (5.5.4)$$

$$Y = C_{aut} + c' \cdot Y + I_{aut} \quad (5.5.5)$$

$$Y \cdot (1 - c') = C_{aut} + I_{aut} \tag{5.5.6}$$

$$Y = \frac{1}{(1 - c')} \cdot (C_{aut} + I_{aut}) \tag{5.5.7}$$

If equilibrium values are again marked with an asterisk, it follows:

$$Y^* = \frac{1}{(1 - c')} \cdot (C_{aut} + I_{aut}) \tag{5.5.8}$$

For a given marginal propensity to consume and given values for autonomous consumption and autonomous investment, there is one value for income for which aggregate supply and demand just coincide, thus leading to an equilibrium in the market for goods.

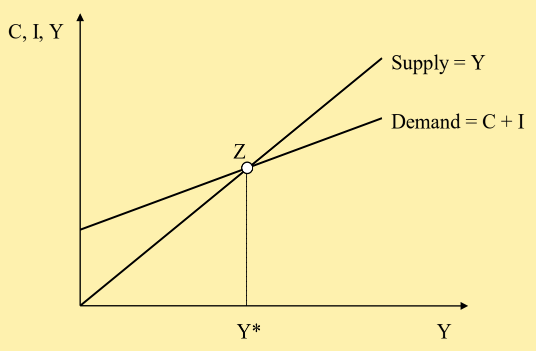
In graphical analysis, this can be shown if the 45-degree line is inserted into the diagram above. Point Z can be characterised by the equivalence of supply and demand in the market for goods and, consequently, in this point, the equilibrium income Y^* is realised. Using again some of the other aforementioned relationships, we can express the equilibrium in an alternative way. In equilibrium, it follows:

$Y = C + I$ and, furthermore, (5.5.9)

$Y = C + S$ and, therefore, (5.5.10)

$I = S$ (5.5.11)

Figure 5.8: Equilibrium in the Market for Goods



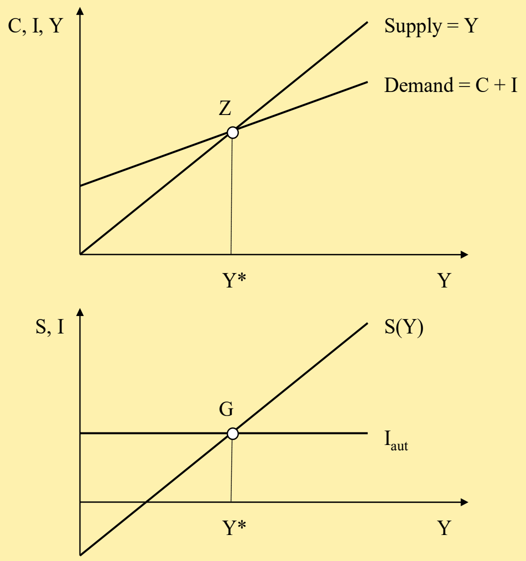
Quite obviously, the equilibrium is not only characterised by the equivalence of supply and demand, but also by the equivalence of savings and investment. In our case, income-induced savings and autonomous investment have to equal each other. It then follows:

$$I_{aut} = S(Y) \tag{5.5.12}$$

These basic relationships can be expressed in graphical terms in the chart below.

The upper part does not necessitate any further explanation. The lower chart includes autonomous investment and savings as an increasing function of income. Point Z in the upper chart and point G in the lower chart, therefore, must coincide. The equilibrium value for income is in both cases Y^*. If we further take into account that we are currently focusing on planned variables, we can state that planned demand equals planned supply and, moreover, (planned) autonomous investment and (planned) savings coincide.

Figure 5.9: Saving, Investment and Equilibrium in the Goods Market



But what happens in disequilibrium? To the left of point Z, income is lower than its equilibrium value. Expressed in vertical terms, demand is higher than supply. To the right of Z, income is higher than its equilibrium value, thus leading to excess supply or, in other words, a "demand gap".

Along the same lines, to the left of point G, investment exceeds savings, while to the right of G, savings are higher than investment. In other words, savings are not fully absorbed by investment, again a demand gap exists. Summing up, the following constellations can materialise:

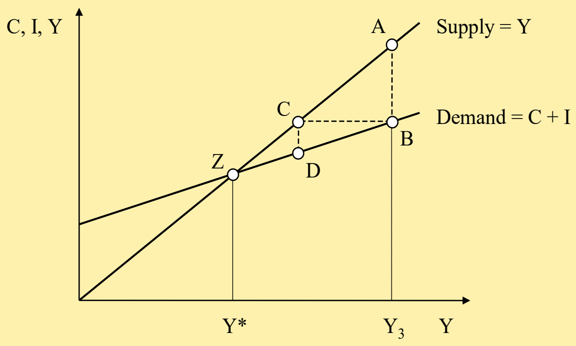
Supply = Demand	$Y = Y^*$	$S = I$	Equilibrium
Supply < Demand	$Y < Y^*$	$S < I$	Lack of supply
Supply > Demand	$Y > Y^*$	$S > I$	Lack of demand

Table: Supply and Demand Constellations

As mentioned above, in equilibrium, planned and realised variables are equivalent. Insofar, there is no imminent tendency for a change in equilibrium. This situation clearly differs from the case of a disequilibrium, where unplanned changes materialise. This immediately raises the question for the stability of the equilibrium. As a rule, an equilibrium is said to be stable, if a disequilibrium initiates changes that lead back to the initial equilibrium, i.e. if deviations are quasi "automatically" corrected.

Assume for instance, income is higher than equilibrium income. This is obviously the case to the right of point Z and point G. In such a case, supply exceeds demand by the vertical distance AB and, in the same vein, savings exceed investment. Quite obviously, the expectations of the firms have been disappointed.

Figure 5.10: Disequilibrium in the Market for Goods



In order to model the adjustment process, the literature usually recurs to a behavioural assumption, which adds a dynamic element to the comparative-static analysis. In this case, it is assumed that firms determine their production in the current period according to their sales in the previous period. This is equivalent to saying that – following their sales in the current period – firms realise in the forthcoming period the supply Y_3 which corresponds to point C on their supply curve.

Following their consumption function, at this income value households realise a demand in line with point D. As a consequence, supply exceeds demand by the vertical distance CD. The original disequilibrium has been reduced, but another disequilibrium has occurred. The process will proceed until point Z and the corresponding equilibrium income value Y^* have been reached. In this sense, the equilibrium in the goods market can be seen as stable. Disequilibria are cleared by means of unplanned investment (i.e. an accumulation or an unwinding of inventories).

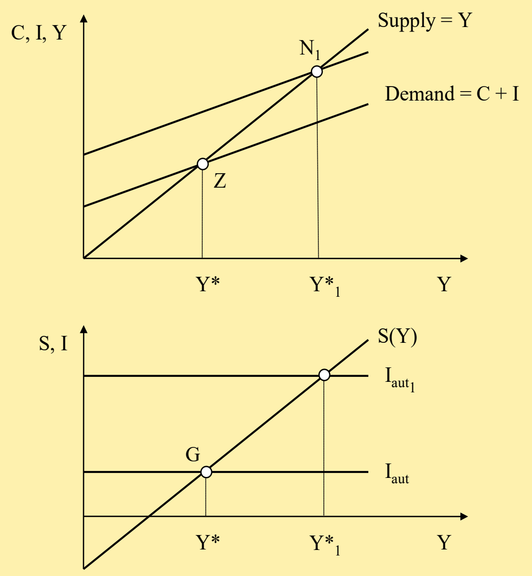
The opposite holds if income is too low. In this case, a decrease of some existing inventories will be realised. Summing up, in Keynesian theory, income is the key variable for the determination of an equilibrium in the market for goods. In case of a disequilibrium, system-immanent forces will start to work, thus leading to a restoration of the equilibrium. The process that leads to the restoration of equilibrium income materialises in discrete steps with individual steps getting smaller and smaller. The forces at work are mirrored in changes in income. An excess supply, or alternatively, a demand gap or "contractionary gap" then leads to a decline in income. Given that such a situation also often leads to a decline in prices, some authors prefer to call this a "deflationary gap". In contrast, a situation of excess demand or a supply gap is also often called an "inflationary gap".

5.6 THE INVESTMENT MULTIPLIER

The equilibrium derived in the last section is stable, but it may be undesirable in economic terms. This is due to the fact, that it is well possible that such a stable equilibrium is accompanied by a massive and unacceptable level of unemployment. This immediately raises the question, whether such a situation has to be accepted as "given", or whether it is somehow possible to raise production and employment.

Following our previous considerations, income can be raised by an increase in aggregate demand, i.e. an increase in autonomous consumption (C_{aut}), an increase in the marginal propensity to consume (c') or an increase in autonomous investment (I_{aut}). And, should, for one reason or another, the private sector not be in a position to take action, the government could take an active role. But what exactly would happen, for instance, if autonomous investment would rise by a certain amount? The charts below shows the adjustment process in more detail (with $I_{aut_1} > I_{aut}$).

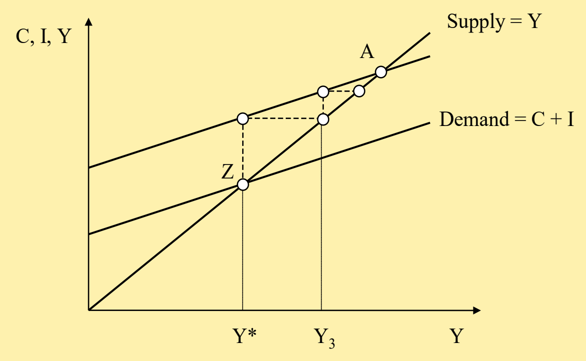
Figure 5.11: Permanent Increase in Investment in the Market for Goods



In the upper chart, the increase in autonomous investment leads to a parallel shift in the demand function. In the lower chart, this leads to a parallel shift in the investment function. In both cases, new points of intersection materialise, of course, accompanied by new values for equilibrium income. The change in investment opens up an "expansive gap", which is then closed again by the multiplier process described above for the case of a disequilibrium. Strictly speaking, however, this process needs an infinite amount of time.

Starting from the original equilibrium, the adjustment process then leads to a new equilibrium. It is worth noting that – as shown below in more detail – the expansive effect on income is higher, the higher the marginal propensity to consume and the smaller the marginal propensity to save. Against this background, the marginal propensity to save must be seen as a "leakage". Expressed in other words, savings induce flows out of the additional demand, which, consequently leads to the result, that the multiplier does not reach its maximum possible effect.

Figure 5.12: The Multiplier Process



The exact quantitative effect of an increase in investment on income can be calculated in a relative precise way. Taking the consumption function used so far into consideration, it follows:

$$Y = C_{aut} + c' \cdot Y + I_{aut} \tag{5.6.1}$$

Since we are looking on the effects of an increase in investment on income, we have to difference the equation. It then follows:

$$dY = dC_{aut} + c' \cdot dY + dI_{aut} \tag{5.6.2}$$

where we assume $dC_{aut} = 0$. It then follows:

$$dY \cdot (1\text{-}c') = dI_{aut} \tag{5.6.3}$$

$$\frac{dY}{dI_{aut}} = \frac{1}{(1-c')} = \frac{1}{s'} \tag{5.6.4}$$

Since the marginal propensity to consume is larger than zero but smaller than one, the expression on the right-hand side will have a positive value. Moreover, it will be larger than one. An increase in investment then leads to a multiple increase in income, a fact which has given rise to the expression "multiplier". It is easy to see that the multiplier is the larger, the higher the marginal propensity to consume and the smaller the marginal propensity to save. Assuming a marginal propensity to save (s') of 0.1, an increase of investment by 100 results, for instance, in an increase in income by 1000. Analogous results can be, of course, derived for an decrease in autonomous consumption.

5.7 THE GOVERNMENT MULTIPLIER

In this section, we want take the government and its actions into account. For didactical reasons, however, we concentrate in a first step on the effects of an increase in exogenous government expenditures. It then follows:

$$G = G_{aut} = \bar{G} \tag{5.7.1}$$

This leads to an extended version of the demand function:

$$Demand = C + I_{aut} + G_{aut} \tag{5.7.2}$$

And in equilibrium, this yields:

$$Y = C + I_{aut} + G_{aut} \tag{5.7.3}$$

$$Y = C_{aut} + c' \cdot Y + I_{aut} + G_{aut} \tag{5.7.4}$$

Differencing the equation then leads to the following expression:

$$dY = dC_{aut} + c' \cdot dY + dI_{aut} + dG_{aut} \tag{5.7.5}$$

We can then derive the so-called "government expenditure multiplier":

$$\frac{dY}{dG} = \frac{1}{1-c'} \tag{5.7.6}$$

where $dC_{aut} = dI_{aut} = 0$ is assumed.

It is obvious that the effect of an increase in government expenditures is mathematically exactly equivalent to the effect of a similar increase in autonomous investment. In graphical analysis, this can again be illustrated by means of a parallel shift in demand and the resulting effects derived above.

How would this result change, if the government instead decided to lower taxes? For the sake of analysis, we assume the government imposes a so-called "lump-sum tax" on every household. Against this background, households can only spend the so-called "disposable income" (Y_D), which is defined as follows:

$$Y_D = Y - T \tag{5.7.7}$$

The fact that consumption now depends on disposable income slightly changes our previous results:

$$Demand = C + I \qquad (5.7.8$$

$$Demand = C_{aut} + I_{aut} + c' \cdot Y_D \tag{5.7.9}$$

$$Demand = C_{aut} + I_{aut} + c' \cdot (Y - T) \tag{5.7.10}$$

Solving for the equilibrium then yields:

$$Y = C_{aut} + I_{aut} + c' \cdot Y - c' \cdot T \tag{5.7.11}$$

And differencing yields:

$$\frac{dY}{dT} = \frac{-c'}{1-c'} \tag{5.7.12}$$

where again, we assume $dC_{aut} = dI_{aut} = 0$.

This expression is the so-called "tax multiplier". The latter has a negative sign and, thus, exactly the opposite sign of the government expenditure multiplier. Given the fact, that the marginal propensity to consume lies between zero and one, the tax multiplier is smaller than the government expenditure multiplier. The latter result is due to the fact that the government expenditure multiplier leads to additional demand by the same amount, whereas a tax reduction only partly translates into demand, since only a fraction of it translates into consumption expenditure.

In the next step, we want to abstract from this isolated perspective used so far and assume that the government increases government expenditures but – at the same time – increases taxes by the same amount (i.e. a so-called "balanced budget"). What are the implications for income? The equation for demand then reads as follows:

$$Demand = C_{aut} + c' \cdot (Y - T) + I_{aut} + G_{aut} \tag{5.7.13}$$

In equilibrium, it follows:

$$Y = C_{aut} + c' \cdot (Y - T) + I_{aut} + G_{aut} \tag{5.7.14}$$

$$Y = \frac{1}{1 - c'} \cdot (C_{aut} + I_{aut} + G_{aut} - c' \cdot T) \tag{5.7.15}$$

Assuming $dC_{aut} = 0$ and $dI_{aut} = 0$ and differencing then yields:

$$dY = c' \cdot dY - c' \cdot dT + dG \tag{5.7.16}$$

Since, by definition, $dG = dT$, it follows:

$$dY = c' \cdot dY - c' \cdot dT + dG \tag{5.7.17}$$

$$dY \cdot (1 - c') = dG \cdot (1 - c') \tag{5.7.18}$$

$$\frac{dY}{dG} = \frac{1 - c'}{1 - c'} = 1 \qquad \text{or, equivalently,} \tag{5.7.19}$$

$$dY = 1 \cdot dG \tag{5.7.20}$$

Quite surprisingly, the corresponding value for the multiplier is one. In other words, the increase in income is equal to the increase in government expenditure. A balanced budget increase is, therefore, not neutral but expansive with respect to income. In the literature, this is often referred to as the so-called "Haavelmo theorem", following the famous Norwegian economist Trygve Haavelmo (1911–1999). We abstract from the graphical analysis of these relationships at this point.

5.8 THE IS CURVE

In this section, we want to relax the assumption of autonomous investment and make use of the more realistic assumption of an interest rate-elastic investment. In formal terms, it follows:

$$I = I(i) \tag{5.8.1}$$

In the following section, we choose various interest rates and determine the corresponding income values necessary for an equilibrium in the market for goods. The demand equation used so far then changes into the following expression:

$$Supply = Demand \tag{5.8.2}$$
$$Y = C + I = C(Y) + I(i) \tag{5.8.3}$$
$$S(Y) = I(i) \tag{5.8.4}$$

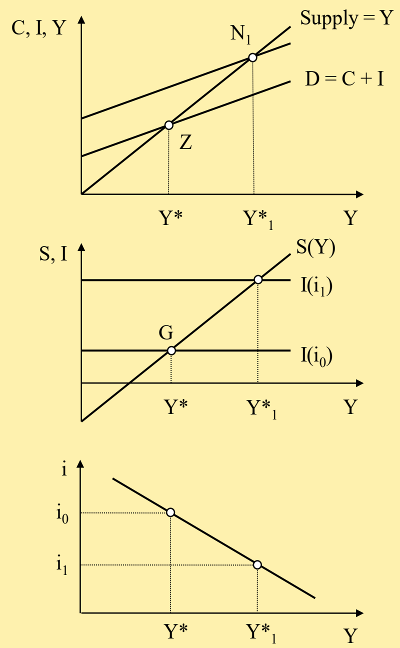
It is obvious that several combinations of interest rate and income exist, that are consistent with an equilibrium in the market for goods. The latter result is due to the fact that, following equation (5.8.3), a given supply of goods is compatible with a high consumption and a low investment, but also with a low consumption and a high investment of. How do these combinations look like?

In line with the previous considerations, a high income leads to high savings. Following equation (5.8.4), this assumes a high investment which, following our earlier considerations, presumes a low interest rate and vice versa. It should be noted, however, that also the reverse causality applies: A high interest rate leads to low investment which, following the "ex-definitione equivalence" of savings and investment, necessitates a low income. Taken together, in general, both causalities and both constellations are possible. But they both imply that, in equilibrium, high values for income must be accompanied by low values for the interest rate.

How can this be illustrated in a chart? On the one hand, this can be done by extending our previous chart with the impact of falling interest rates. As already mentioned above, changes in exogenous factors tend to shift curves in the system.

A fall in the interest rate obviously leads to a parallel shift in the investment function and along the lines of the deliberations outlined above to a new equilibrium. In a graphical illustration with the interest rate and income on the vertical and horizontal axis respectively, the IS equilibria, therefore, will be found on a line with a negative slope.

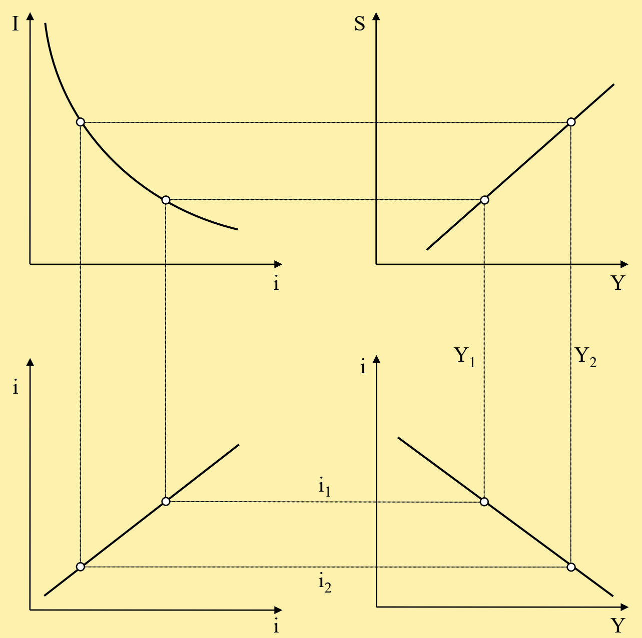
Figure 5.13: IS Curve



In the literature, however, a derivation based on four quadrants has become quite popular.[25] In this respect, the upper right chart contains the income-dependent savings function, whereas the upper left chart shows the interest rate-dependent investment function. In the lower left chart, the 45-degree line is used as an auxiliary device. The lower right chart then contains a diagram with all equilibria in the goods market. The resulting curve is called the IS curve, since along this line, planned savings and planned investment exactly coincide.

To illustrate this in more detail, let us start from a certain income level, say Y_1 in the upper right chart. This income level corresponds to a certain level for savings, which in turn corresponds to a certain level of investment and an appropriate level for the interest rate. In the lower right chart, an interest rate-income-combination (i_1/Y_1) results, which represents an equilibrium in the market for goods. If we now start from a higher income level Y_2 and follow the same procedure, a new combination (i_2/Y_2) can be derived, which again represents an equilibrium in the market for goods. Any time this procedure is replicated, a new equilibrium in the lower right chart can be derived. Combining these points leads to the well-known "IS curve", which represents the geometric location of all combinations of interest rates and income, that are compatible with an equilibrium in the market for goods.

Figure 5.14: IS Curve in Four-Quadrant Scheme



In the next step, we have to ask for the factors which determine the shape and position of the IS curve. In this respect, the graphical illustration clearly shows that the shape of the savings function as well as the shape of the investment function determine the shape of the IS curve. If the savings and investment functions shift, the IS curve will shift. Assume, for instance, that autonomous consumption rises, then the consumption function will shift upwards and, accordingly, the savings function will shift downwards. As a result, the IS curve will shift to the right. If, on the other hand, the investment function would for a given interest rate shift to the right, for instance, due to some more favourable conditions for depreciation allowances, then also the IS curve shifts to the right.

Changes in the slope of the IS curve occur, when the marginal propensity to save or the interest sensitivity of investment change. This is due to the fact that the slope of the IS curve can be expressed as follows:

$$\tan\alpha = di \,/\, dY = s' \,/\, i' \tag{5.8.5}$$

As a consequence, the IS curve gets steeper if either the marginal propensity to save increases or if the interest rate sensitivity of investment decreases (i.e. a flattening of the investment function) or if both events materialise. By contrast, a rather low marginal propensity to save or a high interest rate sensitivity of investment (i.e. a rather steep investment function) will lead to a rather flat IS curve. Given a specific marginal propensity to consume, an increase in the interest rate elasticity of investment will tend to flatten the IS curve.

Along the same lines, a decrease in the marginal propensity to save (or, equivalently, an increase in the marginal propensity to consume) will tend to flatten the savings function and, thus, also the IS curve. Moreover, the more interest rate-elastic investment is, the flatter the IS curve. Following the Keynesian view, investment is relatively interest rate-inelastic (i.e. i' is rather small), which leads to a relatively flat investment function. This implies that large changes in income necessitate considerable changes in interest rates to restore the equilibrium in the market for goods. Therefore, the IS curve is relatively steep.

☑ The Slope of the IS Curve

As defined above, the slope of the IS curve looks as follows:

(i) $\tan\alpha = di/dY < 0$

This relationship can be expressed in an alternative way. Recall that the slope of the investment function is defined as $i' = dI/di$. It then follows that $di = dI/i'$. Moreover, the savings function can be expressed as follows:

(ii) $S = -C_{aut} + s' \cdot Y$

(iii) $dS = s' \cdot dY$

(iv) $dY = dS/s'$

Solving for the slope of IS then yields:

(v) $\tan\alpha = \dfrac{di}{dY} = \dfrac{dI/i'}{dS/s'} = \dfrac{dI \cdot s'}{dS \cdot i'} = \dfrac{s'}{i'}$

where s' stands for the slope of the savings function, i' denotes the slope of the investment function and, along the IS curve, I equals S. Consequently, IS gets steeper, if the marginal propensity to save increases and/or the interest rate sensitivity of investment decreases.

In the extreme case of an interest-rate-inelastic investment, the investment curve gets horizontal and, consequently, the IS curve mutes to a horizontal line (i.e. a parallel to the vertical axis). In this case, several equilibrium values for the interest rate, but just one equilibrium for income do exist. Consequently, the money market, on which the interest rate is determined, does not have an influence on the market for goods anymore, since the market for goods does not depend on the interest rate anymore. Taken together, an interest rate-elastic investment leads to a flat IS curve, whereas interest-rate inelastic investment leads to a steep IS curve.

5.9 UNRAVELLING THE SECRETS OF THE TWIN DEFICITS

Besides offering some fascinating insights on the working of the multipliers, the income expenditure model can also be of help in understanding, why and how the twin deficits – i.e. the fiscal and the trade deficit – are related. Recall that in earlier sections we have derived a relationship showing that, in equilibrium, savings must equal investment. In this context, savings was seen as representing a "leakage" from the spending stream, whereas investment represented an injection.

In an open economy with government, there are three kinds of leakages – namely savings, taxes and imports – and three kinds of injections – namely investment, government purchases and exports. In equilibrium, this yields:

$$S+T+IM=I+G+EX \tag{5.9.1}$$

When rearranging terms, it follows that:

$$(EX-IM)+(G-T)=(S-I) \tag{5.9.2}$$

where $(EX-IM)<0$ denotes the trade deficit and $(G-T)<0$ stands for the budget deficit. This implies that the savings of the country are not enough to finance investment. Expressed in other words: the country lives beyond its means. In case, the two deficits were meant to be brought into balance, either the country has to save more or to invest less.

5.10 SUMMARY

- Private consumption must be seen as a rather complex macroeconomic aggregate that is influenced by a variety of factors. Following the British economist John Maynard Keynes (1883–1946), the dominant determinant of consumption is income.
- In a similar way, investment must be seen as being subject to a variety of determinants. It is realistic, however, to assume that investment is a function of the interest rate prevailing in the economy.
- In its simplest from, the equilibrium in the market for goods then includes an income-induced consumption function and an income-autonomous investment function. Such an equilibrium is not only characterised by the equivalence of supply and demand for goods, but also by the equivalence of savings and investment.
- In case of disequilibrium, system-immanent forces start to work, thus, leading the equilibrium to be re-established. The forces at work are accompanied by changes in income. A situation of excess supply or, alternatively, of a demand gap or of a "contractionary gap" then leads to a decline in income. Given that such a situation also often leads to a decline in prices, some authors prefer to call this a "deflationary gap". In contrast, a situation of excess demand or, alternatively, a supply gap is also often called an "inflationary gap".
- It can be shown that an increase in investment then leads to a multiple increase in income, a fact which has given rise to the expression "multiplier".
- It can further be shown that a balanced budget increase is not neutral, but expansive with respect to income. In the literature, this is often referred to as the so-called "Haavelmo theorem".

- The IS curve represents the geometric location of all combinations of interest rates and income, that are compatible with an equilibrium in the market for goods. The IS curve shifts, if the savings (or consumption) and the investment functions shift. Changes in the slope of the IS curve occur, if ceteris paribus the marginal propensity to save (or the marginal propensity to consume) or the interest sensitivity of investment change.

🕮 Key Concepts

Autonomous consumption, income-dependent consumption, multiplier, leakages, balanced-budget multiplier, accelerator, marginal propensity to consume and to save, average propensity to consume and to save, autonomous investment, internal rate of return, marginal efficiency of capital, interest rate-dependent investment, IS curve.

🕮 Questions for Review

- Which determinants of consumption do you know?
- How could a graphical illustration of Keynes "absolute income hypothesis" look like?
- How can the essence of Keynes "fundamental psychological law" be summarised?
- Which determinants of investment do you know? What is the meaning of the marginal efficiency of capital?
- Show, how the IS curve can be derived out of a chart, containing four quadrants!
- Which factors lead to a shift in the IS curve, which ones lead to a change in the slope of the IS curve?

☑ Digging Deeper

A number of studies have discovered that the relevant authorities – being confronted with a sharp decline in tax revenues during the Great Depression – started to increase tax rates. What would be your best guess of the implications for real income? How would your results change if you consider possible changes in the marginal propensity to consume (due to the crisis) into account?

6 THE MONEY MARKET

6.1 LEARNING OBJECTIVES

We start with some basic considerations on the institutional features of monetary policy in the euro area. We then proceed by looking into the determinants of money supply and money demand, before we analyse the equilibrium in the money market. Finally, the LM curve is derived.

6.2 BASIC CONSIDERATIONS

Besides the market for goods, the money market is the second market of relevance in macroeconomics. In this context, it is worth noting that the expression "money market" is a bit misleading, since, in essence, we are dealing with the financial market, which – for the time being – will be considered as consisting of the market for money and the market for bonds. In our analysis, we will, however, concentrate primarily on the market for money, keeping in mind the existence of "Walras' Law" (developed by the famous French economist

Leon Walras, 1834–1910). Following this principle, in case of just two markets, the market for bonds must be in equilibrium, if the market for money is in equilibrium.

In the terminology of macroeconomics, the money market refers to the location, where money supply and money demand meet. Money supply (M) can be characterised as the amount of money supplied by the central bank and the banking system. Money demand (L) includes the demand for money expressed by private households, firms and the government. The analysis of the money market then asks for the preconditions for an equilibrium in the monetary sector of the economy. After a short look at the institutional background of monetary policy in the euro area, we will, therefore, analyse the determinants of money supply and money demand.

6.3 INSTITUTIONAL BACKGROUND OF EURO AREA MONETARY POLICY

☑ The European Central Bank

On 1 January 1999, the European Central Bank (ECB) assumed responsibility for monetary policy in the euro area – one of the largest economic areas in the world.[26] The transfer of responsibility for monetary policy from eleven sovereign central banks – which are now 19, with the participation of Greece on 1 January 2001, Slovenia on 1 January 2007, Cyprus and Malta on 1 January 2008, Slovakia on 1 January 2009, Estonia on 1 January 2011, Latvia on 1 January 2014 and Lithuania on 1 January 2015 – to a new supranational institution must be seen as a milestone in a long and complex process of integration among European countries. Before adopting the euro, all candidate countries were required to fulfil a number of convergence criteria, which were aimed at ensuring the economic and legal preconditions for successfully participating in the European Monetary Union.

☑ Mandate of the ECB

The mandate of the ECB is laid down in the Treaty establishing the European Community. Article 127 states that "[…] the primary objective of the ESCB shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Community with a view to contributing to the achievement of the objectives of the Community […]". In this respect, Article 3 of the Treaty mentions as objectives of the Community, inter alia, "[…] the sustainable development of Europe based on balanced economic growth and price stability, and a highly competitive social market economy, aiming at full employment and social progress […]". The Treaty thus establishes a clear hierarchy of objectives for the Eurosystem and assigns overriding importance to price stability.

☑ Decision-Making Bodies of the ECB

There are two main decision-making bodies of the ECB, namely the Governing Council and the Executive Board, which are responsible for the preparation, conduct and implementation of the single monetary policy.[27] Moreover, a third decision-making body, the General Council, exists.

The Governing Council of the ECB consists of the six members of the Executive Board and the Governors of the euro area NCBs.[28] Its responsibilities are first, to adopt the guidelines and take the decisions necessary to ensure the performance of the tasks entrusted to the Eurosystem and, second, to formulate the monetary policy of the euro area.

The Executive Board of the ECB is composed of the President and the Vice-President and four other members, all appointed by common accord of the Heads of State or Government of the euro area countries.

☑ Key provisions from the Treaty and the Statute of the ECB

This box includes selected key monetary policy provisions taken from the Treaty and the Statute of the ESCB.[29]

Article 3

3. The Union shall establish an internal market. It shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment. […]

4. The Union shall establish an economic and monetary union, whose currency is the euro.

Article 127

1. The primary objective of the ESCB shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Community with a view to contributing to the achievement of the objectives of the Community as laid down in Article 2. The ESCB shall act in accordance with the principle of an open market economy with free competition, favouring an efficient allocation of resources, and in compliance with the principles set out in Article 4.

2. The basic tasks to be carried out through the ESCB shall be: to define and implement the monetary policy of the Community; to conduct foreign exchange operations consistent with the provisions of Article 111; to hold and manage the official foreign reserves of the Member States; and to promote the smooth operation of payment systems. […]

Article 130

When exercising the powers and carrying out the tasks and duties conferred upon them by this Treaty and the Statute of the ESCB, neither the ECB, nor a national central bank, nor any member of their decision-making bodies shall seek or take instructions from Community institutions or bodies, from any government of a Member State or from any other body. The Community institutions and bodies and the governments of the Member States undertake to respect this principle and not to seek to influence the members of the decision-making bodies of the ECB or of the national central banks in the performance of their tasks.

The Board is inter alia responsible for the current business of the ECB and also for the implementation of the monetary policy guidelines and decisions taken by the Governing Council. Both the Governing Council and the Executive Board are chaired by the President of the ECB or, in his absence, by the Vice-President.[30]

The General Council of the ECB includes the President and the Vice-President of the ECB and the Governors of the NCBs of all EU Member States (28 in 2017). This gremium will remain in existence for as long as there are Member States that have not adopted the euro as their currency. While the General Council has no responsibility for monetary policy decisions in the euro area, it basically carries out some tasks inherited from the European Monetary Institute.

As regards the voting modalities in the Governing Council, the Statute of the ESCB states that the Governing Council shall act by a simple majority when taking decisions on monetary policy and on the other tasks of the Eurosystem. In this context, monetary policy decisions in the euro area must be based on a euro area perspective. Each member of the Governing Council has one vote. In the event of a tie, the President of the ECB has a casting vote. When taking decisions, the members of the Governing Council do not act as national representatives, but in a fully independent, personal capacity.

In order to ensure that decisions are also taken in a timely and efficient manner in an enlarged euro area, on 21 March 2003, the European Council approved an amendment to the Statute of the ESCB, which provides for an adjustment of the voting modalities in the Governing Council. According to the new voting system, the six members of the Executive Board will maintain a permanent voting right, but the voting rights of NCB Governors will be subject to a rotation scheme, once the number of euro area countries exceeds 18. However, all Governors will participate in all meetings of the Governing Council, irrespective of whether they hold a voting right at the time. The new voting system has been adopted at the beginning of 2015.

☑ Presidents of the ECB

So far, the ECB has witnessed three presidents. Willem Frederik "Wim" Duisenberg was born in 1935 in Herentveen (Netherlands). After a successful career in the International Monetary Fund, as a professor at the University of Amsterdam, as a finance minister in the Netherlands and President of De Nederlandsche Bank, he was appointed as the first President of the European Central Bank and, therefore, in office during the introduction of the Euro in twelve European countries in 2002.[31]

Wim Duisenberg became well-known as "Mr. Euro" and even more famous for his statement "I hear you but I do not listen" with which he responded to the continued suggestions of politicians for lower interest rates. On 31 July 2005, Wim Duisenberg died from a heart attack at the age of 70, while on vacation in his villa in Southern France.

☑ The Appointment of the first ECB-President – A Problem Case?

While the virtues of independent central banks seem to be undisputed in theory, in practice this does not seem to work without frictions. In fact, various sources report about an incident related to the appointment of the first ECB-President. Despite a general agreement among the member governments to entrust W.F. Duisenberg with this task, the French government insisted on its own candidate, J.-C. Trichet for the position. In the course of this dispute, the French government only agreed to support Duisenberg after he had indictated to the ministers that he was prepared to resign after four years, but without setting a more precise date. Indeed, on 7 February 2002, Duisenberg announced that he would resign on 9 July 2003, after having served more than five years of his eight-year term. This rather unveiled way, in which the French government successfully pushed through its own interests cast a shadow over the new central bank's independence.

Source: Marshall (1999, pp. 197ff), Pollard (2003, p. 24).

Jean-Claude Trichet was born on 29 December 1942 in Lyon (France) as the son of a professor of Greek and Latin.[32] He graduated in the "Institut D'Etudes Politiques de Paris" (better known as "Sciences Po") and the "Ecole Nationale d' Administration" ("ENA"). In 1993, Jean-Claude Trichet was appointed Governor of Banque de France. On 1 November 2003, he took Wim Duisenberg's place and became second President of the European Central Bank.

Mario Draghi was born on 3 September 1947 in Rome (Italy). He graduated from La Sapienza University of Rome and earned a Ph.D. in ecomomics from the Massachusetts Institute of Technology in 1976.[33] After holding positions as a full professor at the University of Florence, Executive Director of the World Bank, Director General of the Italian Treasury, Vice Chairman and Managing Director at Goldman Sachs, he became Governor of the Banca d'Italia. In November 2011, he succeeded Jean-Claude Trichet as third President of the European Central Bank.

☑ ECB-Presidents and Terms of Duty

So far, the ECB has been lead by three presidents with differing terms of duty:

Willem Duisenberg:	1 June 1998–31 October 2003
Jean-Claude Trichet:	1 November 2003–31 October 2011
Mario. Draghi:	1 November 2011–31 October 2019

At the time of writing, discussions regarding the fourth President were just starting. According to some sources, a natural candidate was the President of the Deutsche Bundesbank, Jens Weidmann.

Source: http//www.ecb.int.

6.4 MONEY SUPPLY

To begin with, it is worth noting, that in the macroeconomic literature, the sources of money creation and, therefore, the analysis of money supply are usually considered to be of lesser importance than, for instance, in the textbooks focusing on monetary theory and policy. In most cases, the various monetary aggregates are defined in terms of "M's" and it is assumed that the central bank is able to fully control the amount of money in circulation by appropriately setting its instruments. In the terminology used in this book, this would imply that money supply can be regarded as autonomous.[34] It then follows:

$$M = M_{aut} = \bar{M} \tag{6.4.1}$$

While this assumes that other factors, as, for instance, interest rates, do not play a role for money supply, it should be noted that the influence of interest rates can be easily incorporated into the following deliberations, without changing the results too much.

6.5 MONEY DEMAND

Unlike money supply, the question for the determinants of money demand or, in other words, the reasons for holding money are regarded as a crucial issue. It should be noted, however, that with respect to the motives for holding cash, different views have been expressed by different economic schools. While, for instance, the so-called "classical economists" postulated that money holdings do not serve a purpose of their own, but just serve as a means for conducting transactions, Keynesian economists have challenged this view by pointing towards the additional use of money as a store of value. Given the fact that classical economists have stressed the importance of money for carrying out transactions, they have consequently focused on explaining the so-called "transactions demand" for money. In this context, money holdings were seen as not bearing any positive interest rate earnings and, therefore, not yielding a return. As a consequence, money was not regarded as a good, as it does not have a (positive) utility.

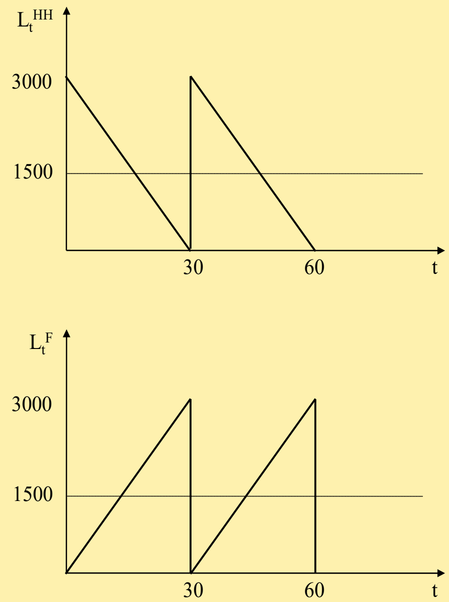
☑ The Transactions Demand for Money

The determinants of the transactions demand for money (or transactions demand for liquidity, "L_T") are often illustrated by means of the well-known "inventory model".[35] Suppose, for the sake of illustration that every month has 30 days. At the beginning of the month, households get € 3000, which they use to buy goods from firms for € 100 each day.

So, at the end of the first day, households would still have € 2900, whereas firms would hold € 100. In the same vein, at the end of the second day, firms would hold € 200, while the amount remaining with households would be € 2800. In a graphical illustration, this would look as shown below.

Quite obviously, money has the function of "synchronising" between the various monetary in- and outflows. Moreover, it is easy to see that the average cash holdings of households over the month are € 1500 and the same also holds for the firms. When taking an annual perspective, the average cash holdings for households and firms, respectively, over the year are € 1500. By contrast, the average holdings of households and firms together over the year are € 3000, a number which is in our simple model exactly equal to the figure for monthly income.

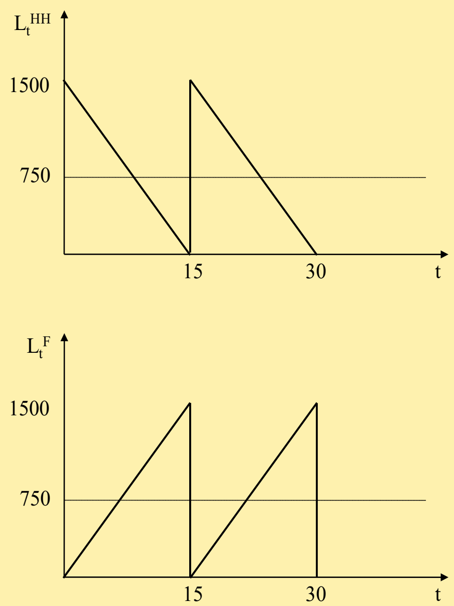
Figure 6.1: Transactions Demand for Money



Now suppose, the firms would pay income twice per month, instead of once per month. This is shown in the chart below. The aggregate demand for money is now just € 1500, with average money holdings by households standing at € 750. This means that, in this case, households (and also firms) are able to manage their in- and outflows with a smaller amount of money. Households and firms together now hold on average € 1500.

Let us make use of this rather simple model for some other, relatively straightforward considerations. In the first case, the average money holdings of households were € 1500, compared to an income of 12 times € 3000 (= € 36000) over the year and the same result also holds for firms. The fraction 3000/36000 then indicates how much transactions demand for money, households and firms together hold in every period relative to income. This ratio is in macroeconomics often labelled as the "cash holding coefficient" (k) of an economy.

Figure 6.2: Transactions Demand for Money (ctd.)

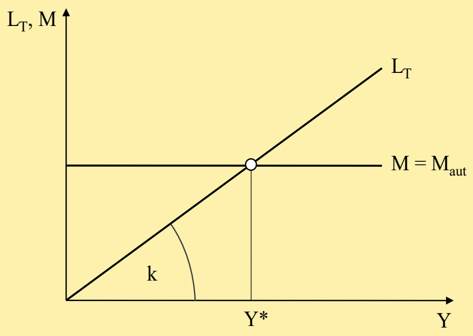


What do these figures tell us? Well, in the first case, the (aggregate) money holdings of households and firms together were exactly $k = (1500+1500)/12 \cdot 3000 = 3000/36000 = 1/12 \approx 0.08$. In the second case, households and firms each hold on average € 750. As a matter of fact, it follows that the (aggregate) money holdings were then $k = 1500/(24 \cdot 1500) = 1500/36000 \approx 0.04$. It is easy to see, that the variable k is obviously determined to a considerable degree by the payment habits prevailing in an economy. More formally, it follows:

$$L_T = L_T(Y) = k \cdot Y \tag{6.5.1}$$

In a graphical illustration, it would follow:

Figure 6.3: Transactions Demand for Money and Equilibrium in the Money Market



Against this background, k stands for the proportionality factor of money demand with respect to income. If, for instance, k equals the value of one and income doubles, then also the transactions demand for money doubles.

The equilibrium in the money market is then given by the intersection of money supply and money demand which then, in turn, determines equilibrium income. Determinants of the transactions demand for money are the income variable and the time span between inflows and outflows, which are often simplified as "payment habits" in an economy.

In the next step, we can further extend our deliberations. Seen from another angle, it could be shown that an amount of € 3000 was sufficient to "finance" an income of € 36000. This was due to the fact that the given amount of money was used twelve times for goods purchase over the year. Expressed in other terms, the amount of money was "circulated" twelve times. In order to describe such a behavior, economists often use the term "velocity of money" or "income velocity of money". The latter concept can be expressed in terms of a definition as follows:

$$L_T = k \cdot Y \tag{6.5.3}$$

$$\frac{Y}{L_T} = \frac{1}{k} = V \tag{6.5.4}$$

where, in the context of this expression, V stands for the velocity of money. Velocity thus represents the inverse of the cash holding coefficient and, therefore, in essence expresses the payment habits. In addition, velocity mirrors the fact that money circulates in the economy.

The more money circulates, the more transactions can be carried out with a given amount of money. An increase in velocity allows for a decline in cash holdings. Taken together, the income velocity and the cash holding coefficient mirror the payment habits in an economy. It is worth noting that some studies have found the transactions demand for money to also depend on (short-term) interest rates; for the time being and for reasons of simplicity, this fact will be neglected.[36]

☑ The Speculative Demand for Money

Like the classical economists, Keynes regarded the transactions motive as one of the key determinants for holding money. This notwithstanding, he extended the classical view by putting more emphasis on the savings function of money. In this respect, contrary to the classical assumption of perfect foresight, Keynes assumed the existence of uncertainty, which implies that economic subjects have to form expectations. More precisely, following Keynes, three motives for holding money can be distinguished, namely a "transactions demand for money", a "precautionary demand for money" and a "speculative demand for money" (often also labelled as "asset demand for money").[37]

As already shown, money held in the form of transactions demand serves the purpose of synchronising monetary in- and outflows that do not coincide in terms of timing. By contrast, money held for precautionary purposes is needed to deal with unforeseen monetary in- and outflows. Finally, money held for speculative purposes, in essence, represents the novelty of the Keynesian approach to money demand. As a rule, the transactions and precautionary motives are usually treated together since, assuming given payment habits, they both depend on income.

The speculative demand for money is of decisive importance for capturing the essence of Keynesian money demand and will, therefore, have to be treated in more detail here. As a starting point, suppose that economic subjects have a certain amount of nominal wealth at their disposal, which may include various forms of assets. The focus of Keynes was, however, on monetary assets only and, thereby, especially on money and bonds. More specifically, the bonds under consideration are so-called "consols" (i.e. perpetual bonds with an infinite maturity).

In order to be in a position to invest into bonds at short notice, economic subjects have to hold a certain amount of cash as an asset (or store of value). As a consequence, money does have a major advantage, namely the chance of being "liquid" at any point in time which, in turn, opens the possibility to enter the bond market without any delay, when deemed appropriate.

What matters for the investment decision are in essence the relative advantages and disadvantages of money and bonds. Holding money has the great advantage of a high degree of liquidity, but the disadvantage in form of opportunity costs (represented by forgone interest rate returns). Contrary to that, bonds have the advantage of yielding an interest rate return but, at the same time, their degree of liquidity is considerably lower.

When taking a decision on the allocation of wealth, a variable that is of crucial importance is the interest rate. This is due to the fact that the interest rate is inversely correlated with the bond price. The higher the interest rate, the lower the bond price and vice versa. It then follows:

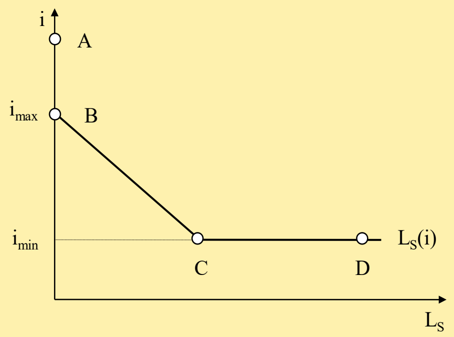
$$\text{Return of a bond} = \text{Nominal interest rate} / \text{Bond price} \qquad (6.5.5)$$

Following Keynes, economic subjects are subject to imperfect foresight and, thus, have to form expectations regarding the future developments of bond prices. As a consequence, if the interest rate is low or bond prices are high, economic subjects will expect bond prices to decline and, thus, prefer to hold money. By contrast, a high interest rate or low bond prices will lead to holdings of bonds. As a consequence, the speculative or asset demand for money depends on the interest rate. It then follows:

$$L_S = L_S(i) \tag{6.5.6}$$

Once economic subjects have formed their views about the future, they will allocate their wealth accordingly. Therefore, at the micro level, a Keynesian individual is an "all or nothing"-individual meaning that it will just hold one asset.

Figure 6.4: Speculative Demand for Money



Expressed in other words, in Keynes' framework, an individual keeps its entire wealth either in form of money or only in bonds. At the macro level, however, heterogeneous expectations do exist and, therefore, contrary to the micro level, a mixed portfolio is possible.

In graphical terms, the exact characteristics of the resulting curve can be illustrated as shown above. In the literature, this function has been labelled as the "speculative demand for money" as it basically explains the demand for speculation purposes. Visual inspection shows that there is a vertical segment ("classical segment", illustrated by the vertical distance AB), a "normal" segment, and a horizontal segment ("Keynesian segment", illustrated by the horizontal distance CD). How can such a vertical segment be explained? From a certain level of the interest rate onwards, it can be expected that bond prices are very low. Consequently, all economic subjects believe that bond prices can only rise and interest rates can only decline and, thus, they aim at buying bonds. There is no economic subject willing to hold wealth on the form of money, as a matter of fact, L_S has a value of zero.

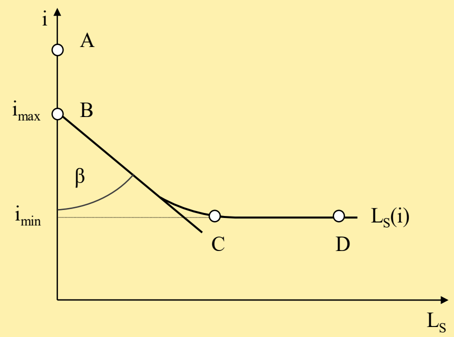
In the horizontal area, the interest rate has reached a minimum ($i_{\min}$) and, consequently, bond prices have reached a maximum. Fearing the losses evolving out of the expected decreases in bond prices, economic subjects do not want to hold bonds anymore, therefore, all the money stays in the speculative demand for money. The section characterised by this low level of interest rates is also called the “Keynesian segment” or, equivalently, the ”liquidity trap”. While its empirical relevance has been the subject of long-standing discussions among macroeconomists, a number of economists compare the developments that materialised in the 1990s in Japan with such a situation.

The slope of the so-called “liquidity preference function” is mirrored in the angle β in the chart below.

$$\tan \beta = \frac{\delta L_S}{\delta i} = l' < 0 \tag{6.5.7}$$

The coefficient l' represents the so-called ”liquidity preference”. As a rule, values between zero (in the “classical segment” and infinity (in the “Keynesian segment”) can be realised. Following Keynes, l' varies over time. Changes in interest rates, therefore, result in unpredictable changes of the speculative demand for money and, thus, also in money demand.

Figure 6.5: Liquidity Preference Function



6.6 EQUILIBRIUM IN THE MONEY MARKET

In this section, the two modules, i.e. the transactions demand for money and the speculative demand for money, will be combined together. As a starting point, it can be shown that:

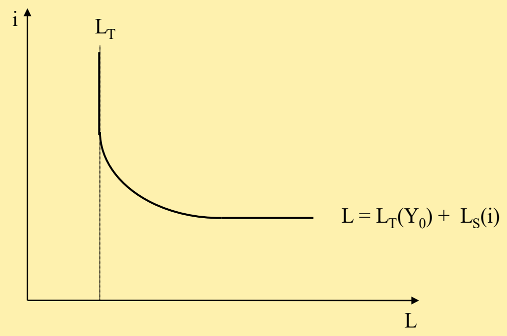
$$L = L_T + L_S \tag{6.6.1}$$

$$L = L_T(Y) + L_S(i) \tag{6.6.2}$$

$$L = k \cdot Y + l' \cdot i \tag{6.6.3}$$

As a consequence, the aggregate demand for money depends on the level of income and the interest rate. The following charts illustrate aggregate money demand primarily as a function of the interest rate, with aggregate income assumed to be constant. In a graphical illustration containing the interest rate on the vertical axis and aggregate money demand (i.e. the sum of the transactions demand and the speculative demand for money) on the horizontal axis, the transactions demand for money (L_T) can be shown as a parallel line to the vertical axis.

Figure 6.6: Aggregate Money Demand Function



In the next step, the interest rate-dependent liquidity preference function is added via horizontal addition to the curve derived above. Given the fact, that the dependency of this function with the interest rate is negative, the resulting aggregate money demand function takes this particular form. If income increases, the L_T-function moves to the right, and so does the aggregate demand for money. Vice versa, a decrease in income will lead to a leftward shift in the transactions demand function and the aggregate money demand function. An equilibrium exists, if (planned) money supply and (planned) money demand just coincide. This is equivalent to saying that the autonomous money supply ($M = M_{aut}$) provided by the central bank is fully absorbed by the transactions demand and speculative demand for money by private economic agents. Expressed in a more formal way, it follows:

$$M = L \tag{6.6.4}$$

$$M = L_T + L_S \tag{6.6.5}$$

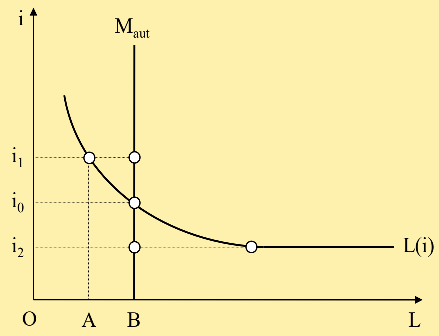
$$M = k \cdot Y + l' \cdot i \tag{6.6.6}$$

with $M = M_{aut}$. Since obviously aggregate money demand consists of transactions demand for money and speculative demand for money, which in turn, depend on the level of income and the interest rate, it proves necessary to find the specific combinations of income and the interest rate that will ensure equilibrium in the money market.

☑ Equilibrium in the Money Market with Constant Income

As a starting point, we assume a given constant level of income. In such a case, it is possible to include the money supply curve into the charts derived above. Since money supply is regarded as an autonomous variable, it enters the chart as a parallel to the interest rate axis. It is easy to see that, quite obviously, one interest rate (i_0) exists, at which money demand corresponds to money supply and, thus, there exists an equilibrium in the money market.

Figure 6.7: Equilibrium in the Money Market Assuming Constant Income



Only at this interest rate level, the desired level of cash is fully satisfied by the central bank. More specifically, the horizontal distance OA reflects the amount of transactions demand and the horizontal distance AB reflects the amount of speculative demand for money.

At the interest rate level i_1, quite obviously a disequilibrium exists, since – in horizontal terms – the level of money supply exceeds the level of money demand $(M > L)$. Expressed in other words: the actual cash holdings are higher than the desired cash holdings. Therefore, economic subjects will use the excess cash holdings to buy bonds, which in turn, raises bond prices and, consequently, interest rates fall. The decrease in interest rates will then lead to an increase in the speculative demand for money, which makes the aggregate level of money demand increase. This process will persist, until the desired level of money demand equals the actual level of money demand, and, therefore, there is no more tendency for bond purchases.

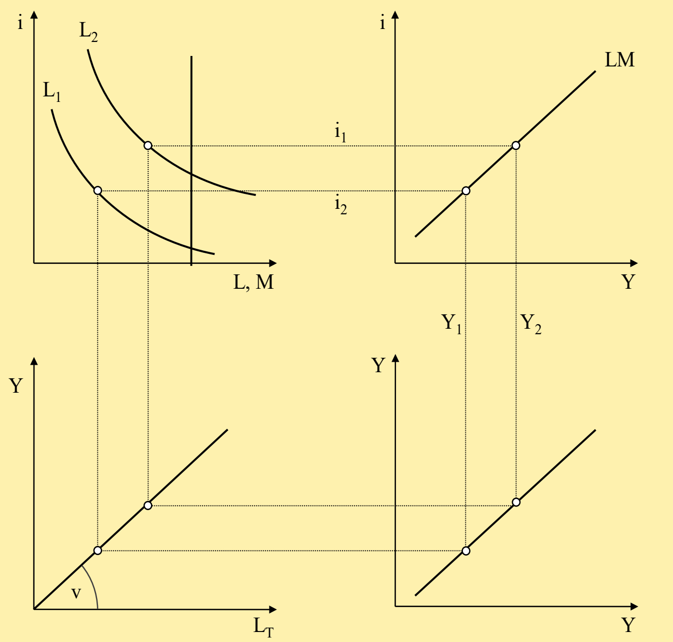
In case, the interest rate is too low, money demand will exceed money supply $(M > L)$. As a consequence, bonds will be sold, their prices decrease and the interest rate increases. The higher interest rate will then dampen the speculative demand for money, until a new equilibrium situation is reached. It is worth noting that, contrary to the situation in the market for goods, a disequilibrium in the money market will set in motion "automatic" adjustment processes, that are going to prevail until the equilibrium situation is reached again.

☑ Equilibrium in the Money Market with Variable Income

In this section, we want to relax the assumption of constant income and want to derive the equilibrium in the money market with variable income.[38] As in the case of the goods market, we would like to illustrate all possible combinations of the interest rate and income that represent an equilibrium in the money market. In the literature, this is often done following a scheme based on four quadrants.

The upper left quadrant contains the money supply and money demand curves outlined in previous sections. As already mentioned, money supply is seen as a variable, that is set in an exogenous way by the central bank. The money demand function corresponds to the one derived in more detail above. The intersection of the two curves determines the equilibrium in the money market and, thereby, the equilibrium interest rate.

Figure 6.8: Derivation of LM Curve based on a Four-Quadrant Scheme



The lower left chart shows the transactions demand for money and allows us to derive the level of income that corresponds to a certain level of transactions demand. The angle measuring the slope of the curve represents the velocity of money. This can be shown as follows:

$$L_T = k \cdot Y \text{ and therefore } \frac{\delta L_T}{\delta Y} = k \qquad (6.6.7)$$

And, therefore, it follows for the slope coefficient that we are looking for:

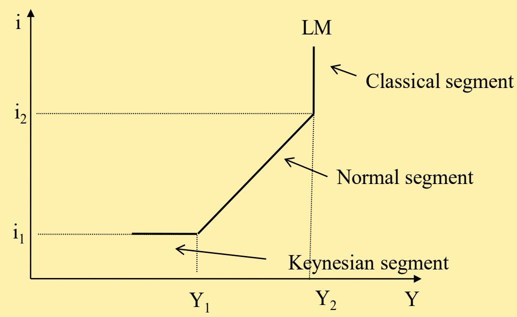
$$\frac{\delta Y}{\delta L_T} = \frac{1}{k} = V \qquad (6.6.8)$$

The lower right chart contains again the 45-degree line. Starting from the equilibrium interest rate in the upper left chart (i.e. from a point of intersection of money supply and demand), it is easy to see that this corresponds to a certain level of transactions demand for money in the lower left chart. If this income value is mirrored in the lower right quadrant, a first equilibrium situation (i_1/Y_1) for the interest rate and income can be mapped in the upper right chart. If the procedure is replicated for a higher interest rate, it leads to a second equilibrium combination of interest rate and income (i_1/Y_1).

It is easy to see how further equilibria can be derived. As a consequence, the so-called "LM curve" results that contains all combinations of the interest rate and income that represent an equilibrium in the money market. By contrast to the situation in the market for goods, an equilibrium situation in the money market requires a positive relationship between income and the interest rate. This is due to the fact that a high income necessitates a high level of the transactions demand for money. Assuming a given money supply, this asks for a low level of the speculative demand for money which, in turn, requires a high level of the interest rate.

An exact derivation – which will not be done here for reasons of space – shows that the LM curve includes three segments, namely a horizontal section, also known as the "Keynesian segment", a section in which the LM curve is upward sloping, also known as the "normal segment" and a vertical section, which is also known as the "classical segment". In graphical illustration, it thus follows:

Figure 6.9: Various Segments of the LM Curve



In the horizontal or "Keynesian segment", an infinite interest rate elasticity can be found. The economy is, thus, caught in the "liquidity trap". Any additional money is absorbed by the speculative demand for money, without leading to increases in bond prices and decreases in interest rates. Therefore, the interest rate remains unchanged. This situation typically occurs at rather low interest rate levels (such as, for instance, i_1) and corresponding values for income.

☑ The Slope of the LM Curve

As shown in the chart above, the slope of the LM curve should be

(i) $\tan\beta = \frac{d\,i}{d\,Y} > 0$

This can be shown as follows. We have seen that

(ii) $\tan\beta = \frac{d\,L_S}{d\,i} = l' < 0$ and, therefore, $dL_S = l' \cdot di$

Along the LM curve, the following relationship holds

(iii) $dM = dL = 0$ or equivalently $dM = dL_T + dL_S = 0$

or, equivalently,

(iv) $dM = k \cdot dY + l' \cdot di = 0$ and, therefore, $k \cdot dY = -\,l' \cdot di$

It then follows

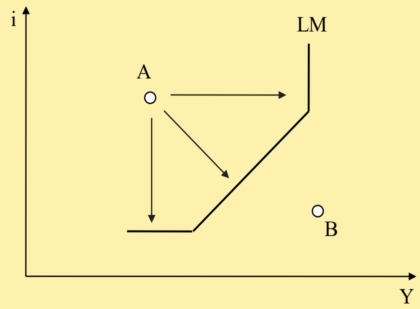
(v) $\frac{d\,i}{dY} = \tan\beta = \frac{k}{-l'}$

In the vertical or "classical" segment, money is only held in form of transactions demand for money. The interest rate elasticity and the speculative demand for money are equal to zero, which corresponds to the classical interpretation of money demand. This situation typically occurs at interest rates higher than i_2. In the normal area, the LM curve has a positive slope.

This immediately raises the question for the factors determining the position of the LM curve. An increase in money supply, for instance, would, assuming unchanged interest rates and an unchanged speculative demand for money, ask for a higher transactions demand for money, which in turn, asks for higher levels of income. As a consequence, LM must shift to the right and vice versa.

By contrast, on the money demand side, a decrease of the cash-holding coefficient implies a flatter L_T-function in the lower left quadrant and, thus, a steeper LM function. This is due to the fact that, for a given level of income, higher equilibrium interest rates must result. The formal derivation shows that the LM curve is rather flat when the responsiveness of the transactions demand of money vis-à-vis income is small or the responsiveness of the speculative demand for money vis-à-vis interest rates is high, and vice versa.

Figure 6.10: Disequilibrium in the Money Market



Which constellations of disequilibrium could occur and what are the resulting consequences? Since all points along the LM curve represent situations of equilibrium in the money market, points to the left and to the right of the LM curve must represent situations of disequilibrium.

To the left of the LM curve, as, for instance, in point A, money supply is too high or money demand is too low. This implies that, either the interest rate is too high or income is too low, or a combination of both. Since money supply is fixed by the central bank, it is necessary that money demand increases. This can happen, on the one hand, if the transactions demand for money increases, while the speculative demand for money stays unchanged. This would imply an increase in income, while the interest rate stays the same.

On the other hand, this can happen, if the speculative demand for money increases while the transactions demand for money stays unchanged. An increase in money holdings for speculation purposes can be set in motion by a decrease in the interest rate (or, equivalently, an increase in bond prices), with income remaining unchanged.

Third, this could be brought about by an increase in both, the transactions and the speculative demand for money, which necessitates both, an increase in income and a decrease in interest rates.

Following Keynes, a reaction in interest rates is the most plausible solution. In line with this, the excess money supply leads to bond purchases, bond prices increase and the interest rate decreases. Following the decrease in interest rates, the speculative demand for money increases. The opposite happens in point B. In sum, variations of the interest rate lead to systematic adjustments that persist until the equilibrium is reached again.

As pointed out on various occasions, the size of the interest rate elasticity plays a crucial role in the discussion of money demand. We will return to this issue at a later stage.

6.7 SUMMARY

- On 1 January 1999, the European Central Bank (ECB) assumed responsibility for monetary policy in the euro area – one of the largest economic areas in the world. As of 1 January 2015, the euro area includes nineteen countries.
- There are two decision-making bodies of the ECB, which are responsible for the preparation, conduct and implementation of the single monetary policy, namely the Governing Council of the ECB and the Executive Board of the ECB. A third decision-making body of the ECB is the General Council.
- Following Keynes, three motives for holding money can be distinguished, namely a transactions demand for money, a precautionary demand for money and a speculative demand for money (often also described as asset demand for money).
- Money held in the form of transactions demand serves the purpose of synchronising monetary in- and outflows that do not coincide in terms of timing. Money held

as precautionary demand is needed to deal unforeseen monetary in- and outflows. Money held for speculative purposes, in essence, represents the novelty of the Keynesian approach to money demand.

- Money is held for purposes of speculation, since economic subjects have to hold a certain amount of cash as an asset (or store of value) in order to be able to immediately invest into bonds. As a matter of fact, money does have a positive utility, namely the chance of being "liquid" at any point in time.
- The so-called "LM curve" contains all combinations of the interest rate and income that represent an equilibrium in the money market. In contrast to the situation in the market for goods, an equilibrium situation in the money market requires a positive relationship between income and the interest rate. This is due to the fact that a high income necessitates a high level of the transactions demand for money. Assuming a given money supply, this asks for a low level of the speculative demand for money which, in turn, requires a high level of the interest rate.

🕮 Key Concepts

Money supply, money demand, transactions demand for money, cash-holding coefficient, velocity of money, inventory model, speculative demand for money, liquidity preference function, interest rate elasticity, income elasticity, Keynesian segment, classical segment, normal segment, liquidity trap.

☑ Questions for Review

- Who is responsible for monetary policy in the euro area?
- What does the mandate of the ECB imply?
- Which decision-making bodies of the ECB do you know?
- Why do macroeconomists usually regard money supply as exogenous?
- What is the meaning of the velocity of money and how is this concept related to the cash-holding coefficient?
- Which three motives for holding money can be found in Keynesian theory?
- What is the liquidity preference function and how can it be illustrated in graphical terms?
- Show, how the LM curve can be derived in a four-quadrant scheme!
- What is the meaning of the expression "liquidity trap"?

7 THE IS-LM-MODEL

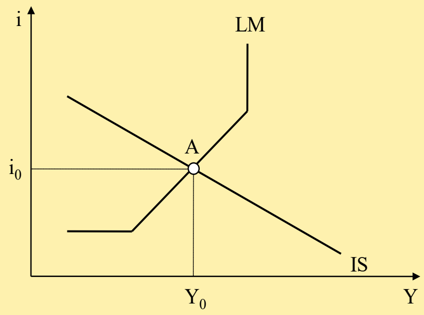
7.1 LEARNING OBJECTIVES

We start with some basic considerations on a simultaneous equilibrium in the goods market and the money market. We then analyse the existence of disequilibria and the resulting consequences. Finally, we perform some comparative-static analysis exercises in the IS-LM-model.

7.2 EQUILIBRIUM IN THE MARKETS FOR GOODS AND MONEY

After having derived the individual equilibria in the market for goods and the money market, we want to combine the previous results and use them to discuss the conditions for a simultaneous equilibrium in both markets.[39] Recall that every point on the IS curve represents an equilibrium in the market for goods, whereas every point on the LM curve stands for an equilibrium in the money market.[40]

Figure 7.1: Simultaneous Equilibrium in the Goods and Money Market



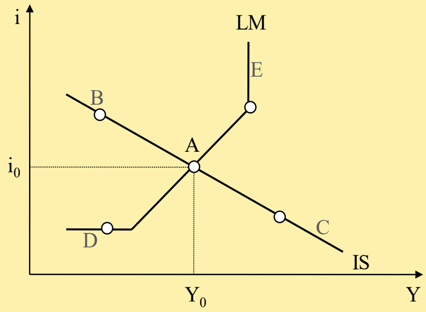
Is there a point in which both markets are simultaneously in equilibrium? Obviously, this is exactly the case, where the IS and the LM curves intersect.

Only in point A, which is consistent with the combination (i_0, Y_0), an equilibrium in the market for goods and the money market holds. It is worth mentioning, however, that this constellation represents a demand-driven equilibrium, since demand determines supply in the market for goods.

7.3 DISEQUILIBRIA

It is important to note that all points that differ from point A represent situations of either partial or of total disequilibrium. Let us illustrate this in the following chart.

Figure 7.2: Disequilibria in the IS-LM-Model



A simultaneous equilibrium only occurs in point A. In B, the market for goods is in equilibrium, but the demand for money is lower than the supply of money. In C, the market for goods is in equilibrium, but the demand for money balances exceeds the supply of money. In D, the money market is in equilibrium, but the demand for goods exceeds production, so that an unwanted inventory deccumulation occurs. In E, the money market is in equilibrium but the demand for goods falls short of production, so that an unintended inventory accumulation is occurring.

☑ Simultaneous Equilibrium in the IS-LM-Model – The Algebra

We have seen that equilibrium income and the equilibrium interest rate will materialise in the point, in which the IS and the LM curves intersect. How can this result be derived in algebraic terms? Recall that the following conditions hold:

(i) $Y = C_{aut} + c' \cdot Y + b \cdot i$ IS curve

(ii) $M = k \cdot Y + l' \cdot i$ LM curve

Following this system of equations, the goods market (for a closed economy without government influence) is in equilibrium when equation (i) holds and the money market is in equilibrium when (ii) holds. In order to ensure that both markets are simultaneously in equilibrium, both equations must hold at the same time. The general equilibrium then combines all information from the IS and the LM curves. How can we calculate the equilibrium values for income and the interest rate? To do so, we have to express equilibrium income exclusively in terms of the parameters and exogenous variables. It then follows from (ii):

(iii) $\frac{M - k \cdot Y}{l'} = i$ and, therefore,

(iv) $Y = C_{aut} + c' \cdot Y + b \cdot i = C_{aut} + c' \cdot Y + b \cdot \left(\frac{M - k \cdot Y}{l'} \right)$

(v) $Y - c' \cdot Y + (b \cdot k / l') \cdot Y = C_{aut} + (b / l') \cdot M$

(vi) $Y^* = Y = \frac{C_{aut} + (b \;/\; l') \cdot M}{(1 - c' + (b \cdot k / l'))}$

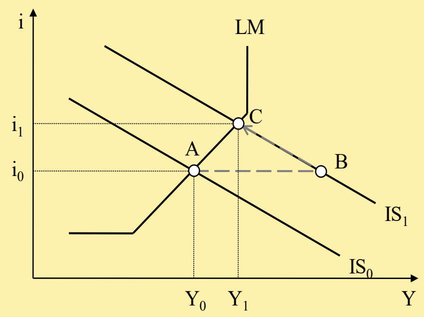
Inserting (vi) into (iii) will then give the equilibrium level for the interest rate. If the exact parameter values are known, the equilibrium values of income and the interest rate can easily be calculated.

How does the economy arrive in general equilibrium when it starts out at the wrong place? If the market for goods is out of equilibrium and, therefore, inventory accumulation or decumulation occurs, firms will step up or cut production, thus pushing the economy in direction of general equilibrium. If the money market is out of equilibrium, there will be pressure on interest rates to adjust. If, for instance, money demand is higher than money supply (as in point C), individuals cannot hold enough money at the given interest rate and income level. Therefore, they will sell bonds to obtain more money, thus driving bond prices down and interest rates up. The higher interest rate then tends to dampen investment and, thereby, also income. By contrast, if there is too little demand for money, as in point B, people will use the unwanted amount of money to buy bonds, thus increasing bond prices and lowering interest rates and so on.

7.4 SOME COMPARATIVE-STATIC ANALYSIS

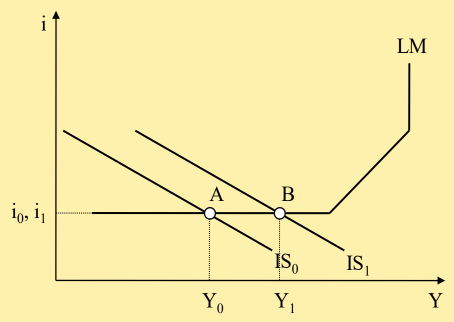
Now, let us have a closer look into comparative-static analysis. Suppose, for instance, the level of investment would increase.

Figure 7.3: Increase in Investment in the IS-LM-Model



This would lead to a rightward shift of the IS curve, from IS_0 to IS_1. Obviously, the economy moves from the previous equilibrium in point A to a new equilibrium in point C, whereby the adjustment process runs as follows: First, the increase in investment leads to an increase in income via the multiplier process. The increase in income leads to a higher transactions demand for money. Given a fixed money supply, this can only be realised via a reduction in the speculative demand for money, which in turn asks for higher interest rates. The higher interest rate then tends to dampen investment. Insofar, the initial multiplier process will to some extent be reversed by a dampening effect with the opposite sign, the latter effect being due to the interest-rate sensitivity of investment. The initial increase of the size AB is then dampened by the amount BC.

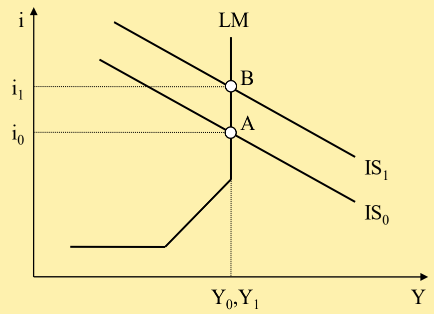
Figure 7.4: Shift of the IS curve in the Keynesian Segment



Now suppose that the initial impact would not stem from a rise in investment, but from a rise in government expenditure. Then, as we know from earlier chapters, the net effect on income is equivalent. What would be different, however, would be the effect that the higher interest rates induced by a more expansionary fiscal policy would curb back private investment, which is sensitive to higher interest rates. The latter effect is often labelled in terms of the well-known "crowding out", since government expenditure (at least partly) "crowds out" private investment. The existence and magnitude of "crowding out" effects has led to some major controversies among macroeconomists.

The overall results outlined above hold if the IS curve shifts in the "normal segment" of the LM curve. If the shift occurs in the "classical segment" or the "Keynesian segment", results will tend to be quite different. In the Keynesian segment, for instance, the full multiplier effect will work. Why is that the case? Now, obviously, the speculative demand for money is infinitely interest-rate elastic. The higher transactions demand for money that follows the initial increase in income can, therefore, be fully satisfied at the current interest rate level, since economic subjects reduce their speculative demand for money without an increase in the interest rate.

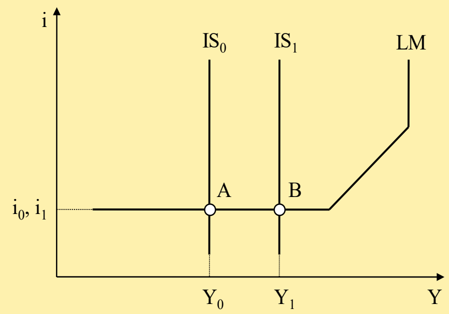
Figure 7.5: Shift of the IS curve in the Classical Segment



By contrast, in the "classical segment" area, income remains unchanged and only the interest rate increases. In other words: the multiplier effect is equal to zero. Why is that? Quite obviously, in that area, people tend to hold only transactions demand for money and are not at all willing to hold any speculative demand for money, which is, therefore, equal to zero. A decrease in the speculative demand for money is, therefore, not possible.

In our next case study, we assume investment to be completely interest-rate inelastic (i.e. "investment trap"). In such a case, the IS curve becomes a vertical line and, consequently, the multiplier works with the full effect, since the increase in the interest rate does not have an effect on investment. The full multiplier effect then holds for the Keynesian segment as well as for the normal segment.

Figure 7.6: Shift of Interest-Rate Inelastic Investment in the IS-LM-Model



So far, we have focused on changes coming from the goods market. Now, what happens if changes occur in the money market? Suppose, for instance, the central bank increases the (autonomous) money supply. Following this, the LM curve shifts from LM_0 to LM_1. As before, the results critically hinge on the exact position, in which the IS curve and the LM curve intersect. In the "normal segment" (IS_0), an increase in income and a decrease in the interest rate result.

Why is that? First, given the increase in money supply, the economic subjects have more cash available than desired. Therefore, they will try to make use of the undesired cash by buying bonds. Consequently, the prices of bonds will rise, the interest rate will fall and, following the decline in the interest rate, part of the money will end up in the speculative demand for money. At the same time, the decline in interest rates will be followed by an increase in investment and, thus, in income, in which case, the other part of the money ends up in the transactions demand for money.

Figure 7.7: Increase of Money Supply in the Normal Segment

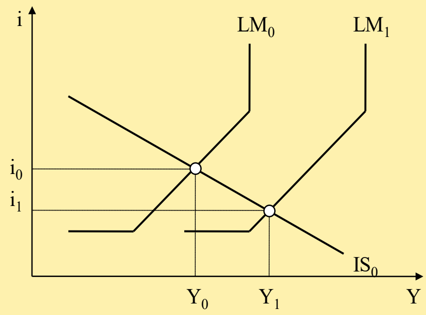
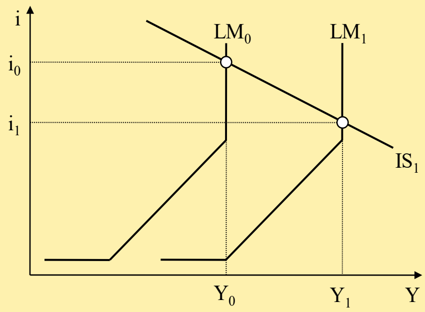


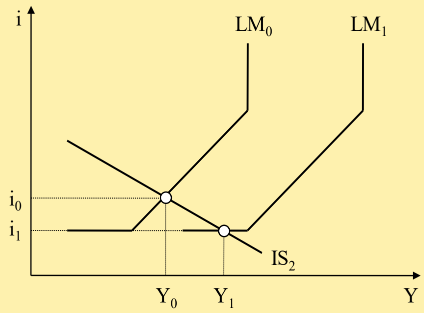
Figure 7.8: Increase of Money Supply in the Classical Segment



In the "classical segment" (IS_1), the increase in interest rates and income will be stronger than in the normal area. This is due to the fact that the amount of money held for speculative purposes is equal to zero, so that the effect on bond prices does not materialise. A new equilibrium will occur, when all the money is in the transactions demand for money. In order to materialise, the interest rate must decline to a reasonable extent, so that investment and income are stimulated enough.

In the "Keynesian segment" (IS_2), the shift in the LM curve does not have any effect on income or the interest rate. This is due to the fact that the interest rate is so low and bond prices are so high that nobody is willing to buy bonds. Therefore, the interest rate stays constant and accordingly, investment does not react. All the money disappears in the so-called "liquidity trap". In this case, which according to Keynes can happen if economies find themselves in a deep depression, monetary policy does not have any effect anymore, so that the government has to help the economy by means of fiscal policy.[41]

Figure 7.9: Increase of Money Supply in the Keynesian Segment

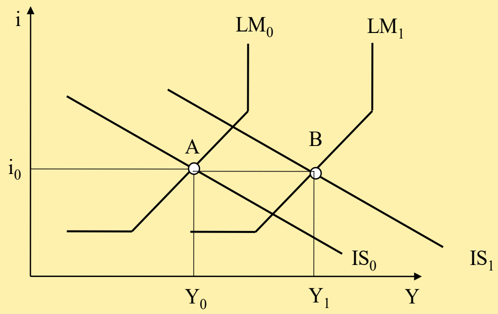


7.5 POLICY MIX

Up to now, we have investigated the effects of fiscal policy and of monetary policy on an individual basis. But this is only part of the story. In reality, monetary policy and fiscal policy can dampen each other or reinforce each other. In order to see this, suppose fiscal policy and monetary policy would run an expansionary course in combination. It is then possible to achieve a much higher effect on GDP than could be realised by following individual policies only.

Note that the increase in interest rates that normally goes hand in hand with an expansionary fiscal policy is just offset by the decrease in interest rates accompanying an expansionary monetary policy. This is what renders such a "policy mix" so attractive. Why not use this procedure then all the time? The problem is that central bankers do not like to pre-commit ex ante when talking to the fiscal policy decision-makers. This is because monetary policy-makers face a clear mandate and feel obliged to follow it.

Figure 7.10: Policy Mix



7.6 SUMMARY

- Every point on the IS curve represents an equilibrium in the market for goods, whereas every point on the LM curve represents an equilibrium in the money market. The only point, in which both markets are simultaneously in equilibrium is the location, where the IS curve and the LM curve intersect.
- An economy that starts in a situation of disequilibrium arrives in general equilibrium via changes in production and interest rates. If the market for goods is out of equilibrium and, therefore, an inventory accumulation or decumulation materialises, firms will step up or cut production, thus pushing the economy in direction of general equilibrium. If the money market is out of equilibrium, there will be pressure on bond prices and interest rates to adjust.
- An expansionary fiscal policy leads to higher interest rates and, therefore, curbs back private investment, which is sensitive to higher interest rates. The latter effect is often called "crowding out", since government expenditure (at least partly) "crowds out" private investment.
- An investment function that is completely interest-rate inelastic, a so-called "investment trap", implies a vertical IS curve. In such an environment, the multiplier works with the full effect, since the increase in the interest rate does not have an effect on investment. The full multiplier effect then holds for the Keynesian segment as well as for the normal segment.
- In the well-known "liquidity trap", bond prices are so high that nobody is willing to buy bonds. Therefore, the interest rate stays constant and, accordingly, investment does not react. In this case, which according to Keynes, can happen if economies find themselves in a deep depression, monetary policy does not have any effect anymore, so that the government has to help the economy by means of fiscal policy.

🕮 Key Concepts

Increase in investment, increase in money supply, normal segment, Keynesian segment, classical segment, "investment trap", "liquidity trap", "crowding out".

☑ Questions for Review

- What is the meaning of a "crowding out"?
- What is the meaning of a "liquidity trap"?
- What is the meaning of an "investment trap"?
- Suppose, the economy finds itself in a "liquidity trap". Is monetary policy still effective? Is fiscal policy still effective?

☑ Digging Deeper I

In 1963, Friedman and Meiselman presented the results of a study that became very famous afterwards.[42] In a nutshell, they regressed income on a measure of public expenditure, a measure of monetary policy and an additional measure representing a "catch-all variable". Using a so-called "Almon-lag technique", they in essence combined various measures of fiscal and monetary policy in order to investigate, whether changes in those policy variables have a significant impact on the economy's nominal spending. They concluded that monetary policy seemed to have an impact, while fiscal policy did not. How would you interpret these results and what would be your policy conclusions?

☑ Digging Deeper II

A number of observers have praised the virtues of a so-called "policy mix", that is a combination of monetary and fiscal policy aiming at achieving better results than by using a single instrument alone. Are they correct? What could be the main advantages of such a procedure? What could be problematic?

8 THE LABOUR MARKET

8.1 LEARNING OBJECTIVES

We start with some basic considerations on the labour market. Subsequently, we analyse the classical labour market and the way, disequilibria are dealt with. We then derive the Keynesian view of the labour market and the resulting implications. Finally, we draw some conclusions on how to best fight unemployment.

8.2 BASIC CONSIDERATIONS

As already mentioned in earlier sections, there is a third key market in macroeconomics, namely the market for labour. The latter market can be characterised by the interplay of labour supply and labour demand. In order to avoid confusion, however, it should be noted that labour supply denotes the supply of labour expressed by households, whereas the demand for labour stands for the demand for labour expressed by firms. For didactical reasons, we will first present the classical view and, subsequently, the Keynesian view in more detail.

8.3 THE LABOUR MARKET IN A CLASSICAL VIEW

When asking for the determinants of labour supply, it is obvious that households will offer their skills in order to acquire an income. This is basically equivalent to saying that the wage level is a key determinant of the amount of labour supply. In this respect, however, a crucial aspect refers to the distinction between the nominal wage level and the real wage level.

☑ Nominal and Real Wages

Suppose a household earns € 10 per hour. If the price of a good is € 1, the household can exactly buy an amount of ten goods. If the price of the good increases, however, to € 10, the household can just buy one good for his hourly wage. The real wage then equals one.

While the former (W) denotes just the wage expressed in monetary units (i.e. in €), the latter is defined as the ratio between the nominal wage and the price level (i.e. $W^r = W/P$) and, thus, expresses the purchasing power of money.

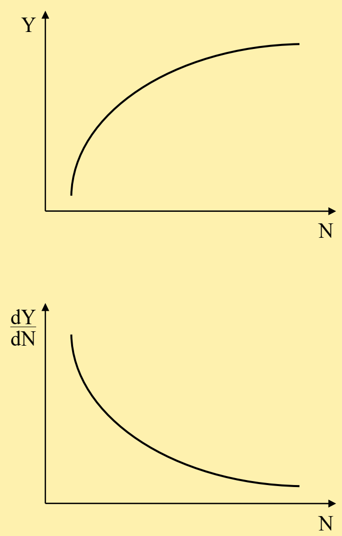
The classical doctrine is based on the belief that labour supply (N^S) depends positively on the real wage. This can be illustrated as follows:

$$N^S = N^S\left(\frac{W}{P}\right) = N^S(W^r) \qquad \text{where} \qquad (8.3.1)$$

$$dN^S / dW^r > 0 \qquad (8.3.2)$$

A higher real wage will then imply that households will tend to substitute more leisure against work. As a consequence, in a chart containing the real wage and employment, labour supply can be illustrated as an upward-sloping curve.

Figure 8.1: Production Function and Marginal Productivity



But what about the factors underlying firm's labour demand? Quite obviously, labour represents one of the main input factors of the production process. It is, therefore, helpful to characterise labour demand expressed by firms along the lines of microeconomic theory.

In terms of the latter, an increase in labour input that is accompanied by a constant input in capital implies an increase in production. A further increase in the input of labour will, however, lead to an increasing, but diminishing (that is a less than proportional) growth in output. When illustrating production as a function of employment, the so-called "production function" will result, which in essence mirrors the demand for labour.

How would the exact process look like? In essence, a firm seeking to maximize its profit (G) will have a detailed look at the costs and benefits. In this context, the return can be expressed as the product of the output (Y) and its price (P), whereas the costs of the production amount to the nominal wage (W) multiplied by the level of employment (N). Taken together, it then follows:

$$G = P \cdot Y - W \cdot N \tag{8.3.3}$$

In a purely mathematical sense, the optimal level of employment can then be derived by taking first derivatives of the return with respect to employment and setting them equal to zero. This yields:

$$dG/dN = P \cdot dY / dN - W = 0 \qquad \text{and, thus} \tag{8.3.4}$$

$$P \cdot dY/dN = W \tag{8.3.5}$$

In essence, additional workers will be employed until their marginal revenue, i.e. the price multiplied by the marginal product of their work equals the marginal costs (i.e. the nominal wage). Expressed in other words, workers should be hired up to the point, at which their (nominal) wage equals the value of the marginal product of labour (that is the price times the marginal product of labour). Re-arranging the equation helps to express the aforementioned relationship in terms of the real wage:

$$dY/dN = W/P = W^r \tag{8.3.6}$$

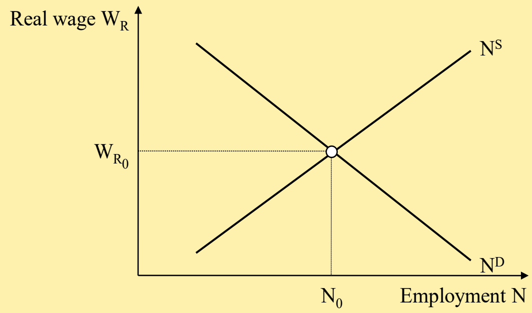
Following this equation, it is easy to see that an increase in the real wage will then lead to a decrease in the demand for labour, since wages basically represent a cost factor. Taken together, it follows that

$$N^D = N^D\left(\frac{W}{P}\right) = N^D(W^r) \qquad \text{with} \tag{8.3.7}$$

$$d\,N^D / d\,W^r < 0 \tag{8.3.8}$$

When summarising labour supply and labour demand in a chart, the (classical) equilibrium in the market for labour can be derived.

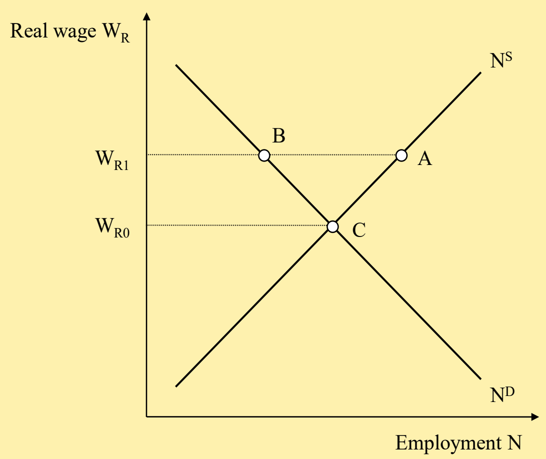
Figure 8.2: Equilibrium in the Classical Labour Market



At the point, where the two curves intersect, the equilibrium is realised and – following the classical view – the latter will be consistent with full employment. This is due to the fact that – by definition – in equilibrium, all people willing to work at the prevailing wage level will find a job. As a consequence, only people that are not willing to work at the current wage level will be unemployed. In line with this, the latter must be "voluntarily unemployed".

What will be the effects of a disequilibrium in the market for labour? If real wages are too high, an excess supply of labour would materialise, which could be graphically illustrated in terms of the horizontal distance AB. This outcome can be explained by the fact that – given the existing wage level – a labour supply in the amount of A exists, but only a demand for labour of the size of B. Quite obviously, some people willing to work at the existing wages cannot find a job. Therefore, some involuntary unemployment must exist. What will happen now? Following the classical view, such a situation cannot persist for a longer period of time, since the labour market is subject to competitive pressures. These pressures emerge from the fact, that the input factor "labour" can be characterised by homogeneity and mobility, as well as full flexibility of wages.

Figure 8.3: Disequilibrium in the Classical Labour Market



In line with this, some of the unemployed workers can be expected to signal their willingness to work for lower wages. At the same time, a lower level of real wages will provide an incentive for firms to demand more labour. As a consequence, shifts along the curves will materialise until the equilibrium is reached again. If, by contrast, real wages were too low, firmswould offer higher wages, until the equilibrium is reached again.

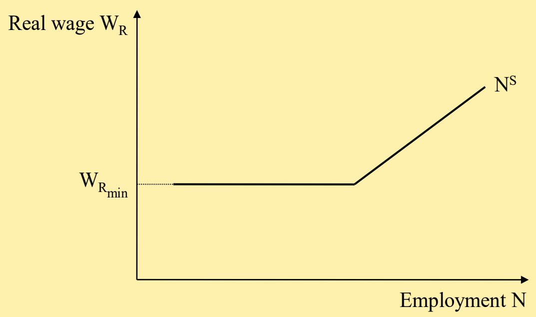
In the literature, the resulting adjustments mechanisms are often summarised in terms of the "classic full employment mechanism" or, following the British economist Adam Smith

(1723–1790), in terms of the working of an "invisible hand". A key message of the classical view, therefore, holds that an involuntary unemployment can only persist for a longer time, if real wages are too high and, for some reason, cannot move in direction of the equilibrium, which is equivalent to saying that the price mechanism fails to work properly. The latter result could, for instance, be the case if the government fixes minimum wages, or if trade unions are able to exert a strong influence on the labour market.

8.4 THE LABOUR MARKT IN A KEYNESIAN VIEW

In line with the proponents of the classical theory, Keynes held the view that the supply of labour by households depends on the wage level. Furthermore, he supported the idea of the real wage constituting the relevant variable for such a decision. Should households erroneously focus on the level of nominal wages when deciding about the supply of labour, their behaviour could be described as being subject to "money illusion". Insofar, the basic considerations are similar in both paradigms.

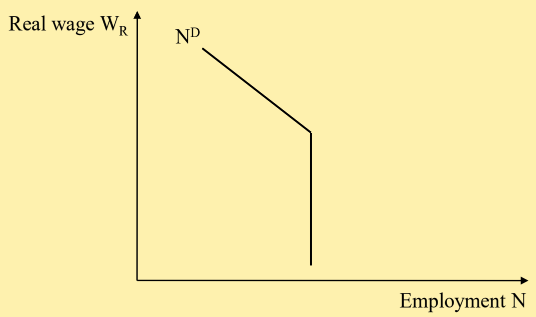
Figure 8.4: Labour Supply following Keynes



But Keynes added a further notion to these deliberations, namely the observation of a "downward rigidity of wages". In his view, the uneven distribution of power and the degree of organisation in the labour market (i.e. the existence and relative power of trade-unions) might lead to a downward rigidity in real wages. Expressed in other words: there is a lower bound for the level of the real wage (W^r_{min}), below which households are not willing to supply labour anymore. This observation bears important implications for the shape of the labour supply function. Indeed, as a consequence, a so-called "kinked" labour supply curve results.

Similar considerations can be applied for labour demand. Again, Keynes generally accepted the microeconomic relationship stating that there is an inverse relationship between the demand for labour and real wages. But, in addition to that, he claimed that the demand for labour also depends on the level of aggregate demand in the market for goods.

Figure 8.5: Labour Demand following Keynes

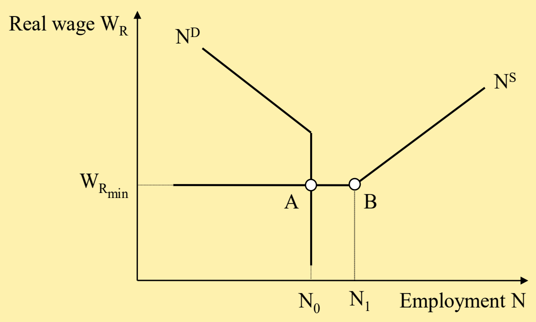


The latter claim is linked to his basic rationale that the demand for goods determines the supply of goods and, thus, employment. Employment in the economy, therefore, tends to increase with the level of aggregate demand for goods. In line with these considerations, the demand for labour can be shown as follows:

As in the case of labour supply, a "kinked" curve results. This shape is the result of the fact that, from a certain point onwards, the effective demand turns out to be too small, so that even a further decrease in the real wage does not lead to an increase in the demand for labour. This is a direct consequence of the fact that there is no demand for the additional output.[43]

If the supply and the demand for labour are illustrated in a diagram, the Keynesian equilibrium in the market for labour results. Both curves intersect in point A, which then determines the equilibrium with an equilibrium employment and an equilibrium real wage.

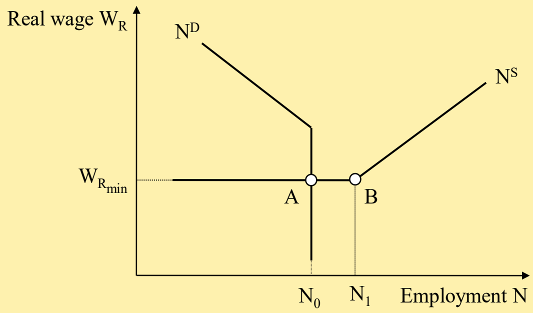
Figure 8.6: Equilibrium in the Labour Market following Keynes



It is easy to see, however, that in this point labour supply is higher than labour demand, as expressed by the horizontal distance AB, which then leads to unemployment (to the amount of AB). Given the fact that labour demand restricts labour supply, an employment of N_0 instead of the full employment level N_1 will be realised, thus leading to "involuntary unemployment". Quite obviously, the shape and position of the two curves are of key importance for the situation in the labour market.

At the same time, it is easy to see that in point B, the full employment equilibrium advocated in the classical paradigm would result. This begs immediately the following question: how can the labour demand curve be shifted to the right? Now, given the fact that the demand for labour depends on the aggregate demand for goods and, therefore, on the income situation of households, an increase in wages would enhance the purchasing power of households, increase their demand for goods, move the labour demand curve to the right and, thus, increase employment.

Figure 8.7: Classical Full Employment Equilibrium in the Labour Market and the Keynesian View



This result is due to the fact that, in the Keynesian model, wages are not just a cost argument (as in the classical model) but also an income element, thus paving the way for the so-called "purchasing power theory of wages". In line with these considerations, an existing unemployment can be either the consequence of wages being too high (i.e. the classical view) or wages being too low (i.e. the Keynesian view). As a consequence, the solution to the problem is either to lower wages (i.e. the classical view) or to raise wages (i.e. the Keynesian view), where the different proposals can be assigned to different assumptions in both paradigms.

It is important to emphasise that, according to the classical view, the labour market represents a competitive market and wages are flexible in both directions. Labour is also seen as a rather homogeneous good and mobility of labour can be assumed. Against this background, the wage mechanism ensures that a full employment equilibrium exists.

By contrast, according to Keynes, the labour market does not have the characteristics of a competitive market and wages de facto suffer from a downward rigidity. Employment then critically hinges on the level of aggregate demand, insofar a stable equilibrium with unemployment may well exist.

8.5 SUMMARY

- The classical view regards the supply of labour by households as a positive function of the real wage, while the demand for labour expressed by firms is a declining function of the real wage, given that wages are regarded as a cost factor.
- The equilibrium in the labour market is then – following the classical view – consistent with full employment. This is due to the fact that – by definition – in equilibrium, all people willing to work at prevailing wages will find work. As a consequence, only people that are not willing to work at current wages are not employed. In line with this reasoning, the latter must be voluntarily unemployed.
- Following Keynes, the so-called "downward rigidity of wages" leads to a lower limit for the real wage, below which households are not willing to supply labour anymore. As a consequence, a so-called "kinked" labour supply curve results.
- With respect to the demand for labour, Keynes accepted the basic microeconomic relationship but claimed that the demand for labour also depends on the level of aggregate demand in the market for goods. This stems from the fact that, following Keynes, demand determines supply and, thus, employment. Employment in the economy then increases with the level of aggregate demand for goods.
- Therefore, according to Keynes, a stable equilibrium with an involuntary unemployment can be realised. This is due to the fact that, in the Keynesian model, wages do not represent just a cost argument (as in the classical model) but also an income element. It then follows the validity of the so-called "purchasing power theory of wages".

- Following these considerations, unemployment can be either the consequence of wages being too high or wages being too low. As a consequence, the solution to the problem is either to lower wages (i.e. the classical view) or to raise wages (i.e. the Keynesian view), where the different proposals are based on different assumptions in both paradigms.

📖 Key Concepts

Labour supply, labour demand, labour market in the classical view, mechanism of the "invisible hand", homogeneity and mobility of labour, flexibility of wages, labour market in the Keynesian view, "money illusion", downward rigidity of wages, "kinked" labour supply curve, non-market clearing in the labour market, "purchasing theory of wages".

☑ Questions for Review

- How can a labour supply curve be derived? Which are the factors that play a role in its determination?
- How can a labour demand curve be derived? Which are the factors that play a role in its determination?
- How can – following the classical view – an equilibrium in the labour market be illustrated in graphical terms? Now suppose, the wage is above its equilibrium value. What are the consequences for the labour market? Which mechanisms can be expected to lead the labour market back to equilibrium?
- Which modifications need to be carried out to the labour supply curve following the Keynesian view? Which modifications need to be done to the labour demand curve following the Keynesian view?
- How would Keynesian economists explain the situation of a non-market-clearing in the labour market? What are the factors that determine how long such a situation will remain?

9 AGGREGATE SUPPLY AND DEMAND

9.1 LEARNING OBJECTIVES

After having derived the individual equilibria in the markets for goods, labour and money in the previous chapters, we are now in a position to proceed by constructing a simultaneous equilibrium in all these markets. This is the model of "aggregate supply and demand" in the economy. We then proceed by distinguishing between the short-run and the long-run aggregate supply curve and the implications for the simultaneous equilibrium.

9.2 AGGREGATE DEMAND

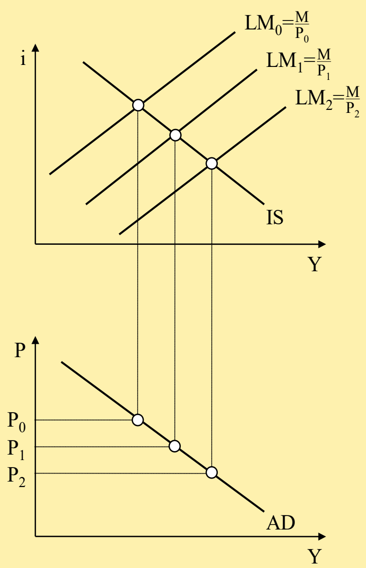
As in previous chapters, we want to derive the aggregate demand curve in a graphical representation. The starting point is the well-known IS-LM-model outlined in previous chapters.

What would be the effects of changes in the price level in the context of this model? Quite obviously, the curve that is most influenced by changes in the price level is the LM curve. If we interpret money supply and demand in real terms, a decrease in the price level will be accompanied by an increase in real money supply and, hence, in income. If the corresponding combinations of prices and income are illustrated in a chart, the "aggregate demand curve" (AD) can be derived. The latter curve has a number of interesting properties.

It basically represents the location of all equilibria between prices (P) and income (Y) that emerge out of an unchanged IS curve and a changing LM curve. It is worth keeping in mind that the changes in the LM curve, thereby, solely stem from changes in the price level since other factors – such as, for instance, the money supply – are taken as given. In the same vein, given that the IS curve remains unchanged, its components (i.e. consumption, investment and the budget deficit) stay constant. Along the AD curve, the market for goods and the money market are in equilibrium.

The AD curve has a negative slope since a decrease in the price level leads to an increase in real money supply, which in turn asks for a lower interest rate and a higher income to get the market for goods and the money market back into equilibrium.

Figure 9.1: Aggregate Demand



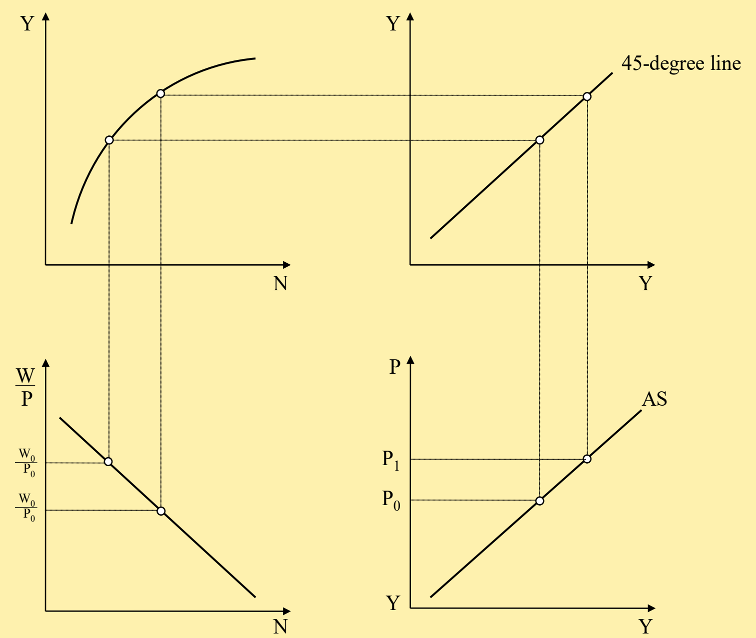
Since the AD curve represents a general equilibrium situation, the location of the curve depends on all factors that either shift the IS or the LM curve. These are a change in the nominal money supply (M) as well as changes in the autonomous components of the demand for goods, such as consumption (C), investment (I), the budget deficit ($G-T$) and the trade balance $(X-IM)$. An increase in money supply or in the autonomous demand for goods will shift AD to the right and vice versa. It is also easy to show in the graphical representation, that the steeper the IS curve, the steeper will be the slope of AD.

9.3 AGGREGATE SUPPLY

Following the construction of the aggregate demand curve, we want to proceed by deriving its counterpart, i.e. the aggregate supply curve (AS). In order to do so, we again make use of the general scheme relying on four quadrants.

In the lower left chart, the demand for labour is shown. In essence, this reflects the fact that an increase in prices will lead to a decline in the real wage and, hence, to an increase in the demand for labour by firms. In the upper left chart, the production function is shown. For a given technology and a given amount of capital, the output (Y) increases if the input of labour increases. The upper right chart contains the 45-degree line. The lower right chart then shows the resulting aggregate supply curve for various price levels. It is important to stress that the aggregate supply curve is constructed for a given nominal wage. The reason is as follows: a given wage determines the demand for labour, and following the production function, the corresponding level of output results.

Figure 9.2: Aggregate Supply



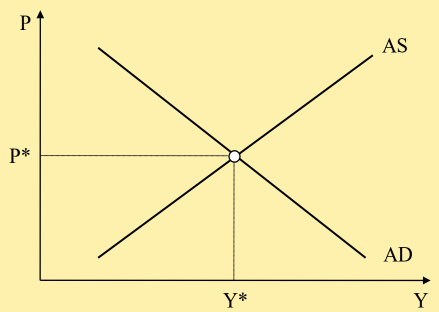
What does the aggregate supply curve exactly show? In essence, it shows for various price levels the corresponding measures of output (Y) for which firms maximise their profits. Along the AS curve, firms are in equilibrium. The AS curve has a positive slope because a higher price level decreases the real wage which, in turn, leads to an increase in the demand for labour and, hence, in production. All points along the AS curve have the same nominal wage (W_0), but different real wages and, thus, different levels of employment and output. If the nominal wage increases, AS shifts upwards.

The exact position of AS clearly depends on the position of the demand for labour and also the marginal productivity of labour in the sense that rather steep curves for labour demand and the marginal productivity will inevitably be reflected in a steep AS curve. Other inputs, such as capital, technology and many more, are taken as given. If these inputs increase (i.e. if more output can be produced with a given input), the production function will shift upward and so does the AS curve.

9.4 EQUILIBRIUM IN THE SHORT RUN

Putting aggregate supply and demand together in a chart with the price level on the vertical axis and real income on the horizontal axis allows us to graphically illustrate the simultaneous equilibrium in the market for goods, the market for labour and the money market.[44]

Figure 9.3: Aggregate Demand and Short-Run Aggregate Supply



What happens if the economy faces a disequilibrium? Suppose, the economy faces a price level that is higher than the equilibrium level.[45] In such a situation, aggregate supply is too high and aggregate demand too low compared to equilibrium. What will happen now? If the price level is higher than in equilibrium, buyers want to buy less than producers want to sell. Therefore, some suppliers will lower their prices, which in turn raises aggregate demand. At the same time, the lower prices will raise real wages (as nominal wages are fixed in the short-run) and – as real wages represent a cost factor for firms – they will cut back production and tend to lower aggregate supply. This process will go on until an equilibrium situation is realised, i.e. a situation occurs where the wishes and plans of buyers and sellers coincide for a specific price level and output level.

Given the fact, that the combination of the price level and the level of real income an economy is experiencing is obviously determined by the interplay of aggregate supply and demand, this raises the question for the factors leading to shifts in the two curves.

Regarding the demand side, the factors leading to an increase in aggregate demand (i.e. an outward or rightward shift in AD) include – among other things – higher private consumption and investment expenditure, an increase in government expenditure, a decrease in taxes and an increase in real wealth (e.g. higher stock and land prices, which in turn also lead indirectly to higher private consumption and investment expenditure). At the same time, private consumption and investment may also be driven by expectations, an aspect that has been widely neglected so far. For example, if firms expect higher future profits, they will tend to increase investment expenditures. And if households expect a higher real income for the future, aggregate demand will also increase. For this reason, improved consumer confidence and investor confidence are usually related to shifts in aggregate demand.

As regards the impact of monetary policy, an increase in money supply and the related lower interest rates will cause aggregate demand to increase, thus, shifting the demand curve to the right.[46] If these variables change in the opposite direction, however, aggregate demand will fall (i.e. AD will shift to the left).

Regarding aggregate supply, it deserves being mentioned that – among other things – increases in the prices of production factors like wages or oil prices will lead to a leftward shift in aggregate supply. By contrast, technological progress or productivity increases will shift the aggregate supply rightwards as they allow for more production at the same cost.

This analysis already shows that changes in the general price level can be brought about by shifts in the supply as well as in the demand curve or in both. A decline in aggregate supply (i.e. a leftward shift of AS) is, for instance, ceteris paribus accompanied by a short-term decrease in real output and an increase in prices, whereas an increase in demand (i.e. a rightward shift of AD) manifests itself at the same time in a higher short-term real activity and higher prices.

9.5 EQUILIBRIUM IN THE LONG RUN

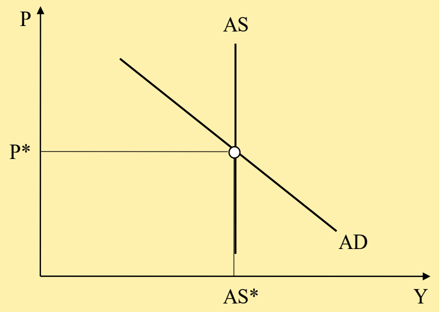
Why do these considerations mentioned above refer to a short-run aggregate supply curve? Assume, for instance, that prices are too high and, consequently, real wages are too low. As a matter of fact, firms will tend to express a higher demand for labour. This, in turn, will lead to a higher production, a shift in aggregate supply and, therefore, to an increase in real output. The positive impact of a higher price level on real output will, however, only last as long as nominal wages are unchanged and real wages remain at the lower level.

In reality, however, nominal wages are normally fixed for a certain period, say about one year, in some cases for up to two years. If workers, or unions, do not accept the lower real wages caused by higher prices, they will use the next round of wage negotiations to demand a compensation in form of higher nominal wages. If real wages then return to the level they had before the initial increase in the price level, firms will no longer find it profitable to keep production and employment at the higher level and will, thus, cut back production and employment. In other words, if real wages cannot be decreased by higher prices in the long run, then employment and production are independent from price developments in the long run. This would imply that the long-run aggregate supply curve is vertical.

The intersection of the AS curve with the horizontal level (i.e. AS^*) is what economists call the "potential level of output".[47] The potential level of output represents the value of final goods and services produced when the economy's resources are fully employed, at the current state of technology.

The long-run model then illustrates that the behaviour of aggregate demand plays a crucial role for the general price level an economy is experiencing in the long run. The reason is that with a vertical aggregate supply curve, changes in aggregate demand affect prices but not real output in the long run. If, for instance, money supply would increase, the aggregate demand curve would shift rightwards and the economy would thus – in the long-run – shift to a new equilibrium, where real production has remained the same but prices have risen.

Figure 9.4: Aggregate Demand and Long-Run Aggregate Supply



Now recall that inflation was defined as a "sustained increase in the general level of prices".[48] This would ask for a permanent upward shift in the aggregate demand curve. So, obviously, inflation must be ultimately caused by a demand factor that shows a permanent increase over time. But consumption, investment or budget deficits cannot rise forever. The latter fact leads many economists to believe, that, ultimately, inflation can only be caused by a permanent increase in the money supply.[49]

9.6 SUMMARY

- The aggregate demand curve basically represents the graphical location of all equilibria between prices and real income that emerge out of an unchanged IS curve and a changing LM curve. Along the AD curve, the market for goods and the money market are in equilibrium.
- The aggregate supply curve shows for various price levels the corresponding real output, for which firms maximise their profits. Along the AS curve, firms are in equilibrium.
- Aggregate supply and demand together then determine the simultaneous equilibrium in the market for goods, the market for labour and the money market.
- Changes in the general price level can then be brought about by shifts in the supply as well as in the demand curve or in both. A decline in aggregate supply (i.e. a leftward shift of AS) is, for instance, ceteris paribus accompanied by a short-term

decrease in real output and an increase in prices, whereas an increase in demand (i.e. a rightward shift of AD) manifests itself at the same time in a higher short-term real activity and higher prices.

- If real wages cannot be decreased by higher prices in the long run, then employment and production are independent from price developments in the long run. This would imply that the long-run aggregate supply curve is vertical.
- Keeping in mind that inflation was defined as a "sustained increase in the general level of prices", the latter would ask for a permanent upward shift in the aggregate demand curve. So, obviously, inflation must be ultimately caused by a demand factor that shows a permanent increase over time. The latter fact leads many economists to believe, that, ultimately, inflation can only be caused by a permanent increase in the money supply.

🕮 Key Concepts

Aggregate demand, aggregate supply, simultaneous equilibrium, price increases, short-run aggregate supply, long-run aggregate supply, inflation, stagflation, oil prices.

🕮 Questions for Review

- Show, how the aggregate demand curve can be derived! Which are the factors that determine its shape and location?
- Show, how the aggregate supply curve can be derived! Which are the factors that determine its shape and location?
- Which are the factors driving price increases? Is there a difference between the short run and the long run?

☑ Digging Deeper I

Assume, the economy is hit by a transitory oil price shock. What could be the consequences? How would you advise the central bank to react? What about first-round and second-round effects?

☑ Digging Deeper II

In today's economic literature, quite often arguments can be found about the effects of shocks to aggregate supply and demand. How could these be identified in real time, if you think about the related price and income changes?

PART III

10 A CLOSER LOOK AT CONSUMPTION

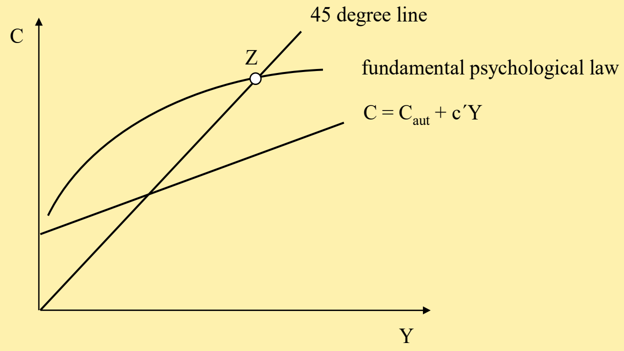
10.1 LEARNING OBJECTIVES

In this chapter, we take a closer look at some more sophisticated theories of consumer behaviour. We start by outlining the caveats of the simple Keynesian hypothesis used so far and then proceed by presenting two more elaborate hypotheses, namely the permanent income hypothesis and the life cycle hypothesis. Finally, we draw some conclusions.

10.2 BASIC CONCEPTS

Recall from earlier chapters that the simple Keynesian consumption function used so far postulated current consumption to be a function of current disposable income.

Figure 10.1: Keynesian Consumption Function

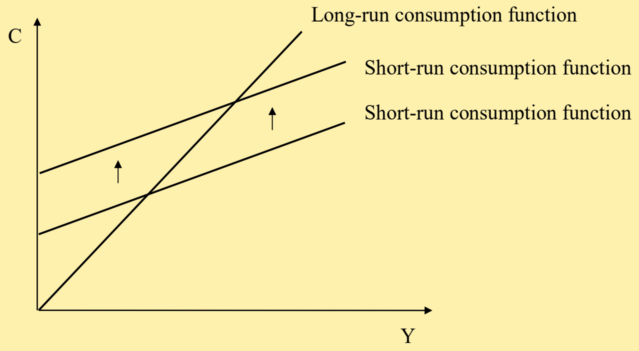


Moreover, looking forward, Keynes claimed that "[t]he fundamental psychological law, upon which we are entitled to depend with great confidence both a priori from our knowledge of human nature and from the detailed facts of experience, is that men are disposed, as a rule and on the average, to increase their consumption as their income increases, but not by as much as the increase in income."[50] It is obvious that this hypothesis would imply a non-linear consumption function of the form shown above.

It is easy to see that this kind of functional form bears far-reaching consequences. They are due to the fact that an increase in income would lead to a (relative) weaker increase in consumption, thus inevitably leading to a demand gap, an excess supply of goods and a "secular stagnation" of the economy.

In 1946, however, the Russian-US economist and nobel prize winner Simon Kuznets (1901–1985) published the results of his own investigations about the behaviour of consumption in the United States, which did not support Keynes' beliefs from a longer-term perspective.[51] In a nutshell, he argued for the existence of a long-run linear consumption function going through the origin, along which the average propensity to consume equals the marginal propensity to consume.

Figure 10.2: Kuznets' Results for the US Consumption Function



Besides, a short-run consumption function seemed to exist, which very much resembled the traditional simple Keynesian function, whereby the marginal propensity to consume is smaller than the average propensity to consume. Moreover, this short-run consumption function seemed to move upwards over time.

Kuznets' results gave rise to a number of important questions. Which of the aforementioned consumption functions is the "correct one"? The long-run variant or the short-run version? Are both correct or both incorrect? In response, some economists started to develop more sophisticated theories of consumer behaviour.

The common feature of these new approaches was the idea that individuals could be assumed to base their consumption decisions on their income over several years (instead of just the actual year) and, in addition, they try to maximise utility over time. More precisely, consumers were, first, assumed to build forward-looking expectations and, second, were regarded as preferring to maintain a stable pattern of consumption over time.

10.3 THE PERMANENT INCOME HYPOTHESIS

The US-economist and nobel prize winner Milton Friedman was the first economist to suggest a distinction between the so-called "permanent income" (Y^T) and the so-called "transitory income" (Y^P):

$$Y = Y^P + Y^T \tag{10.3.1}$$

In Friedman's view, the permanent income variable should be seen as reflecting the part of actual income that people perceive to persist also in the future. By contrast, the so-called "transitory income" represents the part of actual income that people do not expect to persist on a longer-term basis. Accordingly, the transitory income can be defined as the actual income minus permanent income.

Friedman then proposed that individuals consume a constant fraction of their permanent income.[52]

$$C = c^{LR} \cdot Y^P \tag{10.3.2}$$

The individual's marginal propensity to consume out of permanent income (c^{LR}) can then be seen as depending on a variety of determinants, among them individual tastes, interest rates, the proportion of non-human to human wealth, but also wealth considerations.

Friedman's approach allowed to explicitly distinguish between the long-run propensity to consume (described by the above relation) and the short-run propensity to consume (which reflects the reaction to the change in actual income). Following Friedman, consumers react differently to different kind of changes as they have different marginal propensities to consume. A change in permanent income will have a substantial effect on the (stable) consumption level, whereas transitory changes in income will be spread over longer periods and, thus, will only be marginally felt in the same period.

10.4 THE LIFE CYCLE HYPOTHESIS

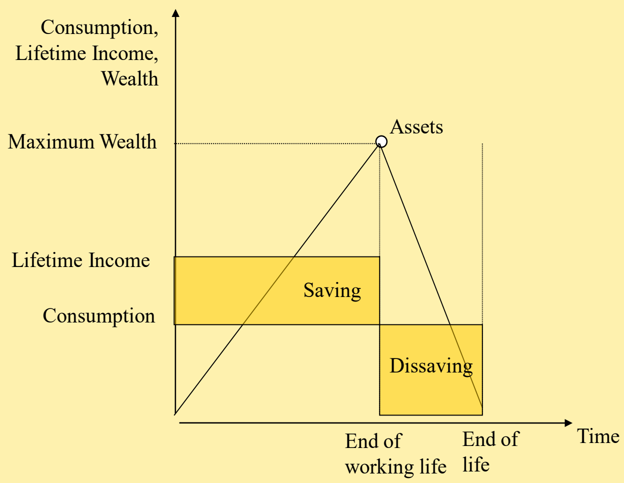
An alternative approach was suggested by the nobel prize winner Franco Modigliani.[53] In his view, people try to "smooth out" their consumption pattern over time and, hence, base current consumption on a prediction of their expected income over lifetime. Therefore, transitory changes in income can be expected to only cause minor spikes in consumption. Moreover, consumption will not only depend on disposable income, but also on the stock of assets and liabilities accumulated over the years.[54]

Just as Friedman's hypothesis, the life cycle hypothesis is able to explain that a low short-run marginal propensity to consume is fully compatible with a high and stable long-run propensity to consume. But it also adds an additional important element to Friedman's approach, namely a so-called "lifetime budget constraint", which states that the consumption of households over their lifetime is linked to their accumulated savings.[55]

In graphical terms, Modigliani's framework can be illustrated as shown in the chart below. In this chart, the horizontal axis shows the lifetime of an individual and, thereby especially two important dates, namely the end of his working life and the years until death.[56] On the vertical axis, income, consumption, savings and the asset accumulation are expressed. They can be shown to be closely interlinked along the lines described above.

An individual is assumed to aim at maintaining a stable (or, in the extreme case, even constant) level of consumption. During his working life, he receives an income. The difference between income and consumption then corresponds to the individual's savings and these savings take place over his entire working life. After retirement, however, the period of dissaving starts, which is going to persist until death.

Figure 10.3: The Life Cycle Theory of Consumption



10.5 POLICY IMPLICATIONS

What the modern theories have in common is that they shift the focus to a longer-term perspective and, thereby, especially to the phenomenon of "consumption smoothing" (i.e. the fact that people base their consumption pattern on several years of income (and not just actual income). As a consequence, a small change in actual income will have minor effects on the permanent (or lifetime) income and will, therefore, not affect consumption in a substantial way. This notwithstanding, It can be expected that small changes in income are (at least partly) spent for the purchase of durable goods, as the latter goods will be "consumed" over several years. In fact, a number of studies report evidence that the demand for consumption durables seems to be closely linked to temporary income changes.

Turning to a business cycle perspective, the same kind of reasoning can be applied. Suppose, an economic downturn materialises and people interpret this as a temporary phenomenon. They will then judge their income losses as being of a temporary nature and, thus, react via a reduction in savings (and similarly with an increase in the average propensity to consume) until the expected upswing emerges. This kind of behaviour could explain why the average propensity to consume rises in recessions and falls during expansions, a fact cannot easily be explained by simple traditional Keynesian theory.

The relatively small response to temporary changes in income also has an important bearing for fiscal policy. If consumers are confronted with tax increases and perceive them as a temporary phenomenon, they will most likely react with negligible changes in consumption.

Therefore, the multiplier effects will be much smaller than the ones derived in earlier chapters. Should the changes, however, be regarded as permanent, the resulting changes in consumption will be more substantial.

Taken together, these modern consumption theories modify the traditional Keynesian results in a way that, in case of temporary changes in income, smaller multiplier effects can be foreseen. These results can, however, be taken appropriately taken into account when designing appropriate policy measures.

10.6 SUMMARY

- The simple Keynesian consumption function postulated current consumption to be a function of current income. Moreover, Keynes suspected the existence of a "fundamental psychological law", leading to a non-linear consumption function.
- In 1946, however, the Russian-US economist Simon Kuznets published the results of his own investigations about the behaviour of consumption in the United States. His conclusions seemed to point towards a long-run linear consumption function going through the origin and a short-run consumption function, which very much

resembled the traditional simple Keynesian function. The latter fact was hard to explain by conventional wisdom and, as a consequence, some economist started to develop more sophisticated theories of consumer behaviour.

- The US-economist and nobel prize winner Milton Friedman was the first economist to propose that individuals consume a constant fraction of their expected income (i.e. the so-called "permanent income", Following Friedman, consumers react differently to different kind of changes as they have different marginal propensities to consume. A change in permanent income will have a substantial effect on the stable consumption level, whereas transitory changes in income will be spread over longer periods.
- An alternative approach was suggested by the nobel prize winner Franco Modigliani. In his view, people try to "smooth out" their consumption pattern over time and, hence, base current consumption on a prediction of their expected income over liftetime. Therefore, transitory changes in income can be expected to only cause minor responses in consumption. Moreover, consumption will not only depend on disposable income, but also on the stock of assets and liabilities accumulated over the years. In this constellation, the difference between income and consumption corresponds to the individual's savings and this saving behaviour takes place over his entire working life. After retirement, however, the period of dissaving starts, which is going to persist until death.
- Taken together, these modern consumption theories modify the traditional Keynesian results in a way that in case of transitory changes in income, smaller multiplier effects can be foreseen. This notwithstanding, consumption will change less than income and the marginal propensity to consume will be between zero and one. Insofar, the modifications can be taken appropriately into account.

📖 Key Concepts

Keynes' fundamental psychological law, secular stagnation, Kuznets' long-run consumption function, Kuznets' short-run consumption function, permanent income hypothesis, permanent income, transitory income, long-run propensity to consume, short-run propensity to consume, life cycle hypothesis, lifetime budget constraint.

☑ Questions for Review

- What was the essence of Keynes' fundamental psychological law? How can this be related to the suspicion of a secular stagnation for developed countries?
- In which way did the results of Simon Kuznets change the traditional picture?
- What are the key features of the permanent income hypothesis?
- What is the essence of the life cycle hypothesis?
- Which overall conclusions can be drawn?

11 A CLOSER LOOK AT INVESTMENT

11.1 LEARNING OBJECTIVES

In this chapter, we take a closer look at some more sophisticated theories of ivnvestment. We start by outlining some key relationships and then proceed by presenting some more elaborate considerations. Finally, we draw some conclusions.

11.2 BASIC CONCEPTS

Recall from earlier chapters that consumption was found to fluctuate procyclically, although not as much as predicted by the actual income hypothesis. In this chapter, we will find that there are good reasons to believe that also business investment also tends to fluctuate procyclically.

But before going into further detail, let us start by defining the basic concepts. What exactly is investment? In essence, investment corresponds to the change in the capital stock materialising over a specific period. As a consequence, unlike capital, investment represents a flow variable and not a stock variable. This is equivalent to stating that, while capital is measured at a specific point in time, investment can only be measured over a specific period of time.

A further distinction refers to the concepts of gross and net investment. In economics, gross investment represents the total spending of a firm on newly produced physical capital (i.e. fixed investment) and on inventories (i.e. inventory investment). By its very nature, gross investment also includes the value of capital depreciation since some investment is needed each year just to replace depreciated capital goods (i.e. technologically obsolete or worn-out plant and machinery). It is for this reason that only in case gross investment exceeds depreciation, then net investment – being defined as gross investment minus replacement investment – will be positive and this enables businesses to have a higher productive capacity and to meet rising demand. Taken together, we can define

$$I = I_{net} + D \quad \text{or, alternatively,} \tag{11.1.1}$$

$$I_{net} = I - D \tag{11.1.2}$$

where total investment (I) can – by definition – be divided into net investment (I_{net}) and replacement investment (D):

11.3 THE ACCELERATOR HYPOTHESIS

In earlier chapters, we have regarded investment mainly as a function of the level of interest rates or, alternatively, of the "internal rate of return" or, following Keynes, of the "marginal efficiency of capital". In this section, we shall see that there is good reason to regard investment also as income-induced. In fact, the so-called "accelerator hypothesis" rests on the basic assumption that firms aim at maintaining a fixed ratio of their stock of capital to their income (i.e. production).[57] While Keynes himself did not explicitly adhere to this concept in his book, it became very popular later in the Keynesian tradition.

We start by outlining some simple considerations. In order to produce a given amount of output, a certain amount of capital is needed. If we denote capital with K and output with Y, it follows:

$$K = w \cdot Y \tag{11.2.1}$$

It is easy to see that w stands for the capital-output ratio (i.e. $w = K / Y$). If the capital-output ratio can be assumed to be constant over time, the following relationship also holds:

$$K_{t-1} = w \cdot Y_{t-1} \tag{11.2.2}$$

It is then possible to express the increase in the stock of capital by the following equation:

$$K_t - K_{t-1} = w \cdot Y_t - w \cdot Y_{t-1} = w \cdot (Y_t - Y_{t-1}) \tag{11.2.3}$$

Given the fact, that the increase in the stock of capital exactly corresponds to investment, we can rewrite the equation as:

$$I_t = \Delta K_t = w \cdot (Y_t - Y_{t-1}) = w \cdot \Delta Y_t \tag{11.2.4}$$

This equation can be interpreted in a sense that an increase in income (compared to the previous year) will lead to an investment activity that is w times the increase in income.

In other words, the capital-output ratio determines the size of the accelerator. If the capital-output ratio is seven, then investment will be seven times more than the increase in income, hence the accelerator will take value of seven. It also follows that investment must be regarded as a function of the change in income. If output increases over time, then investment will be positive. If income declines, then investment will be negative (i.e. disinvestment will take place). If income remains constant, then investment will be equal to zero.

Taken together, the accelerator theory models investment as a linear proportion of changes in output, as derived from a given production technology. Its relative simplicity made the approach very popular in the fifties and early sixties of the last century and widely used even today. Note, however, that this simple model does not include any variables other than the change in income, so determinants such as, for instance, profitability, expectations and cost of capital considerations play no role in the determination of investment.

11.4 THE NEOCLASSICAL THEORY OF INVESTMENT

The accelerator hypothesis rests on the relatively basic assumption that investment is exclusively related to the change in income. These overly restrictive assumptions led some authors to develop the so-called "neoclassical approach to investment".[58]

The neoclassical theory establishes a coherent framework for investment by explaining how much capital stock a firm is willing to hold at a particular point in time. To begin with, recall that in recent chapters it was shown that an extra unit of labour will not hired unless its marginal product (i.e. the extra output it produces) equals or exceeds its real wage. In the same vein, it can be shown that an extra unit of capital will not be purchased unless the expected marginal product of capital is at least equal to the (real) user cost of capital. Moreover, the rate of investment is also determined by the speed with which firms adjust their capital stocks towards the desired level.

In essence, the amount of investment in an economy is determined by the marginal product of capital (MPK) and by the (real) user cost of capital (also called "real rental cost of capital"). The marginal product of capital quantifies how much an additional unit of capital contributes to the overall production, keeping the other factors (i.e. labour and technology) constant. It is possible to derive the marginal product of capital by making use of the neoclassical production function, which is popularly known as "Cobb-Douglas" production function. The latter can be written as follows:

$$Y = A \cdot K^{b} \cdot N^{1-b} \tag{11.3.1}$$

where Y stands for real output, K for capital, N for labour and A is a parameter that measures the level of technology. Moreover, b is a parameter that measures capital's share of output. The marginal product of capital can then be obtained by differentiating the production function with respect to capital. It then follows:

$$MPK = \frac{\delta Y}{\delta K} = b \cdot A \cdot K^{b-1} \cdot N^{1-b} \quad \text{or, alternatively,} \tag{11.3.2}$$

$$MPK = \frac{b \cdot A \cdot K^{b} \cdot N^{1-b}}{K} = \frac{b \cdot Y}{K} \tag{11.3.3}$$

Due to the existence of the "law of diminishing returns", the marginal product of capital declines, when more units of capital are used for production, the other factors being held constant.

Now let uc be the (nominal) user cost of capital and p be the price of output. In order to maximise profits, a firm will compare the marginal product of capital to the (real) user cost of capital (ruc, also called "real rental price" of capital.

$$\frac{b \cdot Y}{K} = \frac{uc}{p} = ruc \tag{11.3.4}$$

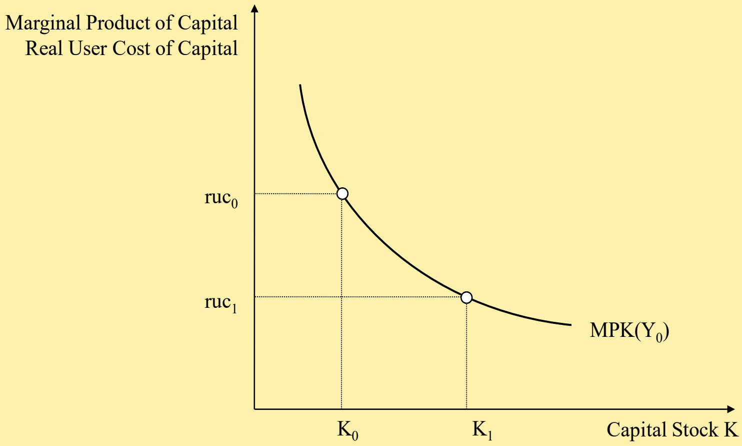
$$K = b \cdot \frac{p}{uc} \cdot Y = b \cdot \frac{1}{ruc} \cdot Y \tag{11.3.5}$$

Then, the optimal stock of capital can be expressed as

$$K^{*} = b \cdot \frac{p}{uc} \cdot Y^{*} = b \cdot \frac{1}{ruc} \cdot Y^{*} \tag{11.3.6}$$

The equation then shows that the optimal stock of capital (K^{*}) depends on the size of (optimal) output (Y^{*}) and the real user cost of capital (ruc). It is easy to see that the higher the real user cost of capital, the lower will be the optimal capital stock targeted by the firm and vice versa. The equation also reveals that a higher expected output will trigger a higher optimal capital stock.

Figure 11.1: Determination of Optimal Capital Stock



Firms are seeking to maximise profits. Therefore, as long as the value of the marginal product of capital exceeds the (real) user cost of capital, it will be profitable for the firm to expand its stock of capital. The optimum will be reached (i.e. profits will be maximised) when the firm has realised the stock of capital at which the marginal product of capital exactly equals the user cost of capital.

The exact derivation of the optimal stock of capital is illustrated in the chart above. The chart depicts the capital stock on the horizontal axis and the marginal product of capital and the real user cost of capital on the vertical axis. As long as the marginal product of capital is greater than the real user cost of capital, it pays for the firm to expand its stock of capital. At the same time, the marginal product of capital is declining with every additional increase in the stock of capital. Thus, the firm will continue adding to the stock of capital (i.e. continue to invest) up to the point, where the marginal product of capital is equal to the (real) user cost of capital.

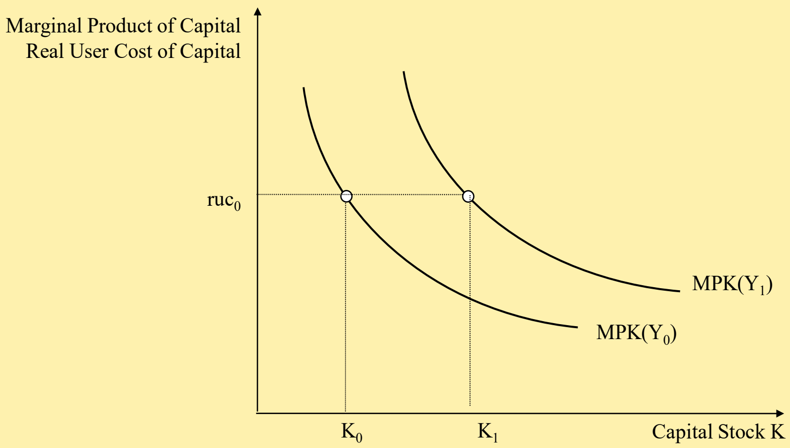
If the (real) user cost of capital is ruc_0, the firm continues investing until the capital stock K_0 is reached. In fact, K_0 is the optimal (desired) capital stock, given a user cost of capital equal to ruc_0 and a given level of output (i.e. real GDP) equal to, say, Y_0). It can be further deducted from the chart that a lower user cost of capital (ruc_1) will lead to an increase in the firm's optimal capital stock along the curve (i.e. K_1).

☑ Increase in GDP and Optimal Capital Stock

The equation above also shows that the optimal capital stock depends on the level of output. When the level of output is expected to increase, the curve describing the marginal product of capital will shift to the right as shown in the chart below. With this increase in the level of output (say from Y_0 to Y_1) for a given user cost of capital (ruc_0), the optimal capital stock increases from K_0 to K_1.

It is worth noting that, from a forward-looking perspective, it is not the current output level that determines the optimal stock of capital, but the expected output level. At the same time, there is good reason to believe that the current output level affects the expectations of future output levels.

Figure 11.2: Optimal Capital Stock and Increase in GDP



☑ Disentangling the User Cost of Capital

Since the optimal capital stock hinges critically on the user cost of capital, it is important to know, how the latter can be calculated. In general terms, the user cost of capital is determined by the price of capital goods, the rate of interest, the rate of depreciation, the expected rate of inflation and the various features of tax system (such as, for instance, the corporate tax rate, the investment tax break and many things more). Let us take a quick look into those components in more detail:

- To begin with, if a firm finances its investment (that is, purchase of new capital goods) by borrowing, then the rate of interest on the funds borrowed for investment purposes is an important element of the user rental cost of capital.
- However, when inflation in the economy is occurring, the purchasing power of money gets wiped off. The firm thus is able to pay off its nominal debt with money of less and less value. Seen from that perspective, inflation has the effect of eroding debt.[59] Taken together, the firm probably bases its decisions on the real cost of capital (i.e. the nominal rate of interest adjusted for the expected rate of inflation).
- Besides, capital undergoes some wear and tear during its use for production. Quite generally, such kind of depreciation is expressed as a flat rate. Let this depreciation be d per cent per year, then the (real) user cost o of capital translates into

$$ruc = i - \pi^e + d \qquad (11.3.7)$$

- Finally, besides the real rate of interest and depreciation, taxes levied by the government also have an effect on the user cost of capital. The impact of taxes is a bit more complex. In most countries around the globe, however, two types of taxes seem to matter in this respect: the corporation tax (i.e. a tax on profits of the companies) and the investment tax break (i.e. a development rebate). Both impact on the user cost of capital.[60]

  The corporation tax is generally believed as a proportion, say, of the profits of the companies. Therefore, the greater the corporation income tax, the higher the (effective) user cost of capital (and, consequently, the lower the firm's desired capital stock and, thus, investment.

  This notwithstanding, the tax system of various countries also provides for investment tax credit to promote investment and development. Under an investment tax credit scheme, the firms are allowed a certain rebate such as, for instance, 10 per cent of their investment expenditure, on the tax payable. Thus investment tax break reduces the (real) user cost of capital.

If t_c stands for the corporation tax and t_r represents the percent tax rebate on investment expenditure per year, then the real cost of capital can be expressed as follows:

$$ruc = i - \pi^e + d + t_c - t_r \qquad (11.4.7)$$

☑ Capital Stock Adjustment

The basic equation derived for the optimal capital stock showed that the optimal capital stock depends on the (real) user costs of capital and the level of output. Whenever one of these variables changes, the optimal capital stock will change. Then a gap between the existing actual capital stock and the desired capital stock will emerge.

How much time is needed to close that gap? In this context, it is worth noting that fixed business investment refers to the purchase of machines, construction of new factories, warehouses, office buildings and other goods. In many cases, the capital stock cannot be adjusted immediately (such as, for instance, in the power and steel industry) and lags in the adjustment of actual capital stock to the level of desired capital stock will maerialise. In such a case, the firms make some gradual adjustment in the capital stock to finally attain the desired capital stock over time. Any attempt to adjust the actual capital stock immediately will most probably result in higher costs.

11.5 TOBIN'S Q THEORY

An alternative formulation of the investment function was suggested by the US economist James Tobin.[61] In his approach, the ratio of the market value of the existing capital stock (MV) to the replacement cost (RC) of the capital stock (the so-called "Q ratio") is the main driving force of investment.

$$Q = \frac{MV}{RC} \qquad (11.4.1)$$

In this context, the market value of the firm's capital stock (in the numerator) mirrors the value of its capital as determined by the stock market and the replacement cost of firm's capital (in the denominator) represents the actual cost of existing capital stock if it is purchased in the market. For instance, if buying a new machine costs 25 million euro but raises the market value of the firm by 40 million euro, the investment should be undertaken. If it raises the market value only by 10 million euro, it should not be realised. Investment is then an incrasing function of the Q ratio.

Following Tobin, mainly two reasons could lead to deviations of Q from unity, namely delivery lags and increasing marginal costs of investment. While the theoretical foundations of the Q-theory are occasionally quite technical and the relevant Q-ratio is not easy to quantify, the approach bears a key message, namely that the macroeconomic environment is of relevance for investment. Instead of formalising the expectation mechanism, it asks to look at the bond and stock markets to determine the firm's value.

11.6 POLICY IMPLICATIONS

What can policy-makers draw as a conclusion out of these deliberations? To begin with, the accelerator theory regards investment as a (linear) proportion of changes in output, on the basis of a given production technology. Seen from that perspective, any factor that raises aggregate demand (or output) will stimulate investment. Among those factors are clearly higher government expenditures or lower taxes.

The neoclassical theory postulates the desired capital stock to be a function of the marginal product of capital and the (real) user cost of capital. The latter in turn depends on the (real) interest rate, the rate of depreciation and the tax treatment of business income. Especially business taxation is clearly one important feature of this theory and it offers ample space for active policy measures. Besides, monetary policy can – through its impact on the interest rate – exert a significant influence on the desired capital stock and, hence, investment.

Finally, Tobin's Q theory shifts the focus to the valuations expressed by the financial markets and, thus, to the broader macroeconomic environment. Seen from that perspective, any measure that impacts on the business cycle or on the actual cost of existing capital stock if re-purchased in the market (such as, for instance, the level of interest rates) can exert an influence.

11.7 SUMMARY

- In essence, investment corresponds to the change in the capital stock materialising over a specific period. As a consequence, unlike capital, investment represents a flow variable and not a stock variable.
- More particularly, gross investment represents the total spending of a firm on newly produced physical capital (i.e. fixed investment) and on inventories (i.e. inventory investment). By its very nature, gross investment therefore also includes the value of capital depreciation since some investment is needed each year just to

replace depreciated capital goods (i.e. technologically obsolete or worn-out plant and machinery). It is for this reason that only in case gross investment exceeds depreciation, then net investment – being defined as gross investment minus replacement investment – will be positive and this enables businesses to have a higher productive capacity.

- The accelerator theory models investment as a linear proportion of changes in output, as derived from a given production technology. Its relative simplicity made the approach very popular in the fifties and early sixties of the last century and widely used even today.
- The neoclassical theory establishes a coherent framework for investment by explaining how much capital stock a firm is willing to hold at a particular point in time. Building on microeconomic theory aspects, it can the be shown that the amount of investment in an economy is determined by the marginal product of capital and by the (real) user cost of capital (also called "real rental cost of capital").

- According to the US economist James Tobin, the ratio of the market value of the existing capital stock to the replacement cost of its capital stock (the so-called "Q ratio") is the main driving force of investment. While the Q-ratio is not easy to quantify in practice, the approach bears a key message, namely that the macroeconomic environment is of key relevance for investment.
- There is ample space for an active policy in order to stimulate investment. Among the most important measures are business taxation and the impact that monetary policy exerts on the interest rate.

🕮 Key Concepts

Stock variable, flow variable, gross investment, net investment, accelerator hypothesis, capital-output ratio, neoclassical theory of investment, marginal product of capital, (real) user cost of capital, (real) rental cost of capital, Tobins' Q, market value of capital stock, replacement cost of capital stock.

☑ Questions for Review

- What is behind the concept of an "accelerator hypothesis"?
- What is the essence of the neoclassical theory of invetsment?
- How can Tobin's Q theory be summarised?
- Which policy conclusions can be drawn?

12 A CLOSER LOOK AT FISCAL POLICY

12.1 LEARNING OBJECTIVES

In this chapter, we aim at shedding more light on fiscal policy. We start with a discussion about some key concepts before entering into the debate on cyclical and structural deficits and the Laffer curve. We then proceed by discussing the concept of "Ricardian Equivalence". Finally, we have a closer look at the data.

12.2 AUTOMATIC STABILIZERS

In recent years, budget deficits have proven quite large in a global perspective and – at the same time – substantially increasing. This observation has triggered discussions about government's abilities to deal with the debt service and – as a mirror image – the burden that future generations will have to face, when trying to repay the debt.

In previous chapters, we have treated government spending and taxes as fixed, exogenous numbers. This is clearly not a realistic assumption. In reality, government spending and taxes vary quite considerably over the course of the business cycle. For instance, when an economy enters into recession and people start losing their jobs and stop paying taxes, it can be expected that income tax revenues start to decline. By contrast, in a boom period, when additional jobs are created and more people will enter employment, tax revenues will quasi automatically start to increase. Seen from that perspective, income taxes tend to contribute to an "automatic" reduction in the amplitude of business cycle fluctuations. Given the fact that this does not necessitate a deliberate decision by economic policy-makers (i.e. it is a so-called "non-discretionary policy action"), economists tend to regard income taxes as so-called "automatic stabilizers".

From an economic perspective, automatic stabilizers can result in two different effects. In case the government faces a situation of an "automatic" increase in tax revenues due to ongoing economic growth, economists speak of a "fiscal dividend". In case, the higher tax revenues are not spent by the government or used for tax cuts, then the fiscal dividend might translate into a "fiscal drag" (i.e. a tendency of contractionary pressure on the economy).

12.3 CYCLICAL AND STRUCTURAL DEFICITS

Notwithstanding these general considerations, a key distinction refers to the distinction between the so-called "cyclical deficit" – defined as the part of the deficit arising from the current state of the economy – and the so-called "structural deficit" – the part of the deficit materialising, when the economy is operating at potential GDP.

More precisely, the fiscal deficit represents just the difference between government spending and tax revenues. It is, however, also of relevance, which causes lie at the root of the deficit and at which point in time it materialises. Against this background, it is quite common in the literature to define a deficit materialising during an economic downturn caused by the related increase in welfare expenditures and decrease in tax revenues as a "cyclical deficit". Running a cyclical deficit in times of recession is a widely accepted measure since any attempt to increase taxes (in order to balance the budget) will clearly worsen the situation. In fact, the cyclical deficit can also be interpreted as an automatic stabilizer because it tends to dampen economic fluctuations.

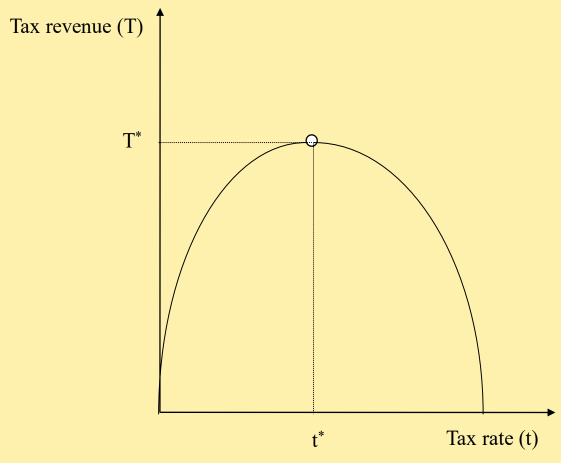
By contrast, a situation, in which a deficit materialises when the economy operates at the potential level of GDP can be described as a "structural deficit". Expressed in other words, if the economy is in equilibrium (i.e. at the potential level of GDP) and the government runs a deficit, by definition, a structural deficit exists. The sheer presence of a structural deficit implies that the government spends more than it receives when GDP is at potential and is, therefore, not very well prepared for bad times.[62]

Independent of these deliberations, the question arises whether a government deficit per se is bad or not. There is no easy answer to this question and various considerations play a role in this respect. Among other things, the answer depends on the fact whether the deficit is used for consumption purposes or for investment projects. If the government finances productive investment projects (such as the construction of schools for instance), then this generates benefits for future generations. If, by contrast, the government uses it for consumption purposes, it will not yield future benefits as the value emerges now and not in the future. Moreover, the burden for future generations is also higher when the deficit is financed by expenditures instead of tax revenues.

12.4 THE LAFFER CURVE

The Laffer Curve is a popular graphical representation of the relationship prevailing between the rates of taxation on the horizontal axis and the resulting levels of government revenue on the vertical axis.

Figure 12.1: The Laffer Curve



The starting point of the graphical visualisation is the observation that no tax revenues will be collected at the extreme tax rates of 0% and 100%. Why is that? To begin with, it is intuitively clear that, at a zero tax rate, quite obviously, no tax revenues are raised. The same probably holds for a level of 100%, since taxpayers have either lost any incentive to work or they will tend to find a way to avoid paying taxes. Laffer's key idea consists of the fact that the shape of the curve between these two extremes can be resonably approximated by a parabola. If this shape holds, there will be exactly one (optimal) tax rate (t^*) that maximises government revenues (T^*).[63]

But there is one more interesting result emerging from this concept. Note that as the marginal tax rate increases from 0 to t^*, tax revenues also increase. This is due to the fact that tax rates are yet not high enough to generate significant work disincentives. However, when the tax rate rises above T^*, more people will decide that working does not pay off anymore and, as a matter of fact, they will exit the labour force or find ways to escape the tax burden. As a consequence, the tax base starts to shrink and tax revenues will unavoidably decline. In line with these considerations, it can be concluded that the close interlinkages between the tax rate and the tax base can lead to the result that an increase in the tax rate can result in either higher or lower tax revenues. Vice versa, one can imagine a situation, in which tax rates can be lowered without any adverse effect on tax revenues.

In reality, various complexities (such as, for instance, a progressive tax system or the existence of tax loopholes and off-shore tax shelters can complicate the underlying issue quite considerably, thus rendering the concrete shape of the curve quite uncertain and disputed. This notwithstanding, the basic idea sounds very intuitive and convincing, qualifying the Laffer curve at minimum as a very useful pedagogical device, if not more.

12.5 RICARDIAN EQUIVALENCE

Another key concept in this area is the one of "Ricardian equivalence". Recall from our earlier discussions of the rational expectations hypothesis that economic subjects can be assumed to be forward-looking, to use all available and relevant information and the "correct" underlying economic model in order to avoid systematic mistakes. Against this background, what will happen if governments decide to run an expansionary fiscal policy financed by an increase in budget deficits? We have seen in earlier chapters that interest rates will increase, possibly leading to a "crowding out" of private investment.

The answer to the same question provided by the advocates of the rational expectations hypothesis is quite different. In their view, nothing will happen. Why is that? In essence, households will take the increase in current deficits as an indication for future tax increases and will, therefore, increase their current savings in order to have enough money to meet these future obligations. As a consequence, the amount of savings will increase enough as to offset the effect caused by higher government borrowing. In short, the net effect on interest rates will be zero.

The empirical evidence on Ricardian equivalence is, at best, mixed. There are as many studies offering support as others, refuting it. It should be kept in mind, however, that any empirical investigation is not only testing for Ricardian equivalence but – at the same time – also for the validity of rational expectations hypothesis, at least implicitly. This renders the issue more complicated.

12.6 SUMMARY

- Income taxes can be regarded as automatic stabilizers. The latter concept stands for a non-discretionary policy action that tends to exert a dampening effect on the business cycle.
- Periods of good economic performance could result in a "quasi-automatic" increase in government's tax revenues, thus creating a fiscal dividend. In case, the higher

tax reveues are not spent by the government or used for tax cuts, then the fiscal dividend might translate into a "fiscal drag", a tendency of contractionary pressure on the economy.

- A deficit caused by the automatic increase in welfare expenditures and decrease in tax revenues occurring during a recession is often labelled as a "cyclical deficit". If the economy is in equilibrium (i.e. at the potential level of GDP) and the government runs a deficit, a "structural deficit" exists.
- The Laffer curve is a popular graphical representation of the relationship prevailing between the rates of taxation and the resulting levels of government revenue.
- The concept of Ricardian Equivalence is a key concept in economics. Under the assumption of the rational expectations hypothesis, it can be argued that rising government deficits will not exert any influence on interest rates because households will foresee a higher tax burden in the future and, thus, start to save already today.

🕮 Key Concepts

Automatic stabilizers, fiscal dividend, fiscal drag, cyclical deficit, structural deficit, Laffer curve, Ricardian Equivalence.

☑ Questions for Review

- What is behind the concept of an "automatic stabilizer?
- What is the essence of a cyclical deficit?
- What is the essence of a structural deficit?
- What is at the core of the Laffer curve?
- What can be said about the concept of Ricardian Equivalence?

13 A CLOSER LOOK AT MONEY DEMAND

13.1 LEARNING OBJECTIVES

In this chapter, we take a closer look at some more advanced models of money demand. We start by outlining the caveats of the simple Keynesian hypothesis used so far and then proceed by presenting some more elaborate models, namely a model for the optimal transactions demand for money, a portfolio selection approach enhancing Keynes' speculative demand for money, Milton Friedman's approach to money demand and the more encompassing portfolio balance approach. Finally, we draw some conclusions.

13.2 BASIC CONCEPTS

Recall from earlier chapters that Keynes distinguished three different motives for holding money, namely transactions balances, precautionary balances and speculative balances.

Transactions balances are held for the purchase of goods and services. In line with this, the transactions demand for money is positively related to real income and prices. Precautionary balances are held to cover for unexpected items of expenditure. For the sake of simplicity, precautionary balances are usually seen as being positively correlated with real income and the price level (similarly to the transactions demand for money). Speculative balances are held to ensure that an investment into other assets is possible at any moment. In Keynes' case, the assets under review were longer-term bonds (so-called "consols"), which can be characterised by an inverse relationship between the price of a bond and the rate of interest.

Keynes argued further, that each individual holds a firm view about an "average" or "normal" rate of interest. If the current interest rate is found above the average rate, then a forward-looking individual would expect interest rates to fall. Similarly, if current rates remain below the average rate, then obviously interest rates would be expected to rise. In case of high rates of interest, individuals expect interest rates to fall and bond prices to rise. In order to take advantage from the rise in bond prices, individuals use their speculative balances to buy bonds. Thus, when interest rates are high, speculative money balances are low. By contrast, at low rates of interest, individuals expect interest rates to rise and bond prices to fall. To avoid the capital losses associated with a fall in the price of bonds, individuals will sell their bonds and add to their speculative cash balances. Thus, when interest rates are low, speculative money balances will be high. Therefore, an inverse relationship between the rate of interest and the speculative demand for money exists.

The total demand for money is obtained by summing up the transactions, precautionary and speculative demands for money. Taken together, money demand can be expressed as follows:

$$L = L^T + L^S = L^T(Y, P) + L^S(i) \tag{13.2.1}$$

whereby Y denotes real income and P and i stand for the price level and the interest rate, respectively. The Keynesian theory of the demand for money was further elaborated in the fifties by several other influential authors.

13.3 THE BAUMOL TOBIN MODEL

In two seminal studies, the US economists William Baumol and James Tobin showed that the transactions demand for money also depends on the interest rate.[64] Why is that? Suppose, an individual (or a household) receives a regular income paid at the start of a period and expenditures would occur evenly throughout the period. At the start of the following period, the individual again receives income and the situation is repeated. The income that the subject receives at the start of the period can be deposited in bonds bearing a fixed yield. The bonds are then periodically converted into money in order to pay for the expenditures. Each conversion of bonds to money is, however, necessarily connected with certain transaction costs (so-called "brokers fee") and, consequently, also with a respective loss of income.[65]

If the individual decides to hold a large amount of money in the beginning, and, thus, avoids converting bonds into money too often, then his expenses for conversion are reduced, but large opportunity costs (in the form of foregone interest rate income) arise. If, by contrast, the individual decides to hold less money, his opportunity costs will be lower, but the conversions from bonds into money will have to take place more often.

What will be the amount of optimal cash holdings? If the individual behaves in a rational manner, the amount of money will be chosen in a way that exactly minimises total costs, which are, by definition, the sum of the transaction costs (i.e. the costs for conversion) and the opportunity costs (i.e. the loss of alternative income). The mathematical derivation then yields the following solution for the optimal transactions demand for money:

$$L^T = \sqrt{\frac{b \cdot Y}{2 \cdot i}} \cdot P \qquad (13.3.1)$$

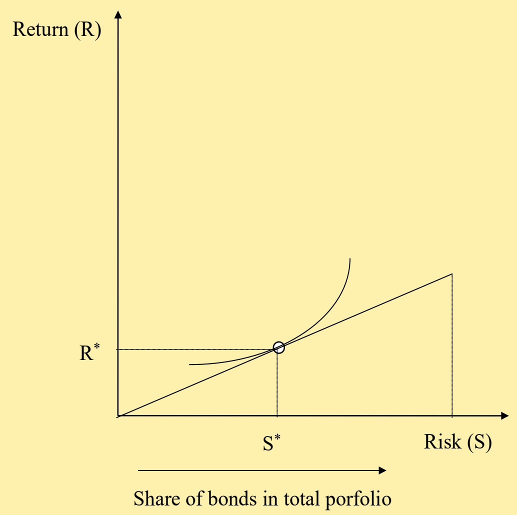
Quite obviously, the optimal transactions demand for money is equal to the square root of the product of the brokers fee (b) times real income (Y) divided by the double of the interest rate (i), and this whole expression is multiplied by the price level. The higher the broker's fee, the higher cash holdings, while the higher the interest rate, the lower these holdings. Baumol and Tobin, therefore, showed that, even in case a speculative motive does not exist, money demand will depend on the interest rate.[66]

13.4 THE PORTFOLIO SELECTION APPROACH

Another shortcoming of Keynes' theory of speculative money demand consisted of the fact that individuals hold all their wealth either in form of money or in the form of bonds (a so-called "all-or-nothing individual"). Therefore, a diversification at the individual level was not foreseen.[67] In his work, the US economist James Tobin further extended Keynes' speculative demand for money and developed it into a fully-fledged portfolio selection theory.[68] His main assumption was that individuals do not only consider the yield of the assets, but also their level of risk, when making their choice. In this respect, money can be seen as an asset which usually gives a yield of zero but, at the same time, does not carry a risk. By contrast, bonds usually return a positive yield, but also carry a certain risk.

At the same time, people have different attitudes towards risk. There are, for instance, "risk-loving" individuals (i.e. investors willing to take on additional risk for an investment that has a relatively low expected return), "risk-neutral" individuals (i.e. investors that do not care about risk) and "risk-averters" (for the latter, risk is a "bad" and, consequently, they would like to be compensated for more risk by a higher return). According to Tobin, the normal case is the one of a "risk-averter", implying that the indifference curve of such a risk-averse individual would be upward-sloping. The optimal portfolio is then determined in the point, where the indifference curve touches the budget constraint, which in turn then determines the share of bonds in the total portfolio.

Figure 13.1: Portfolio Selection Approach



On the basis of a comparison of yields and risks assigned to the assets under consideration, an optimal portfolio structure can be found. It is important to see that – under quite realistic assumptions – a diversified portfolio results at the micro-economic level; a result that has given rise to the popular statement: "don't put all your eggs into one basket".[69] Rational investors, therefore, diversify their portfolio across various assets with varying degrees of risk. This clearly proves to be an important step ahead when compared to Keynes' theory, where a diversified portfolio was only possible at the macro-level. It is worth noting, however, that in both approaches, the speculative demand for money remains a declining function of the interest rate.

13.5 FRIEDMAN'S APPROACH TO MONEY DEMAND

Milton Friedman's approach to money demand was based on the view that the demand for money could be treated similar to the demand for any other particular good along the lines of microeconomic theory.[70] More precisely, according to Friedman, the demand for money can be expressed as follows:

$$L = f(i_M, i_B, i_E, P, \pi, w, Y^P) \tag{13.5.1}$$

It is easy to see that the interest variable entails three components, namely first, the interest paid on money (i_M), which has a positive effect on the demand for money. The other two variables are the interest rates on bonds (i_B) and on equities (i_E), which both tend to decrease the demand for money.

Following Friedman, two additional other variables influencing the demand for money are the price level (P) and inflation (π). While an increase in the price level increases the demand for money, an increase in inflation decreases the demand for money.

Another determinant is represented by wealth. Friedman's definition of wealth is, however, not equivalent to any other wealth variable as it incorporates non-human wealth (i.e. bonds, stocks etc.) as well as human wealth (i.e. the sum of an individual's abilities which, when discounted, will form the background for an individual's current and future earnings). In Friedman's view, however, the fraction of non-human to human wealth (w) represents a determinant of money demand with a positive sign, as non-human wealth can be liquidated much easier in case of emergency.

Finally, Friedman mentions an income variable as a driving force of money demand. As in the case of the wealth variable, also the income variable is not equivalent to the actual income variable used in other approaches, but is represented by the "permanent income" (Y^P), the latter variable being equal to the discounted value of the wealth variable mentioned above.[71]

13.6 THE PORTFOLIO BALANCE APPROACH

Another very useful and somewhat integrated approach to think about money demand consists of the portfolio-balance approach advocated by Frankel and Obstfeld.[72] In this approach, investors allocate fractions of their financial wealth (W) to various financial assets, such as money (L), domestic bonds (B), domestic stocks as well as their foreign counterparts (F, adjusted with the respective exchange rate S). The determinants influencing the portfolio allocation are the various rates of return, the exchange rate as well as the relevant risk measures. It then follows:

$$L = b_L(i, i^*, \Delta e, \sigma) \cdot W \tag{13.6.1}$$

$$B = b_B(i, i^*, \Delta e, \sigma) \cdot W \tag{13.6.2}$$

$$S \cdot F = b_{S \cdot F}(i, i^*, \Delta e, \sigma) \cdot W \tag{13.6.3}$$

where the relative shares add up to one due to the wealth constraint. The specific charme of this model lies in the fact that it is able to explain in a very elegant way why, for instance, increased risks in the bond markets lead to a portfolio shifts into the money market and vice versa.

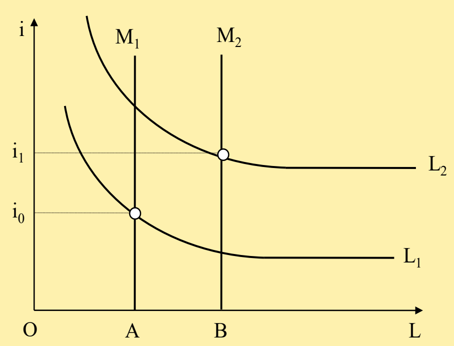
In this context, it is also worth noting that most economists assign a pivotal role to money demand rather than money supply when explaining monetary developments. This is due to the fact that the central bank cannot force individuals to hold money against their will. Individuals can always transfer money into other assets and, thereby, delete it from bank's balance sheets. While this explanation does not negate the overall role of money supply for an economy, it speaks in favour of a careful analysis of the motives underlying money demand, when trying to explain money holdings in an economy.

13.7 POLICY IMPLICATIONS

Friedman's approach relies to a crucial extent on the validity of the quantity theory, which yields a simple, yet transparent framework for monetary policy. One of the basic assumptions in Friedman's re-interpretation of the quantity theory consists of the idea of a stable money demand. And indeed, for a long time, this was not much of a problem, until a series of publications pointed towards a change in the historical relationships emerging over the course of the 1970s.[73]

Why is money demand so important? And what does it mean that money demand is unstable? If money demand were stable, it should be possible to find a stable relationship linking money to a (small) number of macroeconomic variables (such as, for instance, income, inflation and interest rates) and – on this basis – to predict, how much money, the private sector is willing to hold. This result would then enable the monetary authority to determine the exact amount of money supply needed to achieve the level of the interest rate deemed appropriate.

Figure 13.2: Monetary Policy and Unstable Money Demand



If money demand however turns unstable, then the response of the interest rate to a change in money supply is highly uncertain. Suppose, for instance, the economy is in recession and the central bank decides to bring interest rates down. As a consequence, the central bank increases money supply. It is easy to see that the level of money demand is now crucial for the response of the interest rate. If, on the one hand, people want to hold more money than predicted, the increase in the money supply might not succeed in bringing interest rates down to the desired level. If, on the other hand, people want to hold less money than predicted, interest rates might face too much of a decline, causing the economy to overheat and inflation to raise its head. This can be shown in the chart above in a more schematic way. For the sake of illustration, we restrict ourselves to the case of a higher-than-predicted money demand, which, despite an expansionary money supply results in a higher instead of lower interest rate (see points A and B). This complicates the conduct of monetary policy considerably.

The crucial question is of course: Why has money demand become unstable? In the literature, various explanations have been brought forward but none of them was found entirely convincing. Some studies have pointed towards the emergence of financial innovation. Indeed, people have now many more opportunities to hold money and to invest money. Moreover, the transfer of funds is nowadays much easier, so the amount of money kept in narrow aggregates for transaction purposes can be expected to be much smaller.

Another explanation brought forward is the internationalisation of financial markets. Indeed, against the backgrond of globalisation, it can be expected that even small differences in expected returns (but also in risk) trigger sudden and massive flows of funds in and out of countries. While both explanations certainly contain an element of truth, it is hard to believe that they could explain the full picture.

Another interesting explanation has been advocated by the British economist Charles Goodhart. Goodhart noted that the instabilities in money demand for many countries mostly emerged after the monetary authorites had started a regime of monetary targeting. This led him to conclude that a previously stable money demand function might prove unstable, when a monetary authority attempts to use a stable relationship for monetary targeting (so-called "Goodhart's Law).[74] This popular view has been challenged by the former Bundesbank and ECB chief economist Otmar Issing. Issing pointed towards the fact that the estimated money demand functions also contain elements of the money supply process, the effect being that a stable money demand function could possibly be "contaminated" by an unstable money supply process. More generally, Issing claimed that a credible and reliable monetary policy process might strengthen the stability of the financial system and vice versa (so-called "Issing's Law").[75]

13.8 A FIRST LOOK AT THE DATA

From an empirical perspective, it should be mentioned that a large number of studies has been analysing the demand for money in the euro area. Probably the most promising of these studies is the one by De Santis, Favero and Roffia.[76] The latter authors take, in addition to the traditional (domestic) determinants such as prices, income and interest rates, also international cross-border transactions into account. Not surprisingly, this model fares quite well against the background of substantial cross-border investment flows over the past decade.

Taken together, a number of points are worth being mentioned: first, all studies report evidence in favour of a stable money demand for the broad euro area aggregate M3. Second, despite some temporary signs of instabilities, the overall stability still seems to hold. Third, while the concrete set-up differs in various respects, all studies report an income elasticity of above unity in the most preferred specification. How can this be explained? In fact, it can be shown that this coefficient value reflects the effect of the missing wealth variable in the specification, i.e. the results suffer from an "omitted variable" bias.[77]

☑ Money Demand Studies – A Survey

This box summarises the results of a few selected studies on euro area money demand and the reported parameter estimates for the income elasticity.

Authors	Sample	Income elast.
Coenen and Vega (2001)	1980Q4–1997Q2	1.28
Calza, Gerdesmeier and Levy (2001)	1980Q1–2001Q4	1.33
Gerlach and Svensson (2003)	1981Q1–1998Q4	1.06
Bruggeman, Donati and Warne (2003)	1980Q2–2001 Q4	1.38
Greiber and Lemke (2005)	1980Q1–2004Q4	1.26
Brand and Cassola (2004)	1980Q1–1999Q3	1.33
Carstensen (2006)	1980Q1–2004 Q4	1.25
Dreger and Wolters (2006)	1983Q1–2004 Q4	1.24
De Santis, Favero and Roffia (2008)	1980Q1–2007 Q3	1.84
Beyer (2009)	1980Q1–2007Q4	1.70

Taken together, all studies report an income elasticity above unity for the broad euro area monetary aggregate M3.

Source: various studies.[78]

Money demand cannot only be analysed at the aggregate level but also at a sectoral level. In fact, such an investigation can prove particularly useful, as it could allow to draw some conclusions regarding the (relative) stability of the respective sector and its (relative) contribution to (potential) inflationary developments. Against this background, a few studies have been conducted for the euro area. In sum, they seem to hint at the existence of substantial cross-sectoral variations in money demand behaviour.[79] In particularly, household money demand can be shown to follow rather traditional patterns and to be most closely correlated with inflation trends over the medium term. By contrast, firms (or, in the language of the ECB, "non-financial corporations") seem to behave in a more cyclical way than households. Among all sectors, the money demand of "other financial intermediaries" ("OFIs", i.e. in particular corporations engaged primarily in long-term financing (such as financial leasing), securitised asset holdings, other financial holdings, securities and derivatives dealing (on their own account), venture capital and development capital) seems to show the highest interest rate sensitivity of all sectors, obviously reflecting the fact that many funds in this sector are managed by professional investors who continuously seek to optimise their returns.[80]

Demand for money on the part of OFIs can sometimes be very erratic as it is strongly affected by volatile conditions in financial markets and shifts in relative yields across a broad range of financial assets.

13.9 SUMMARY

- A cornerstone of the Keynesian explanation of money demand was the distinction of three different motives for holding money, namely transactions balances, precautionary balances and speculative balances.
- Baumol and Tobin showed that, if the individual behaves in a rational manner, the amount of optimal cash holdings will be chosen in a way that exactly minimises total costs, which are, by definition, the sum of the transaction costs (i.e. the costs for conversion) and the opportunity costs (i.e. the loss of alternative income). It then follows that the transactions demand for money also depends on the interest rate.
- James Tobin further extended Keynes' speculative demand for money and developed it into a fully-fledged portfolio-selection theory. On the basis of a comparison of yields and risks assigned to the assets under consideration, an optimal portfolio structure

can be found. It is important to see that – under quite realistic assumptions – a diversified portfolio results at the micro-economic level.

- M. Friedman's approach to money demand was based on the view that the demand for money could be treated similar to the demand for any other particular good along the lines of microeconomic theory. Accordingly, he distinguished various interest rates, the price level and inflation, wealth and (permanent) income as determinants of money demand.
- Another very useful and somewhat integrated approach to think about money demand consists of the portfolio-balance approach advocated by Frankel and Obstfeld. In this approach, investors allocate fractions of their financial wealth to various financial assets, such as money, domestic bonds, domestic stocks as well as their foreign counterparts. The determinants influencing the portfolio allocation are the various rates of return, the exchange rate as well as the relevant risk measures.
- Empircal studies investigating euro area money demand report evidence in favour of a stable money demand for the broad euro area aggregate M3. Moreover, while the concrete set-up differs in various respects, all studies report an income elasticity of above unity in the most preferred specification.

🕮 Key Concepts

Money demand, transaction balances, precautionary balances, speculative balances, Baumol-Tobin model, portfolio selection approach, Friedman's money demand, portfolio balance approach, instabilities in money demand.

☑ Questions for Review

- What is behind the Baumol and Tobin model?
- What is the essence of the "portfolio selection approach"?
- How can Milton Friedman's approach to money demand be illustrated?
- What is the essence of the portfolio balance approach?
- Why is the stability of money demand an issue and how can the euro area evidence be summarised?
- What can be said about Goodhart's Law and Issing's Law?

PART IV

14 THE EUROPEAN UNION AND THE EURO AREA

14.1 LEARNING OBJECTIVES

In this chapter, the concepts of the "European Union" and of the "European Central Bank" are introduced. We then take a quick look at the history of the European Economic and Monetary Union (EMU) and compare the performance of the euro area with the United States; Japan and China. In the next step, we outline the essence of the convergence criteria and the status quo of nominal and real convergence in the euro area.

14.2 THE EUROPEAN UNION

The European Union ("EU") is an economic and political union consisting of 28 independent member states. As it stands, the EU does neither constitute a federation like the United States of America, nor an organisation for cooperation between governments, like the United

Nations. In essence, the countries that form the European Union remain independent sovereign nations, but they operate through a system of shared supranational independent institutions created by them and – at the same time – also through intergovernmental negotiated decisions by the member states.[81]

☑ Members of the European Union and Year of Entry

Austria (1995), Belgium (1952), Bulgaria (2007), Croatia (2013), Cyprus (2004), Czech Republic (2004), Denmark (1973), Estonia (2004), Finland (1995), France (1952), Germany (1952), Greece (1981), Hungary (2004), Ireland (1973), Italy (1952), Latvia (2004), Lithuania (2004), Luxembourg (1952), Malta (2004), Netherlands (1952), Poland (2004), Portugal (1986), Romania (2007), Slovakia (2004), Slovenia (2004), Spain (1986), Sweden (1995) and United Kingdom (1973).

Source: http//www.europa.eu.

A closer look reveals that the EU's decision-making process involves three main institutions: the "European Parliament" – consisting of 751 Members of Parliament and meeting in Strasbourg (France), Luxembourg and Brussels (Belgium) – which basically represents the EU's citizens and is directly elected by them every five years; the "Council of the European Union" (often also informally described as "EU Council"), which basically represents the individual member states since the national ministers from each EU country meet there; and the "European Commission" (with its headquarters located in Brussels), which seeks to uphold the interest of the Union as a whole. The European Commission also drafts proposals for new European laws and manages the day-to-day business of implementing EU policies and of spending EU funds.

Other institutions are the "European Court of Justice", which upholds the rule of European Law and the "European Court of Auditors", which checks the financing of the Union's activities. Among the other European institutions, especially the "European Central Bank" is worth mentioning, as it is responsible for European monetary policy.

14.3 THE EUROPEAN CENTRAL BANK

The 19 national central banks (NCBs) in the euro area and the ECB together form the so-called "Eurosystem".[82] The Eurosystem needs to be clearly distinguished from the "European System of Central Banks" ("ESCB"), since the latter body also comprises EU Member States which have not yet adopted the euro. The NCBs of those Member States which have not adopted the euro, still conduct their own monetary policies and are, consequently, not involved in the decision-making process vis-à-vis the single monetary policy for the euro area.[83] The basic tasks of the Eurosystem are to:[84]

- define and implement the monetary policy for the euro area;
- conduct foreign exchange operations and to hold and manage the official foreign reserves of the euro area countries;
- promote the smooth operation of payment systems.

Further tasks are to:

- authorise the issue of banknotes in the euro area;
- give opinions and advice on draft Community acts and draft national legislation;
- collect the necessary statistical information either from national authorities or directly from economic agents, e.g. financial institutions;
- contribute to the smooth conduct of policies pursued by the authorities in charge of prudential supervision of credit institutions and the stability of the financial system.

☑ Members of the EMU and Year of Entry

Austria (1999), Belgium (1999), Cyprus (2008), Estonia (2011), Finland (1999), France (1999), Germany (1999), Greece (2001), Ireland (1999), Italy (1999), Latvia (2014), Lithuania (2015), Luxembourg (1999), Malta (2008), Netherlands (1999), Portugal (1999), Slovakia (2009), Slovenia (2007) and Spain (1999).

Source: http//www.ecb.int.

The highest-ranking decision-making body of the ECB is the "Governing Council".[85] It consists of the six members of the Executive Board and the Governors of the NCBs of the euro area.[86] The key task of the Governing Council is to formulate the monetary policy for the euro area. More specifically, it has the power to determine the interest rates at which credit institutions may obtain liquidity from the Eurosystem. Thus, the Governing Council indirectly influences the interest rates throughout the whole euro area economy.

The "Executive Board" of the ECB consists of the President, the Vice-President and four other members.[87] The main responsibility of the Executive Board consists in implementing the monetary policy as decided by the Governing Council and giving the necessary instructions to the NCBs for this purpose. At the same time, it also prepares the meetings of the Governing Council and manages the day-to-day business of the ECB.

The third decision-making body of the ECB is the "General Council", which comprises the President and the Vice-President of the ECB and the Governors and Presidents of all

28 NCBs of the EU Member States. As already mentioned above, the General Council has no responsibility for monetary policy decisions in the euro area. Instead, it contributes mainly to the coordination of monetary policies of those Member States that have not yet adopted the euro and also plays a role in the preparations for the possible enlargement of the euro area.

14.4 THE ROADMAP TO EMU

The abbreviation "EMU" stands for "European Economic and Monetary Union". The EMU represents a currency union located in the heart of Europe that can be characterized by the fact that the participating countries have adopted one common currency, the euro.

The idea of having a common currency in Europe has a long tradition. In 1988, the then acting President of the European Commission, Jaques Delors, chaired a committee that developed a plan to reach full economic union in various stages, including the establishment of a central bank and a single currency which would replace the national currencies. The final outcome of the work of this committee (the so-called "Delors Report") then proposed the introduction of an Economic and Monetary Union in three concerted and sequential steps.[88]

The first stage, which basically consisted of a liberalisation of all capital transactions, was launched on 1 July 1990. The second stage started on 1 January 1994 and was mainly characterised by the establishment of the European Monetary Institute (EMI).[89] The third stage began on 1 January 1999 with the fixing of the irrevocable exchange rates of the participating currencies and with the start of the single monetary policy under the responsibility of the European Central Bank.

The plans for the euro were legally formalized in provisions within the Maastricht Treaty, which was signed in 1992, subsequently ratified by all Member States and then called "European Union Treaty" ("EU Treaty"). The EU Treaty also sets up the conditions or, alternatively, the "convergence criteria", that countries of the European Union have to fulfil before they can join EMU.

Eleven member states initially qualified for the third and final stage of EMU on 1 January 1999. Those states were Belgium, Germany, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal and Finland. The number of participating Member States increased to twelve on 1 January 2001, when Greece joined the third stage of EMU. In January 2007, the number of participating countries changed again to thirteen with the entry of Slovenia into the euro area. Cyprus and Malta joined the Eurosystem on 1 January 2008. Finally, Slovakia joined on 1 January 2009, Estonia on 1 January 2011, Latvia on 1 January 2014 and Lithuania on 1 January 2015, leading altogether to nineteen countries forming the euro area at the current stage.

☑ History of the Euro Area

1962	The European Commission makes its first proposal (Marjolin-Memorandum) for economic and monetary union.
May 1964	A Committee of Governors of central banks of the Member States of the European Economic Community (EEC) is formed to institutionalise cooperation among EEC central banks.
1970	The Werner Report sets out a plan to realise an economic and monetary union in the Community by 1980.
Apr. 1972	A system (the "snake") for the progressive narrowing of the margins of fluctuation between the currencies of the Member States of the European Economic Community is established.
Apr. 1973	The European Monetary Cooperation Fund (EMCF) is set up to ensure the proper operation of the snake.
Mar. 1979	The European Monetary System (EMS) is created.
Feb. 1986	The Single European Act (SEA) is signed.

☑ History of the Euro Area

Jun. 1988	The European Council mandates a committee of experts under the chairmanship of Jacques Delors (the "Delors Committee") to make proposals for the realisation of EMU.
May 1989	The "Delors Report" is submitted to the European Council.
Jun. 1989	The European Council agrees on the realisation of EMU in three stages.
Jul. 1990	Stage One of EMU begins.
Dec. 1990	An Intergovernmental Conference to prepare for Stages Two and Three of EMU is launched.
Feb. 1992	The Treaty on European Union (the "Maastricht Treaty") is signed.
Oct. 1993	Frankfurt am Main (in Germany) is chosen as the seat of the European Monetary Institute (EMI) and of the ECB. The President of the EMI is nominated.
Nov. 1993	The Treaty on European Union enters into force.
Dec. 1993	Alexandre Lamfalussy is appointed President of the EMI, to be established on 1 January 1994.
Jan. 1994	Stage Two of EMU begins and the EMI is established.
Dec. 1995	The Madrid European Council decides on the name of the single currency and sets out the scenario for its adoption and the cash changeover.
Dec. 1996	The EMI presents specimen banknotes to the European Council.
Jun. 1997	The European Council agrees on the "Stability and Growth Pact".
May 1998	Belgium, Germany, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal and Finland are considered as fulfilling the necessary conditions for the adoption of the euro as their single currency. The Members of the Executive Board of the ECB are appointed.
Jun. 1998	The ECB and the European System of Central Banks (ESCB) are established.
Oct. 1998	The ECB announces the strategy and the operational framework for the single monetary policy to be conducted from January 1999 onwards.
Jan. 1999	Stage Three of EMU begins. The euro becomes the single currency of the euro area. Irrevocable conversion rates are fixed for the former national currencies of the participating Member States. A single monetary policy is conducted for the euro area.
Jan. 2001	Greece becomes the 12th Member State to join the euro area.
Jan. 2002	The euro cash changeover takes place; euro banknotes and coins are introduced and become sole legal tender in the euro area by the end of February 2002.
May 2004	The NCBs of the ten new EU Member States join the ESCB.

☑ History of the Euro Area

Jan. 2007	Bulgaria and Romania raise the total number of EU Member States to 27 and join the ESCB at the same time. Slovenia becomes the 13th Member State to join the euro area.
Jan. 2008	Cyprus and Malta join the euro area, thereby increasing the number of Member States to 15.
Jan. 2009	Slovakia joins the euro area.
Jan. 2011	Estonia joins the euro area.
Jan. 2014	Latvia joins the euro area.
Jan. 2015	Lithuania joins the euro area.
Jun. 2016	On 23 June, in a referendum, the population of the United Kingdom (UK) was asked to decide, whether the UK should leave or remain in the European Union. The outcome was 51.9% for leaving the EU, as compared to 48.1% for staying in the EU.
Jun. 2017	As it stands, the UK will depart the EU on 30 March 2019, but the terms of its withdrawal and the nature of its future relationship with the EU are yet to be decided. Several rounds of talks have taken place so far in 2017.

Source: Scheller (2004), p. 16, amendments by the author.

14.5 KEY CHARACTERISTICS OF THE EURO AREA ECONOMY

This section makes a first attempt to put the main economic and financial elements of the euro area economy into an international perspective.[90] Measured in terms of population and abstracting from China, the euro area – with, broadly speaking, 340 million people – is one of the largest economies in the world.

Variable	Euro Area	United States	Japan	China
Population	340.3	323.4	126.8	1382.7
GDP	11.8	15.5	4.4	17.8
GDP per capita	31.7	43.1	31.2	11.8
Value added by economic activity				
Agriculture, fishing, forestry	1.5	1.1	1.1	8.6
Industry (including construction)	25.1	30.0	28.9	39.8
Services (including non-market services)	73.4	78.9	70.0	51.6
Unemployment rate	10.0	4.9	3.1	4.0
Labour partipation rate	72.8	73.0	77.0	n.a.
Employment rate	65.4	68.1	72.8	n.a.
General government surplus (+) or deficit (-)	-1.5	-4.2	-3.5	-2.8
Gross Debt	89.2	98.9	224.1	42.6
Exports of goods and services	27.0	11.9	16.4	21.3
Imports of goods and services	23.0	14.6	15.6	18.1
Current account balance	3.5	-2.4	3.8	2.7

Table: Key Characteristics of Euro Area
Source: ECB data, data refer to the year 2015 (in some cases 2014).[91]

As regards the respective share of world GDP, China and the United States are the largest economies, followed by the euro area and Japan. A comparison of GDP per capita, however, reveals that the United States are dominating, followed by the euro area, Japan and China. The structure of production in the euro area resembles relatively closely that in the United States and Japan.

In all four economies, the services sector accounts for the largest share of total output, followed by the industrial sector. Given the highly developed nature of these economies, the share of agriculture, fishing and forestry is relatively small.

The unemployment rate is susbstantially higher in the euro area than in the other three countries. Moreover, all countries show a deficit in the general government position with United States being in the leading position. By contrast, when looking at gross debt, Japan clearly stands out. While the euro area is less open than most of its member states, it can still be considered more open than the United States. Only China shows a similar degree of openness.

14.6 AN OPTIMUM CURRENCY AREA

The theory of an "optimum currency area" (or, alternatively, "optimal currency area", "OCA") was pioneered by the Canadian economist and nobel prize winner Robert Mundell.[92] The aim of his influential article was to derive the theoretical foundations of an "optimal currency union". The latter concept can be thought of as a region, in which economic efficiency would be maximised, if the region were to share one common currency.

It goes without saying that an optimal currency union must not necessarily coincide with the legal borders of a specific country. In fact, it might perfectly prove useful, in an economic sense, if several countries share a common currency. But what exactly are the criteria that would help in deciding whether a country should enter into such an optimal currency union? This is indeed not an easy question.

Starting from the key observation that the entry into a currency union would entail the loss of two key macroeconomic tools, namely the exchange rate and monetary policy independence, the question arises under which conditions a country is in a position to succesfully cope with these costs. Not surprisingly, it can be concluded that economies that liaise in form of a monetary union should be in some sense be "equal enough". Consequently, countries would qualify that (i) either share rather similar economic structures and are exposed to, broadly speaking, the same kinds of shocks, or (ii) that have successfully established a set of "shock absorbers" that prove powerful enough to offset the effects of symmetric or asymmetric shocks.[93]

☑ Asymmetric Shocks: European Union and United States

In 1997, the IMF published the results of an analysis trying to assess the likely magnitude and effects of asymmetric shocks in the euro area and the United States. One way to carry out such an exercise was to compare the correlations of output growth for euro area countries and US regions (for a sample from 1964–1990). Below are the results:

US regions…		EU regions…	
Mideast	1.00	West Germany	1.00
New England	0.92	Netherlands	0.77
Great Lakes	0.87	France	0.71
Southeast	0.84	Belgium	0.71
Plains	0.74	Austria	0.70
Far West	0.68	Denmark	0.61
Southwest	0.34	Greece	0.61
Rocky Mountains	0.18	Spain	0.54
		Portugal	0.49
		Ireland	0.48
		Italy	0.47
		Sweden	0.43
		Finland	0.41
		United Kingdom	0.19

At the time, the IMF concluded that in both regsions, there seemed to be a "core" where output fluctiuations proved to be highly correlated. For the EU, the "core" comprised Germany, France, the Netherlands, Belgium and Austria.

Source: IMF (1997), Chapter III, pp. 62–63.

Against this background, the literature has developed a long list of criteria:

- Flexible wages: if wages react to rising unemployment figures by a significant decrease, then wage flexibility can be a valid substitute for flexible exchange rates.
- Capital mobility: if capital is mobile, this allows for a temporary increase of debt vis-à-vis foreign countries and, thus, can lead to a stabilisation in real developments.

- Fiscal transfer arrangements: finally, financial transfers from financially sounder countries to financially weaker countries can allow for a convergence and stabilisation in economic developments.

Other authors have added to these deliberations, by mentioning the similarity of inflation rates[94], the openness and the size of the economy[95], the degree of product diversification[96], price and wage flexibility[97], the degree of goods market integration, the need for real exchange rate variability and political factors.[98]

It has repeatedly been argued that – according to these criteria – the euro area would not constitute an ideal optimal currency union. Indeed, a vast number of studies seem to confirm this result. Before drawing premature discussions however, it seems necessary to take a closer look at the process in the following sections.

14.7 ADVANTAGES AND DISADVANTAGES OF A MONETARY UNION

Notwithstanding the considerations outlined above, the literature has over time engaged into a deeper and more systematic discussion of the advantages and disadvantages of a monetary union. First and foremost, a currency union – by its very nature – draws on irrevocable fixed exchange rates and, thus, eliminates any kind of nominal exchange rate uncertainty within the countries forming part of the currency union (therefore probably also reducing most of the real exchange rate uncertainty). As a consequence, the transaction costs incurred by traders and travellers (having been forced forced to exchange the home currency for other currencies before) will be reduced. Third, the aforementioned developments also add to an increased transparency in prices of goods and services and, hence, to efficiency gains and, possibly, to a higher investment activity. Finally, in case of the European Economic and Monetary Union, the newly founded currency area created the potential for the euro area to become a serious competitor to other global players, such as United States of America, China and Japan.

At the same time, such a currency union also has a number of disadvantages. To begin with, the exchange rate instrument will disappear as an active instrument from the toolkit of a country's policy-makers. Similarly, the use of an independent monetary policy as an important tool of moderating aggregate demand shocks will be rendered impossible. In line with this, a currency union will remove any chance for domestic key central bank interest rates to deviate from those in the partner countries. In fact, the principle of "one size fits all" must prevail in a currency union. Quite naturally, views will differ with respect to the question, on how important these losses would be. But recent international experience seems to suggest that these losses can have very substantial and, sometimes, very adverse implications.

Moreover, from an institutional perspective, a considerable loss of sovereignty would materialise, since power would be transferred away from the individual countries to a supranational institution. Furthermore, such a currency union can be expected to put downward pressure on inefficient tax and social security systems, thus forcing a downward adjustment in the long run.

Finally, the empirical research on the effects of exchange rate uncertainty on trade is, unfortunately, not very conclusive, with some studies suggesting that the effects of such uncertainty are actually rather small and others concluding that they are quite significant.

This begs the question of how to weight the pros and cons. As just outlined above, joining a currency union has potentially important implications for individual candidate countries which go well beyond economic issues. But even when focusing exclusively on the economic issues, the weighting of the various pros and cons is not an easy task and would clearly depend on a careful case-by-case assessment.

14.8 SOME CONTROVERSIAL VIEWS ABOUT THE BEST ROAD

The aforementioned considerations immediately give rise to the next question. What is the "best way" to enter a monetary union? In this respect, it is fair to say, that there have occasionally been heated debates between the two main schools expressing substantially different views on this issue.

A first group, comprising mainly French and Italian economists, held the view that monetary integration should play a key role in the convergence process. The creation of a common central bank would lead to a change in policy régime and, hence, to a change in inflation expectations. Therefore, an "institution-building element" was crucial in their argumentation.

By contrast, another group of economists, mainly led by German economists, put a lot of emphasis on the coordination of economic policies, which should foster the convergence process and, hence, in the end lead to the creation of a monetary union. Given the weight put on stability and convergence by this group of economists, this approach was also often referred to a "coronation theory".

From today's point of view and with the benefit of hindsight, it seems as if these two schools have – at some stage – agreed on the fact that a compromise integrating both elements in a balanced fashion could be seen as the most promising avenue.[99]

14.9 CONVERGENCE CRITERIA

As already mentioned, the criteria that a member state of the European Union must fulfil in order to join the European Economic and Monetary Union, i.e. the economic and legal conditions for the adoption of the euro, are generally known as "convergence criteria" (or sometimes also as "Maastricht criteria"). They are laid down in Article 140(1) of the EU Treaty and the Protocol annexed to the EU Treaty on the convergence criteria. More precisely, the convergence criteria include:[100]

- Low inflation: the average inflation rate observed during a one-year period before a country is examined for admission to the single currency must not exceed by more than 1.5% the average of the three best performing Member States in terms of price stability.
- Low interest rates: during the year preceding the examination, the average long-term interest rate must not exceed by more than 2% that of the three best performing Member States in terms of price stability.
- Sound public finances: the government deficit must not exceed 3% of gross domestic product (GDP) and the public debt must not exceed 60% of GDP, unless the ratio is sufficiently diminishing and approaching the reference value at a satisfactory pace.[101]
- Stable exchange rates: candidate countries must have withstood the normal fluctuation margins provided for by the exchange rate mechanism of the European Monetary System for at least two years, without devaluing their currency against that of any other Member State.

In addition to meeting these economic convergence criteria, a euro area candidate country must also ensure the criterion of "legal convergence" to be satisfied. In particular, the legislation of the member state must be in accordance with both, the EU Treaty and the Statute of the ESCB and of the ECB, thus guaranteeing, for instance, the independence of the respective national central bank. If the latter is not the case, the remaining incompatibilities have to be adjusted.

The Treaty requires the ECB and the Commission to report to the Council of the European Union at least once every two years or at the request of a Member State with a derogation on the progress made by Member States in terms of their fulfilment of the convergence criteria.

On the basis of the convergence reports submitted separately by the ECB and the Commission, and on the basis of a proposal by the Commission, the European Council (having consulted the European Parliament) may decide on the fulfilment of the criteria by a Member State and allow it to join the euro area. Since the beginning of Stage Three, the ECB has prepared convergence reports in 2000, 2002, 2004, 2006, 2007, 2008, 2010, 2013 and 2014.

The concrete application of the convergence criteria mentioned above can be illustrated by the convergence report prepared for Lithuania. Besides the legal convergence, the report also testifies compliance with the economic convergence criteria, as is shown in more detail in the table below.[102]

This notwithstanding, the convergence criteria have been criticized intensively for various reasons.[103] First, they are completely backward-looking by nature. Second, the reference values for public deficit and public debt are widely seen as arbitrary.[104] Third and perhaps most fundamentally, they are not related to the criteria for an optimal currency area that have been developed in the economic literature, such as, for instance, the mobility of labour. More broadly speaking, there are in essence no convergence criteria that refer to real developments, such as, for instance, unemployment rates or real growth in GDP in the member states.

Criterion	Lithuania	Benchmark
Inflation	0.6%	1.7%
Long-term interest rate	3.6%	6.2%
Government budget deficit	- 2.1%	- 3.0%
Government debt	41.8%	60.0%
Exchange rate	Stable within ERM II over two-year reference period	

Table: Economic Convergence Results for Lithuania

14.10 EXITING THE EURO AREA

An exit from the euro area country is, in principle, not forese en and, thus, not described in the EU-Treaty. As a consequence, no clear rules exist. While such an exit, thus, so far only represents a purely theoretical scenario, at least occasionally, press reports have indicated that some countries felt tempted to abandon the euro and to reintroduce their old currency.

A closer look at the economic implications, however, reveals that such a solution is much less attractive as it appears at first glance. In fact, a number of serious and far-reaching effects can be expected to materialise. To begin with, the newly introduced currency can be expected to devalue substantially in financial markets from the beginning. In parallel, transaction costs and currency risks would begin to re-emerge.[105] The devaluation of the new national currency can be expected to trigger a wave of capital flight as savers and investors seek a safe haven for their investments.[106] At the same time, the devaluation would also result in an initial increase in price competitiveness, thus, triggering a rise in export volumes. This notwithstanding, this beneficial effect would be offset by a rise in import prices and a potential rise in inflation, especially if wages were allowed to increase to compensate for higher import prices. In such a case, a wage-price spiral could kick off, resulting in a significant rise in unemployment, declining real income levels and a loss of savings. Finally, given that the previous debt of the country is denominated in euros, the devaluation makes those debt levels explode with the risk of default and banking and economic crises.

☑ Key Characteristics of the Euro

There are seven different denominations of the euro banknotes, namely € 500, € 200, € 100, € 50, € 20, € 10, and € 5. Some higher denominations are not issued in some countries, but this notwithstanding are legal tender. Euro banknotes have a common design for each denomination on both sides.

Moreover, there are € 2, € 1, 50c, 20c, 10c, 5c, 2c and 1c coins (the euro is divided into 100 cents), though the latter two are not generally used in Finland or the Netherlands, but again, remain legal tender. All euro coins have a common side showing the denomination and a national side showing an image specifically chosen by the country that issued it; the monarchies often have a picture of their reigning monarch; other countries usually have their national symbols. All different coins can be used in all the participating member states: for example, a euro coin bearing an image of the Spanish king is legal tender not only in Spain, but also in all the other nations where the euro is in use.

Source: http//www.ecb.int.

14.11 NOMINAL AND REAL CONVERGENCE

This brings us to the next question. What is the status of nominal and real convergence at the current juncture? Admittedly, the concept of convergence has many facets.

Country	Inflation[1)]	Long-term bond yields[1)]	Unemployment[2)]	GDP per capita[3)]
Belgium	0.6	0.84	8.5	36.5
Germany	0.1	0.50	4.6	37.1
Estonia	0.1	(n.a.)	6.2	15.2
Ireland	0.0	1.18	9.4	41.0
Greece	- 1.1	9.67	24.9	16.2
Spain	- 0.6	1.73	22.1	23.3
France	0.1	0.84	10.4	32.2
Italy	0.1	1.71	11.9	26.9
Cyprus	- 1.5	4.54	15.0	20.4
Latvia	0.2	0.96	9.9	12.3

Country	Inflation[1)]	Long-term bond yields[1)]	Unemployment[2)]	GDP per capita[3)]
Lithuania	- 0.7	1.38	9.1	12.8
Luxembourg	0.1	0.37	6.4	87.6
Malta	1.2	1.49	5.4	20.4
Netherlands	0.2	0.69	6.9	40.0
Austria	0.8	0.75	5.7	39.1
Portugal	0.5	2.42	12.6	17.3
Slovenia	- 0.8	1.71	9.0	18.7
Slovakia	- 0.3	0.89	11.5	14.4
Finland	- 0.2	0.72	9.4	37.6
Euro area	0.0	1.27	10.9	29.8

Table: Nominal and Real Convergence in the Euro Area
Source: Eurostat data, year 2015, differences due to rounding, 1) in percentages, 2) in percent of the labour force. 3) in PPP thds.

In the table above we restrict ourselves to four criteria: nominal convergence is judged by the use of inflation rates and long-term government bond yields (both can also be found among the convergence criteria). By contrast, real convergence is assessed by the use of unemployment rates and real GDP per capita.

While nominal convergence seems to broadly hold, the progress on real convergence is really disappointing. This is in line with the results of large parts of the literature.[107]

14.12 THE FUTURE OF EMU

Already at a relatively early stage, many observers have pointed to a number of shortcomings in the construction of EMU. Among other things, the lack of a central authority supervising the financial systems of EMU, the absence of central co-ordination of fiscal policies within EMU and the fact that the euro area does not constitute an "optimal currency area" were mentioned.[108] The incompleteness of EMU's institutional framework and its vulnerabilities became even more apparent in the course of the crisis. In his book, the US economist and nobel prize winner Joseph Stiglitz claims that "the eurozone was flawed at birth" and suggests – among other possible solutions – "an amicable divorce" as a way forward.[109] He further concludes that "it is better to abandon the euro to save Europe and the European project".[110]

Ii fair to say, however, that Member States have undertaken widespread reforms over the last decade.[111] In particular, two main initiatives are worth recognizing. First, given the fact that, in the absence of a complete fiscal union (as, for instance, in the United States), the euro area does not possess a federal budget with redistributive features and, therefore, national fiscal discipline proves more than essential. In this context, the newly introduced "fiscal compact" has two main elements, namely first the mandatory introduction of a balanced budget rule and a correction mechanism for deviations from balanced budgets at the national level and, second, a strengthening of the excessive deficit procedure within the Stability and Growth Pact (SGP). The European Court of Justice will supervise this process.

Another weakness consisted in uneven supervision, regulation and resolution procedures across Eurozone countries. Against this background, the need for a new supervisory framework emerged. The latter consists of two pillars. At the level of micro-prudential supervision, the European Banking Authority (EBA) as well as the European Insurance and Occupational Pensions Authority (EIOPA) and the European Securities and Markets Authority (ESMA) are involved. At the level of macro-prudential supervision, the focus is on the European Systemic Risk Board (ESRB), which can issue warnings and macro-prudential recommendations, whenever deemed necessary. The latter steps are accompanied by the new Basel III directives.

Remaining weaknesses are tackled by the establishment of 'firewalls' (that is, the EFSF and the ESM). It goes without saying, however, that further steps are needed to complete the institutional framework.

A concrete vision for the future path of EMU is laid out in the so-called "Report of the Five Presidents". The Report sets out three concrete stages:[112]

- Stage 1 or "Deepening by Doing" (1 July 2015–30 June 2017): using existing instruments and the current Treaties to boost competitiveness and structural convergence, achieving responsible fiscal policies at national and euro area level, completing the Financial Union and enhancing democratic accountability.
- Stage 2 or "completing EMU": more far-reaching actions will be launched to make the convergence process more binding, through for example a set of commonly agreed benchmarks for convergence, which would be of legal nature, as well as a euro area treasury.
- Final Stage (at the latest by 2025): once all the steps are fully in place, a deep and genuine EMU would provide a stable and prosperous place for all citizens of the EU Member States that share the single currency, attractive for other EU Member States to join if they are ready to do so.

14.13 SUMMARY

- The European Union is an economic and political union consisting of 28 independent member states.
- The Eurosystem consists of the 19 national central banks in the euro area and the ECB. By contrast, the European System of Central Banks also comprises EU Member States, which have not yet adopted the euro.
- The three decision-making bodies of the ECB are the Governing Council, the Executive Board and the General Council.
- A look at the data shows that, in terms of population, with the exception of China, the euro area is one of the largest economies in the world, with almost 340 million people. A comparison of GDP per capita, however, reveals that the United States are dominating, followed by the euro area, Japan and China. The unemployment rate in the euro area is susbstantially higher than in the other three countries. All countries show a deficit in the general government position, with Japan being in the leading position. The same applies when looking at gross debt. While the euro area is less open than most of its member states, it can still be considered more open than the United States and Japan. Only China shows a similar degree of openness.

- The economic power of economies can be measured by GDP in absolute terms or, in order to take account of the size of the population, by GDP per capita. There are substantial differences within the euro area in that respect.
- While nominal convergence seems to broadly hold, there remain substantial differences within the euro area regarding the status of real convergence.
- It is fair to admit that EMU suffers from a number of shortcomings in its construction. Among other things, the lack of a central authority supervising the financial systems of EMU, the absence of central co-ordination of fiscal policies within EMU and the fact that the euro area does not constitute an "optimal currency area" have been mentioned in the literature. However, not least against the background of the financial crisis, the Member States of EMU have undertaken widespread reforms. This notwithstanding, remaining weaknesses will need to be tackled and further steps are needed to complete the institutional framework.

🕮 Key Concepts

European Union, European Central Bank, Eurosystem, European System of Central Banks, decision-making bodies of the ECB, Governing Council, Executive Board, General Council, population, GDP per capita, gross value added, unemployment, general government debt (or surplus), unit labour costs.

☑ Questions for Review

- What is the essence of the European Union?
- What is behind the concept of the European Economic and Monetary Union?
- What is the difference between the European System of Central Banks and the Eurosystem?
- Which decision-making bodies of the ECB do you know? What exactly are their tasks?
- Which countries have the highest population in the euro area?
- Which countries perform best in terms of GDP per capita in the European Union?
- What can be said about the gross value added in various EU countries?
- What do the data tell us about the status of nominal and real convergence in the euro area?

☑ Digging Deeper

On 23 June 2016, a referendum was held seeking a decision whether the United Kingdom should leave the European Union (a so-called "Brexit") or not. The results showed a (slight) majority of 52% to 48% in favour of a Brexit. According to the literature, the main transmission channels being at work are through trade, uncertainty, cross-border investment and migration, with inevitable consequences for both regions, the United Kingdom and the European Union.

Against this background, please select two of the transmission channels mentioned above and describe in more detail, which effects would concretely work in case of a Brexit (as opposed to a situation of a non-Brexit). Who would win and who would lose? Could you guess which euro area country would react most sensitive to a Brexit, due to its strong trade and energy links with the United Kingdom?

15 BUSINESS CYCLE FLUCTUATIONS

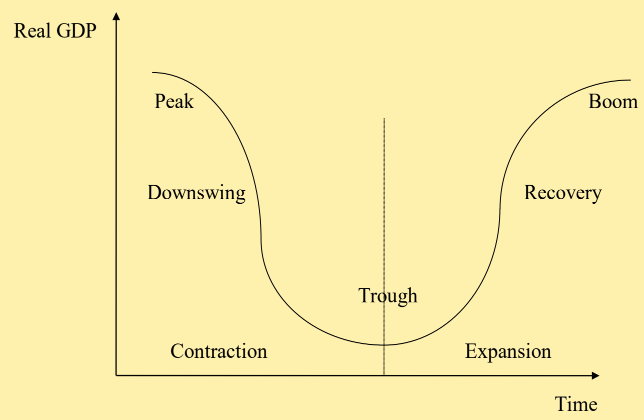
15.1 LEARNING OBJECTIVES

In this chapter, we first outline some basic considerations on business cycle fluctuations and then proceed by illustrating some possible explanations advocated in the economic literature. We then identify some business cycle indicators. Finally, we investigate the concept of the output gap before we have a closer look at the data.

15.2 FLUCTUATIONS IN REAL GDP

Economic history shows that economies typically do not grow in smooth way and along a straight path, but that growth rates tend to fluctuate over time. These variations in economic activity are generally known as "business cycles" or "business fluctuations".[113] Understanding the causes of business cycle fluctuations has attracted interest ever since in the economic profession.[114]

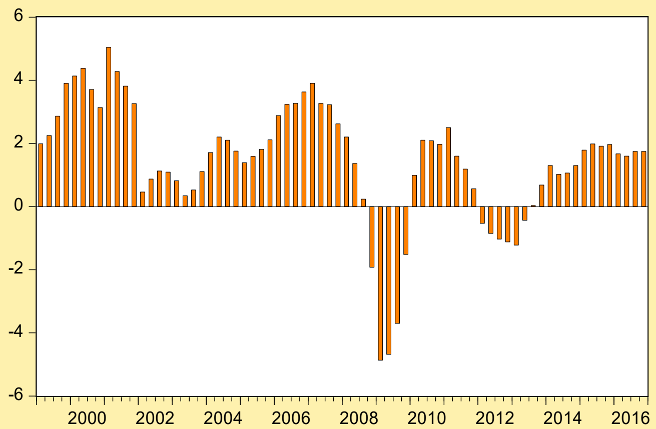
Figure 15.1: Stylised Business Cycle



As already mentioned, the expressions "business cycle" or "business fluctuations" refer to the ups and downs in economic activity.[115] In essence, the business cycle manifests itself in phases of relatively rapid growth of output, alternating with periods of relative stagnation or even decline. It is not unusual to measure business cycle fluctuations in terms of the growth rates of the real gross domestic product over time.[116] The chart above illustrates a stylised business cycle.

It is quite common in the literature to label the two main phases of the business cycle as "recession" and "expansion".[117] In addition, the turning points of such a cycle are marked by a "peak" and a "trough". While an expansion denotes an upswing in economic activity, a recession stands for a period of decline in real output, which usually spreads further into various sectors of the economy. The expression "depression" is generally used to describe a recession that is exceptional in scale as well as in duration.

Figure 15.2: Fluctuations in Euro Area Real GDP



Source: Annual percentage changes, based on ECB data

For the following considerations, the term Y_t will denote real GDP in the year t. Similarly ΔY_t will refer to the growth rate of real GDP in the year t, that is:[118]

$$\Delta Y_t = \left(\frac{Y_t - Y_{t-1}}{Y_{t-1}} \right) \cdot 100 \tag{15.2.1}$$

In this context, periods of positive GDP growth are often called expansions, whereas periods of negative GDP growth are called recessions. However, in order to avoid calling just one quarter of negative growth a recession, most practitioners use the expression only, if the economy experiences at least two consecutive quarters of substantial negative growth. In line with these considerations, a closer look at the annual growth rates of euro area data reveals the emergence of three expansions and two recessions with signs of another upswing at the end of the sample.[119]

15.3 VARIOUS TYPES OF CYCLES

Economic research has identified a variety of different cycles that have been named after their discoverers or proposers.[120] Among them are the "Kitchin inventory cycle" (after Joseph Kitchin, the cycle is generally regarded as having a duration of 3–5 years), the "Juglar fixed investment cycle" (after Clement Juglar, estimated to have a duration of 7–11 years), the "Kuznets infrastructural investment cycle" (after Simon Kuznets, 15–25 years) and the "Kondratieff cycle" or "Kondratieff wave" (after Nikolai Kondratieff, 45–60 years). It is the Juglar cycle, which is sometimes called "the" business cycle.

Especially the Kondratieff cycle deserves a closer look. In 1920, the Russian economist Nikolai Kondratieff (1892–1938) was among the first to suggest the existence of 50–60 year economic cycles.[121] More specifically, Kondratieff linked the occurrence of these so-called "waves" to the breakthrough of basic innovations that lead in turn to technological revolutions; an idea that was taken up by the Austrian economist Joseph Schumpeter in the 1930s. In line with this, the proponents of this theory suggest the existence of five waves so far, starting with the industrial revolution, and the sixth one to come. More precisely, the five cycles identified so far are:[122]

i) the wave initiated by the Industrial Revolution (1771),
ii) the wave initiated by the Age of Steam and Railways (1829),
iii) the wave initiated by the Age of Steel, Electricity and Heavy Engineering (1875),
iv) the wave initiated by the Age of Oil, the Automobile and Mass Production (1908),
v) the wave initiated by the Age of Information and Telecommuniations (1971).

Over the years, macroeconomists have engaged in heated debates about the sources of business cycles.[123] What are the very forces that induce swings in economic activity, employment and inflation? Why do market economies sometimes overheat and sometimes cool down? At the current stage, there is no final and uncontroversial answer to these questions. A variety of explanatory approaches are still in the competition.

Explanations range from the approach advocated by Thomas Malthus (1766–1834, claiming recessions were a logical consequence of the rising population), the explanations by Kondratieff (1892–1938) and Schumpeter (1883–1950, the former finding long waves which seemed to appear and disappear and the latter assigning these waves to fundamental innovations).[124] Other approaches refer to changes in aggregate demand as a major source of business cycle fluctuations (originating, for instance, from changes in spending behaviour by consumers, businesses or government) or changes in aggregate supply (attributing business cycle fluctuations mainly to changes in aggregate supply such as, for instance, the oil price shocks of the 1970s). An alternative approach, the "multiplier-accelerator model" proposed by the US-economist P.A. Samuelson (1995–2009), in essence, explains business cycle fluctuations by means of exogenous shocks that are propagated by the multiplier mechanism along with a development in investment, that is often referred to as the "accelerator". The interaction of these two behavioural assumptions then leads to regular cycles in aggregate demand.[125] Monetary theories (advocated, among others, by the Austrian School of Economics and the Monetarists) regard the expansions and contractions of monetary and credit aggregates as primary sources of fluctuations. Political business cycle theories regard the desire of politicians to be re-elected and the associated attempt to manipulate economic policies as the driving force of economic fluctuations. More precisely, it is stated that – as a rule – the year preceding the elections has turned out to be decisive for the voter's opinion. Therefore, it is very tempting for politicians to initiate expansionary policies prior to the elections and, if needed, restrictive polices afterwards. As a result, the economy is forced to experience sudden changes in economic conditions leading to economic cycles.

Real-business cycle proponents believe that innovations or productivity shocks in one sector spill over to the rest of the economy and cause recessions and booms. In a way, this can be seen as a complement of the view that cycles are caused primarily by shocks to aggregate supply, and not by changes in aggregate demand.

Taken together, it is easy to see that most approaches are not mutually exclusive. In fact, some cycles might contain elements of various theories. Furthermore, since in reality no two cycles are similar in their actual characteristica, all of the competing theories probably contain an element of truth, but none of them can claim to be universally valid.

15.4 BUSINESS CYCLE INDICATORS

In order to categorise the various business cycle indicators used in most industrial countries, it is useful to distinguish them according to some three criteria. The first criterion relates to the "direction" of the variable and, consequently, procyclical, countercyclical or acyclical indicators can be separated. The second criterion focuses on the aspect of the "timing" and, accordingly, variables can be found to show a leading, coincident or lagging behaviour. The third criterion relates to the "availability" of the variable, some of which are easily available in a timely fashion, whereas others need to be quantified or estimated beforehand.

How do the most popular indicators perform in that respect? To begin with, industrial production is procyclical and coincident; both consumption and investment are procyclical with investment usually being more sensitive than consumption to the business cycle, as durable goods make up for a larger fraction of investment than of consumption. Capacity utilization is procyclical, employment is procyclical and coincident; the unemployment rate proves to be countercyclical, whereas the inflation rate is pro-cyclical and lags the business cycle (as it tends to build up during an expansion and fall after the cyclical peak). Moreover, the short-term nominal interest rate is procyclical and lagging (often mirroring the reaction of the respective central bank) and corporate profits are very procyclical as they tend to increase during booms and strongly fall during recessions.[126]

In many cases, also the growth rates of some monetary aggregates move in line with the growth rate of GDP. Seen from that perspective, money is a good indicator of the state of the economy. And since monetary measures are generally made available more quickly than GDP data, its information is available in a more timely fashion.

Even better indicators are financial prices and yields, which have the additional advantage of being available immediately (and, in addition, are not subject to subsequent revisions, as is the case with other variables such as, for instance, consumer price indices, unemployment rates, new orders, etc.). As might be expected from the theory of finance, asset prices tend to incorporate the markets' "best guess" of future events and, therefore, they are often quite good predictors of the future state of the economy.[127] Other useful financial variables are yield spreads, especially the so-called "long-short spread" (that is the difference between yields on long- and short-term government bonds) and the so-called "junk bond" spread (that is the difference between yields on high-grade and low-grade bonds). Both measures have been quite useful in predicting downturns in the economy.[128]

15.5 OUTPUT GAPS

The difference between the actual output of an economy and the respective value that could be achieved when it is operating at full capacity is generally referred to as the "output gap". By construction, output gaps can be positive or negative. A positive output gap occurs when actual output exceeds its full-capacity equivalent, whereas a negative output gap materialises when actual output operates below its full-capacity level.

☑ The Hodrick-Prescott Filter

The Hodrick-Prescott (HP) filter is a very popular procedure that is used by many macroeconomists in order to remove the cyclical component of a time series from the raw data and, thereby, to derive a long-term trend value for the corresponding series. The method dates back to the original work by R. Hodrick and E. Prescott, who developed it for their analysis of U.S. postwar business cycles.[129] In technical terms, the HP-filter is a two-sided filter. When applied to real output, the HP filter is derived by minimising the following expression:

(i) $$\sum_{t=1}^{T}(y_t - y_t^*)^2 + \lambda\sum_{t=2}^{T-1}\left[(y_{t+1}{}^* - y_t^*) - (y_t^* - y_{t-1}{}^*)\right]^2$$

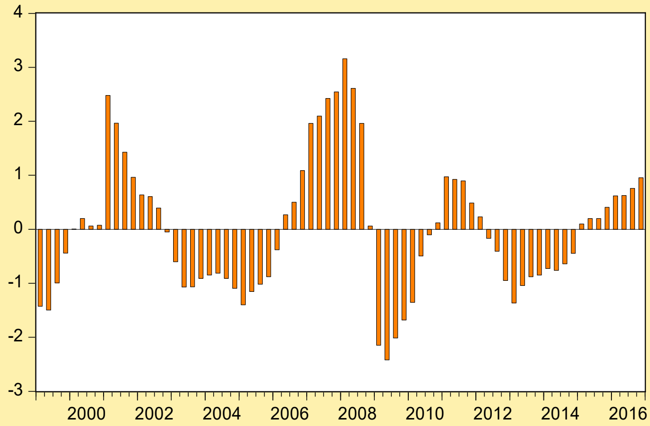
This expression basically consists of two terms, whereby the first component asks for a minimisation of the sum of squared deviations of actual real output and its trend value. The second component, by contrast, asks for a minimisation of the sum of squares of the change in the trend rate. The weighting factor (λ) basically determines the smoothness of the whole process. As λ goes to infinity, the underlying time series approaches a linear trend.[130] In practice, the concrete value for λ is often selected as 100 for annual data, 1600 for quarterly and 14400 for monthly data.

Source: Hodrick and Prescott (1997), Junius et al. (2002, p. 180).

15.6 A FIRST LOOK AT THE DATA

When applying this method to euro area data, evidence for a business cycle consisting of three upswings and three downswings (with clear signs of a recovery towards the end of the sample) can be found. Other, more complex methods could be applied, but would not change this basic picture.

Figure 15.3: Output Gap for the Euro Area



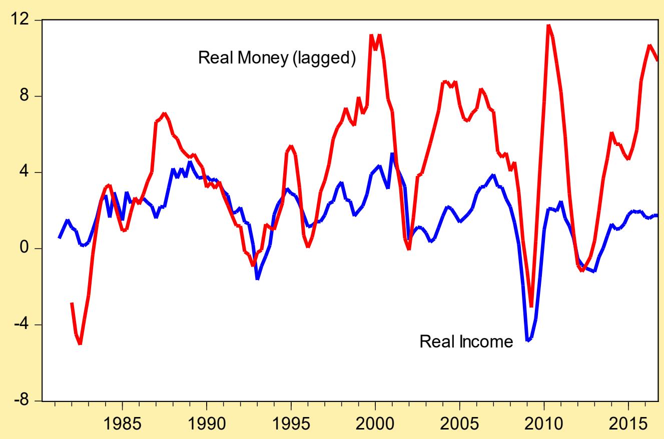
Source: Own estimations, based on ECB data

15.7 A SECOND LOOK AT THE DATA

Without pre-empting the deliberations in the coming chapters too much, it can be said that M1 is a narrow monetary aggregate and it traditionally has the highest interest rate (semi-) elasticity of all monetary aggregates, which is equivalent to saying that the central bank can influence it more easily.

Moreover, this aggregate most closely serves transactions purposes. At the same time, (real) M1 has reliable forecasting properties for (real) GDP growth for a period of three to four quarters ahead.[131] This is illustrated in the chart below.

Figure 15.4: Real M1 and Real GDP



Source: Own estimations based on ECB data, real M1 moved forward by 3 quarters

15.8 SUMMARY

- Economic research has identified a variety of different cycles that have been named after their discoverers or proposers. Among them are the "Kitchin inventory cycle", the "Juglar fixed investment cycle", the "Kuznets infrastructural investment cycle" and the "Kondratieff cycle" or "Kondratieff wave".
- In order to categorise the various business cycle indicators used in most industrial countries, it is useful to distinguish them according to three criteria. The first criterion relates to the "direction" of the variable, whereas the second criterion focuses on the aspect of the "timing" and the third criterion relates to the "availability" of the variable.
- The difference between the actual output of an economy and the respective value that could be achieved when it is operating at full capacity is generally referred to as the "output gap". Output gaps give a pretty good picture about where the economy stands in the business cycle.
- At the same time, (real) euro area M1 has reliable forecasting properties for (real) GDP growth in the euro area for a period of three to four quarters ahead.

🕮 Key Concepts

Business cycle, recession, expansion, depression, peak, trough, exogenous business cycle theories, endogenous business cycle theories, supply-induced business cycle theories, demand-induced business cycle theories, multiplier-accelerator model, monetary business cycle theories, political business cycle theories, real business cycle theories, business cycle indicators, direction, timing and availability of business cycle indicators, output gap, Hodrick-Prescott filter.

☑ Questions for Review

- What are the main elements of a stylised business cycle?
- What can be said about the regularity by which these cycles do occur?
- Which business cycle theories do you know? What is their main argumentation in explaining fluctuations in economic activity?
- Which business cycle indicators do you know?
- What is the essence of an output gap and how can it be derived?

16 UNEMPLOYMENT

16.1 LEARNING OBJECTIVES

In this chapter, we outline the essence of unemployment. We first identify some key features of unemployment. We then analyse different types of unemployment. Finally, we have a look at the euro area evidence.

16.2 BASIC CONSIDERATIONS

Another key economic variable is unemployment. To approach this issue, it is useful to follow a two-step approach. In the first step, we start from the concept of the labour force (LF), which is defined as the sum of those employed (N) and those unemployed (U):[132]

$$LF = N + U \tag{16.2.1}$$

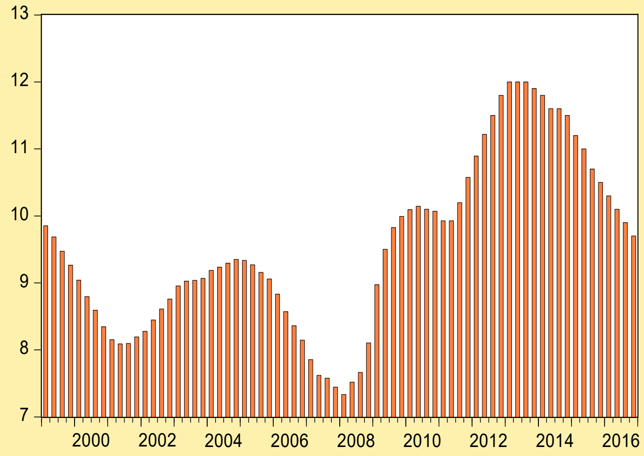
In the next step, the unemployment rate (u) is defined as the ratio of the number of unemployed people (U) to the total labour force (LF) and it is generally explained in terms of percentages:

$$u = \left(\frac{U}{LF}\right) \cdot 100 \tag{16.2.2}$$

An important feature of the definition of the unemployment rate consists of the fact that only those that are actually registered as being looking for work are counted as unemployed. By contrast, those who are not looking for work are counted as not being in the labour force and will, therefore, not appear in the statistics. There is, however, good reason to believe that many of those without jobs at some stage simply give up looking for work and, therefore, are no longer counted as unemployed. The latter group of people are then usually described in terms of "discouraged workers".

Should one care about unemployment? Most macroeconomists would probably agree that there are (at least) two main reasons for this. First, unemployment has important social consequences. Second, the unemployment rate must be seen as an important economic indicator in the sense that it tells us something about the level at which the economy is operating.[133]

Figure 16.1: Unemployment in the Euro Area



Source: ECB data, percentage of labour force.

What about the euro area performance? Without going too much into detail at this stage, the figure shown above indicates that for the period between 1999 and end-2016, the unemployment rate in the euro area seems to have oscillated between, broadly speaking, seven and twelve percent, with its cyclical fluctuations apparently not being completely unrelated to business cycle developments.

The fact that unemployment in the euro area is generally higher than in the United States is often attributed to the so-called "eurosclerosis" phenomenon (a term coined by the German economist Herbert Giersch in the 1970s). According to Giersch, eurosclerosis embraces three main ingredients, namely excessive government regulation, rather generous unemployment benefits and relatively high European tax rates (hindering entrepreneurship and discriminating in particular small and medium-sized enterprises).

16.3 TYPES OF UNEMPLOYMENT

Suppose for a moment, the economy is operating at full employment, where everyone who is willing and able to work can find a job. Does this imply that the unemployment rate is zero? Indeed, this is not the case. But why? In order to answer this question, we have to distinguish between three types of unemployment.

The first type is "cyclical unemployment", which is the kind of unemployment that occurs over the business cycle. In essence, this phenomenon is due to the fact that, if the economy falls into recession, it is not uncommon that firms close down and many workers lose their job, while an expanding economy typically experiences lower levels of unemployment.[134]

☑ Okun's Law

The relationship between unemployment and forgone GDP has been analysed by the US economist Arthur Okun (1929–1979). His results could be summarised in a rule of thumb known as "Okun's Law". In essence, Okun's Law can be expressed in terms of the following equation (for the United States):

(i) $$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \frac{\Delta Y_t}{Y_{t-1}} \approx 2.5\,(U - U^*)$$

Expressed in words, the relationship states that the percentage change in real output is approximately two and half times the difference between the prevailing level of unemployment and the full employment rate of unemployment. Given the fact that the calculations are based on the difference between U and U^*, Okun's Law clearly gives a measure of the forgone output caused by cyclical unemployment.

Source: Okun (1962).

By contrast, “structural unemployment” (or, alternatively, “mismatch unemployment”) refers to people that have either not acquired the skills needed in the labour market or live in the wrong area. For instance, people that are not familiar to work with a computer might face difficulties when looking for an office job today. Given this mismatch, people suffering from structural unemployment will face difficulties finding jobs even when the economy is booming.

☑ Germany's Hartz Reforms

The so-called “social-market economy”, which had been successfully established in Germany after the second world war, comprised a powerful combination of market capitalism, strong labour protection and a generous welfare state. While it served the country very well for several decades, towards the change of the millenium, it came under mounting pressure. Accompanied by stagnating growth, unemployment remained stubbornly high at 4 million or, broadly speaking, 10% of the workforce.

In light of Germany`s dominant economic weight (after all, Germany accounts for about one third of the euro area`s GDP), this was widely seen as a problem for the euro area and the euro (“when Germany sneezes, its neighbours feel a chill”). Markets felt nervous and the media branded Germany as “the sick man of Europe”.

Chancellor Gerhard Schröder had come to power in October 1998, having declared job creation as a top priority on his agenda, but the new government noticeably failed to get people back to work. The challenge was to revive the German economy. The German government took up the challenge and, between 2003 and 2005, introduced a series of reforms that lead to significant improvements in unemployment. These so-called “Hartz reforms” limited unemployment benefits for the long-term unemployed, increased flexibility in the labour market (via 'work time accounts'), made benefits conditional on job search, and reduced employment protection for new hires. Fuelled by a decline in union membership rates, these reforms ignited substantial improvements in German structural unemployment levels.[135]

Today, these reforms are often seen as a blueprint for further actions, also in other countries. Recent reforms show signs of movements in the right direction in France, Italy and Spain.

Source: The Economist (1999), The Sick Man of the Euro, 3 June.

Seen from that perspective, structural unemployment depends to a large extent on the dynamic changes faced by an economy. For instance, advances in technology often turn many skills obsolete, thus typically increasing the unemployment rate.

Finally, there will be always some people, who are in the process of changing jobs. From the moment they quit their old job up to the moment they start their new job, they are said to be “frictionally unemployed”. Frictional unemployment is often also termed as “turnover unemployment”. Taken together, this explains why the unemployment does not equal zero even in the case of full employment. There will always be some people who are structurally or frictionally unemployed.[136]

16.4 SUMMARY

- The unemployment rate is defined as the ratio of the number of unemployed people to the total labour force and generally explained in terms of percentages.
- Most macroeconomists would agree that there are two main reasons for taking unemployment serious. First, unemployment has important social consequences. Second, the unemployment rate must be seen as an important economic indicator.
- Okun's Law quantifies the relationship between unemployment and forgone GDP and it relates back to the work of the US-economist Arthur Okun (1929–1979).
- In the literature, there are three main categories of unemployment, namely structural, frictional, and cyclical unemployment.

🕮 Key Concepts

Unemployment, labour force, unemployment rate, eurosclerosis, Okun's Law, cyclical unemployment, structural unemployment, mismatch unemployment, frictional unemployment, turnover unemployment.

☑ Questions for Review

- How can the unemployment rate be defined?
- What do you know about Okun's Law?
- Which main types of unemployment do you know?

☑ Digging Deeper

A striking feature in European unemployment over recent years has been the high rates in youth unemployment. Why could this development be a reason of particular concern? Why did some observers characterise this people as the "lost generation"?

17 PRICES AND INFLATION

17.1 LEARNING OBJECTIVES

We start with some basic considerations on prices and then proceed by illustrating some measurement issues. We then identify the three main price indices used in most economies. Finally, we have a look at the key features of the euro area HICP before we analyse the data.

17.2 GOODS AND BASKETS

Let us begin by illustrating some basic considerations by means of a simple numerical example.[137] Suppose that a representative market basket of the yearly expenditure of teenagers is 100 sandwiches, 50 soft drinks, ten energy drinks and one mountain bike.

Good	Quantity	Price (Year 1)	Price (Year 2)
Sandwiches	100	1.00	1.20
Softdrinks	50	0.50	0.40
Energy drinks	10	1.50	1.70
Mountain bike	1	160	173
Cost of basket		300	330

Table: Hypothetical Market Basket
Source: own considerations.

The total costs of the basket can then be calculated by multiplying the quantities with the respective prices and adding everything up. It is easy to see that between the first and second year, the costs of this basket of goods have risen from € 300 to € 330, or by 10%.

Another way to express this result is by means of a price index. In order to compute such a price index, the ratio of the costs of the market basket in any period and the costs of the market basket in the base period (i.e. the first year) is taken. The price index for the second year is therefore:

$$P_t = \frac{330}{300} = 1.1 \tag{17.2.1}$$

As a rule, price indices are multiplied by 100. This would convert the 1.10 into 110. The base year of a price index is always assigned the value of 1.0 or 100. This allows for an easy comparison between the initial and subsequent year. A price index of 1.10 or 110 means that the market basket costs 10 percent more in the second year than it did in the base year. Note that no single price rose by 10 percent. Sandwiches, energy drinks and mountain bikes have increased in price, whereas softdrinks have decreased. This notwithstanding, if consumers want to buy the same basket in second year than in the base year, they will have to pay 10 percent more.

It is intuitively clear that such a price index is capable of providing an accurate summary of what is happening to a vast number of prices. As the example shows, the price index may rise despite some prices actually declining.

17.3 INFLATION AND THE PRICE LEVEL

The concept of a price index should not be confused with the concept of the inflation rate. At a general level, inflation is defined as the rate of change in prices. If $P_{t\text{-}1}$ represents the price level last year and P_t represents the actual price level, then the inflation rate can be written as:

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} = \frac{\Delta P}{P_{t-1}} \qquad (17.3.1)$$

where π stands for the inflation rate. For example, if the price index in the first year would be $P_1 = 100$ and the price index in the second year $P_2 = 110$, the inflation rate would be equivalent to:

$$\pi = (110 - 100)/100 = 10/100 = 0.10 = 10\% \qquad (17.3.2)$$

However, most consumers would not define the ten percent change in the price index as inflation, unless it continues to last for several time periods. A one-period change in the price index is just that what the name says – a one-period change in the price index – whereas inflation stands for is a continued rise in the price index.

It is easy to see that the price level is by definition related to the cumulated changes in past inflation. Rearranging the above expression yields that the actual price level equals last year's price level adjusted for inflation:

$$P_t = P_{t-1} + (\pi_t \cdot P_{t-1}) = P_{t-1} \cdot (1 + \pi_t) \qquad (17.3.3)$$

This also ilustrates one important point made above: the price level will not fall unless the inflation rate becomes negative, that is, unless there is deflation.[138]

17.4 EFFECTS OF INFLATION

The table below gives a quantitative impression of the impact of inflation on the purchasing power of money.[139] Among other things, it shows the effects that even relatively benign inflation rates have, if they persist over longer time horizons.

Annual inflation rate	1%	2%	5%	10%
1 year later	99.0%	98.0%	95.2%	90.9%
2 years later	98.0%	96.1%	90.7%	82.6%
3 years later	97.1%	94.2%	86.4%	75.1%
4 years later	96.1%	92.4%	82.3%	68.3%

Annual inflation rate	1%	2%	5%	10%
5 years later	95.1%	90.6%	78.4%	62.1%
6 years later	94.2%	88.8%	74.6%	56.4%
7 years later	93.3%	87.1%	71.1%	51.3%
8 years later	92.3%	85.3%	67.7%	46.7%
9 years later	91.4%	83.7%	64.5%	42.4%
10 years later	90.5%	82.0%	61.4%	38.6%

Table: Costs of inflation

Assuming, for instance, an inflation rate of five percent and a ten-year horizon, only around 61% of the initial amount invested would remain in your hands.

Besides these more generic effects, inflation clearly has effects on the distribution of wealth. In particular, inflation can be harmful to fixed-income returns. While the rate of interest (or coupon) on most fixed-income securities remains the same until maturity, the purchasing power of the interest payments declines as inflation rises. In much the same way, rising inflation erodes the value of the principal on fixed-income securities. It is exactly for this reason that investors will demand an extra return (a so-called “inflation risk premium”) to compensate them for the inflation risks associated with holding nominal assets over the longer term.

Another problem related to inflation consists of the fact that most tax and welfare systems are not really well equipped to deal with inflation. In particular, fiscal systems do normally not allow for the indexation of tax rates and social security contributions to the inflation rate. In line with this, salary increases that are meant to compensate workers for inflationary developments could result in employees being subject to a higher tax rate, a phenomenon that is also known as “cold progression”.

In fact, many economists would also agree with the idea that inflation can be interpreted as being equivalent to a hidden tax on holding cash. In other words, people who hold cash experience a decline in their real money balances and, thus, in their real financial wealth when the price level rises, just as if part of their money had been taxed away.

More generally, inflation can also be seen as implying higher “shoe-leather costs”, because it necessitates more frequent visits to the bank (to withdraw money from interest-paying accounts) and walking to the bank causes one’s shoes to wear out more quickly. In the same vein, higher "menu costs" are implied as firms must change their prices more often in order to keep up with the continuous rise in the price index. It is worth noting that "menu costs" and "shoe leather costs" would even materialise if inflation were to be perfectly anticipated.

Moreover, inflation has effects on savings and investment as the uncertainty about the future purchasing power of money makes the estimation of future revenues unpredictable. Furthermore, since it becomes harder, if not impossible, to distinguish between changes in relative prices and changes in the general price level, misallocations of resources will inevitably result. Finally, there is a high probability that effects on unemployment and the business cycle will materialise, an issue to which we will have to return at a later stage.

17.5 INFLATION INDICES

The three main price indices used in economics are the GDP deflator, the consumer price index and the producer price index. To begin with, the calculation of nominal and real GDP allows us to derive a very useful measure of inflation, the so-called "GDP deflator". The GDP deflator is defined as the ratio of nominal GDP in a given year to real GDP in the same year. By construction, the GDP deflator, therefore, represents a broad measure of the overall change in prices and it involves a vast amount of goods, services and final products, namely all of the items produced in an economy over the year.

By contrast, the "consumer price index" ("CPI") measures the costs of buying a fixed basket of goods and services representative of the purchases of consumers.

The producer price index (PPI) is the third price index that is widely used. Like the CPI, the PPI is a measure of the cost of a given basket of goods. However, the PPI includes, for instance, raw materials and semi-finished goods and, thus, measures inflation in the eyes of producers. Given the fact that an increase in the prices of raw materials often feeds into the prices of the final products, the PPI frequently signals changes in the general price level, or the CPI, some time before they actually materialize. For this reason, the PPI can often give reliable early warning signals well ahead of future inflationary pressures.

The CPI and the GDP deflator differ in various respects. First, the GDP deflator measures the price of a much broader group of goods than the CPI does. Second, the CPI measures the costs of a basket of goods which is the same from year to year. The basket of goods included in the GDP deflator, however, differs from year to year, depending on what is produced in the economy in each year. Third, the CPI includes the prices of imports, whereas the GDP deflator includes only prices of goods produced in the home country. Therefore, the GDP deflator and the CPI differ in behaviour from time to time. For instance, at times when the price of imported oil rises rapidly, the CPI is likely to increase more than the GDP deflator. This notwithstanding, over longer periods, the two indices can be expected to produce quite similar measures of inflation.

17.6 THE HARMONISED INDEX OF CONSUMER PRICES

The importance that the European Central Bank attaches to price stability has been clearly stated in its monetary policy strategy, which contains inter alia a quantitative definition of price stability. According to it, price stability is defined as "a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below but close to 2%".[140] In light of the facts that prices are affected over short- to medium-term horizons by a variety of factors being far beyond the control of the monetary authority and because monetary policy actions take time to affect inflation, the objective is interpreted as applying over the medium term.

The HICP was specifically developed as a comparable measure of inflation for all member states of the European Union. The conceptual work behind the compilation of the HICP has been carried out by Eurostat (the Statistical Office of the European Commission) in close liaison with the respective national statistical institutes.[141]

In essence, the HICP for the euro area reflects a weighted average of the harmonized indexes of consumer prices for the individual euro area countries, whereby the weights are based on each country's share of euro area private domestic consumption expenditures. As a rule, the harmonised indices of consumer prices cover the same set of goods and services in each country and are calculated using the same methodology. This notwithstanding, the weights given to each item within the index vary across countries depending on the expenditure habits of the country's consumers.[142]

How do these weights look like? The table above contains the household expenditure weights used in the context of the construction of the Harmonised Index of Consumer Prices (HICP) for the euro area in the year 2016, where for the sake of simplicity the figures are shown as a percentage of the expenditures covered by the overall HICP. It is worth noting in this context that the HICP expenditure weights are updated on an annual basis. The concrete breakdown is in line with international conventions and meant to allow for a better identification of the causes underlying the developments in the various underlying components.[143] Based on the consumer expenditure weights applicable for 2016, goods account for around 55% and services account for around 45% of the HICP.

Overall index	100.0
Goods prices	55.4
Unprocessed food	7.5
Processed food	12.0
Non-energy industrial goods	26.3
Energy	9.5
Services	44.6
Housing services	10.7
Transport	7.3
Communication	3.2
Recreation and personal services	15.1
Miscellaneous	8.2

Table: Weights of main euro area HICP components
Source: Eurostat, as of 2016.

While the HICP can, broadly speaking, be seen as a high-quality index that also allows for comparability across countries, some open issues remain. For instance, ongoing work needs to tackle with quality adjustment and the conceptual treatment of residential housing in a general price measurement.[144]

A closer look into the country dimension (see below) reveals that the euro area rate is driven to a large part by developments in countries like Germany, France and Italy, whereas countries such as, for instance, Malta, Cyprus, Estonia and Latvia have less of an influence.

17.7 CORE AND NON-CORE INFLATION

The fact that headline inflation rates are driven by a variety of determinants at different frequencies has also given rise to another important distinction, namely the one between "core inflation" and "non-core inflation".[145] The expression "core inflation" refers to that part of inflation that is caused by developments in fundamental factors, such as, for instance, the interaction of aggregate supply and demand, or the external environment, as reflected in exchange rates.[146] By contrast, the term "non-core inflation" reflects the influence of factors other than fundamentals, such as, for instance, the influence of a rise in administered prices (for instance, an increase in the value added tax ("VAT")) or the element of "food price inflation" (caused, for instance, by crop diseases), but also energy prices (i.e. oil and gas prices), which can – by their very nature – be considered as very volatile.

It is often claimed that core inflation measures can be a very useful guide for monetary policy decision-makers as the headline inflation measures are often blurred by the noise coming from the aforementioned volatilities. Indeed, there is not much that would speak against the construction and use of such an indicator.

	EA	BE	DE	EE	IE	GR	ES	FR	IT	CY	LV	LT	LU	MT	NL	AT	PT	SI	SK	FI
1999	100.0	4.0	34.5	(-)	1.0	(-)	9.1	21.1	18.8	(-)	(-)	(-)	0.2	(-)	5.1	2.9	1.8	(-)	(-)	1.5
2000	100.0	4.0	34.7	(-)	1.0	(-)	9.1	20.9	18.3	(-)	(-)	(-)	0.2	(-)	5.7	2.9	1.8	(-)	(-)	1.5
2001	100.0	3.3	30.9	(-)	1.2	2.4	10.4	20.5	18.7	(-)	(-)	(-)	0.2	(-)	5.3	3.3	2.1	(-)	(-)	1.6
2002	100.0	3.4	30.6	(-)	1.2	2.5	10.3	20.4	19.3	(-)	(-)	(-)	0.3	(-)	5.2	3.2	2.0	(-)	(-)	1.6
2003	100.0	3.3	29.9	(-)	1.3	2.6	10.9	20.5	19.2	(-)	(-)	(-)	0.3	(-)	5.4	3.2	2.1	(-)	(-)	1.6
2004	100.0	3.3	29.2	(-)	1.3	2.7	11.1	20.7	19.3	(-)	(-)	(-)	0.3	(-)	5.3	3.1	2.1	(-)	(-)	1.6
2005	100.0	3.3	29.0	(-)	1.3	2.7	11.4	20.7	19.2	(-)	(-)	(-)	0.3	(-)	5.2	3.1	2.1	(-)	(-)	1.6
2006	100.0	3.4	28.7	(-)	1.3	2.9	12.0	20.3	19.1	(-)	(-)	(-)	0.3	(-)	5.2	3.1	2.2	(-)	(-)	1.6
2007	100.0	3.4	28.2	(-)	1.4	3.1	12.3	20.7	18.3	(-)	(-)	(-)	0.2	(-)	5.3	3.1	2.1	0.3	(-)	1.6
2008	100.0	3.4	27.0	(-)	1.5	3.4	12.7	20.5	18.6	0.2	(-)	(-)	0.3	0.1	5.0	3.1	2.2	0.3	(-)	1.6
2009	100.0	3.4	26.1	(-)	1.6	3.5	12.8	20.6	18.5	0.2	(-)	(-)	0.3	0.1	5.1	3.0	2.2	0.4	0.7	1.7
2010	100.0	3.2	26.2	(-)	1.5	3.6	12.6	20.8	18.2	0.3	(-)	(-)	0.3	0.1	5.1	3.0	2.2	0.4	0.7	1.7
2011	100.0	3.3	25.9	0.1	1.3	3.8	12.7	20.7	18.2	0.3	(-)	(-)	0.3	0.1	4.8	3.2	2.2	0.4	0.7	1.7
2012	100.0	3.5	26.5	0.1	1.4	3.3	12.4	20.6	18.5	0.3	(-)	(-)	0.3	0.1	4.9	3.1	2.4	0.4	0.7	1.8
2013	100.0	3.5	26.9	0.2	1.3	2.9	12.4	20.5	18.2	0.2	(-)	(-)	0.3	0.1	4.9	3.4	2.3	0.4	0.7	1.8
2014	100.0	3.6	27.7	0.2	1.4	2.6	12.0	20.6	17.7	0.2	0.2	(-)	0.3	0.1	5.0	3.3	2.1	0.4	0.7	1.9
2015	100.0	3.6	28.3	0.2	1.3	2.4	11.1	20.6	17.5	0.2	0.2	0.4	0.3	0.1	5.1	3.4	2.1	0.4	0.7	1.9
2016	100.0	3.8	27.8	0.2	1.4	2.4	11.0	20.7	17.6	0.2	0.3	0.4	0.3	0.1	5.1	3.4	2.2	0.4	0.8	1.9

Table: Country Weights for Euro Area HICP
Source: ECB data.

17.8 MEASUREMENT PROBLEMS

As we have just seen, measuring inflation is, in practice, equivalent to quantifying the changes in the price of a large basket of representative goods and services. For various reasons, there are some difficulties associated with any attempt to express the overall change in prices in one number.[147]

For instance, as time goes by, the underlying basket has to be modified, be it with respect to the relative weights of the goods in the basket, or be it that goods and services existing at present have to be put into comparison with goods and services from the past. It is intuitively clear that an existing basket usually becomes less and less representative over time as consumers increasingly substitute more expensive goods for cheaper ones.

Moreover, changes in quality are sometimes not easy to incorporate into the price index. If the quality of a product improves over time and the price also rises, not all of the price increase can be perceived as being negative. In particular, price increases which are due to quality changes cannot be considered as giving rise to inflation, as they do not reduce the purchasing power of money.

Finally, the inclusion of new products poses an additional challenge, as there is the question of when and how to best invorporate the former into the official price statistics.

17.9 HYPERINFLATION

A situation in which the economy shows a rapid (and often even accelerating) increase in the general price level that eventually gets out of control and, consequently, results in a rapid loss of the value of its purchasing power is usually called "hyperinflation". It is quite common in economics to regard hyperinflation as materialising, when the monthly inflation rate exceeds the value of 50 percent.[148] It is intuitively obvious that such a phenomenon places a heavy burden on the economy and is, not only from an economic point of view, extremely destructive as it effectively wipes out the purchasing power of savings. Taken together, it has far-reaching consequences, not only for individuals but also for the economy as a whole.[149]

From a historical perspective, hyperinflations have often occurred during or after wars or other events of social unrest. While in Europe, such events have fortunately not materialised since the earlier years of the last century (the most famous being probably the German hyperinflation of 1922/23 with an average inflation rate of 322 percent per month[150]), a number of other countries have experienced hyperinflationary periods more recently. The table below lists for illustrational purposes the month-on-month and the year-on-year inflation rates for one particular example, namely the hyperinflation in Zimbabwe.[151]

Date	Month-on-month inflation rate (%)	Year-on-year inflation rate (%)
Mar. 2007	50.54	2.200.20
Apr. 2007	100.70	3.713.90
May 2007	55.40	4.530.00
Jun. 2007	86.30	7.251.10
Jul. 2007	31.60	7.634.80

Date	Month-on-month inflation rate (%)	Year-on-year inflation rate (%)
Aug. 2007	11.80	6.502.80
Sep. 2007	38.70	7.982.10
Oct. 2007	135.62	14.840.65
Nov. 2007	131.42	26.470.78
Dec. 2007	240.06	66.212.30
Jan. 2008	120.83	100.580.16
Feb. 2008	125.86	164.900.29
Mar. 2008	281.29	417.823.13
Apr. 2008	212,.54	650.599.00
May 2008	433.40	2.233.713.43
Jun. 2008	839.30	11.268.758.90
Jul. 2008	2.600.24	231.150.888.87

Date	Month-on-month inflation rate (%)	Year-on-year inflation rate (%)
Aug. 2008	3.190.00	9.690.000.000.00
Sep. 2008	12.400.00	471.000.000.000.00
Oct. 2008	690.000.000.00	3.840.000.000.000.000.000.00
Nov. 2008	79.600.000.000.00	89.700.000.000.000.000.000.000.00

Table: Zimbabwe's hyperinflation
Source: Hanke (2009, p. 355), the Nov. 2008 date refers to 14 November.

Without pre-empting the following deliberations too much, it is a well-known fact that such hyperinflations have usually been accompanied by massive increases in money growth as well as large budget deficits. In reality, the interactions between money growth, budget deficits and inflation are rather complex and not easy to disentangle. In many cases, the origin of the budget deficits was wartime spending that subsequently translated into large national debts. The large deficits often caused goverments to print money in order to finance those deficits, thus fuelling inflation. The high inflation then in turn increased the budget deficits further, first by decreasing the real value of the taxes collected and, second, since interest rates traditionally increase when inflation increases, by increasing the nominal interest rates paid by the government, thus, leading in sum to a further widening of the deficit.

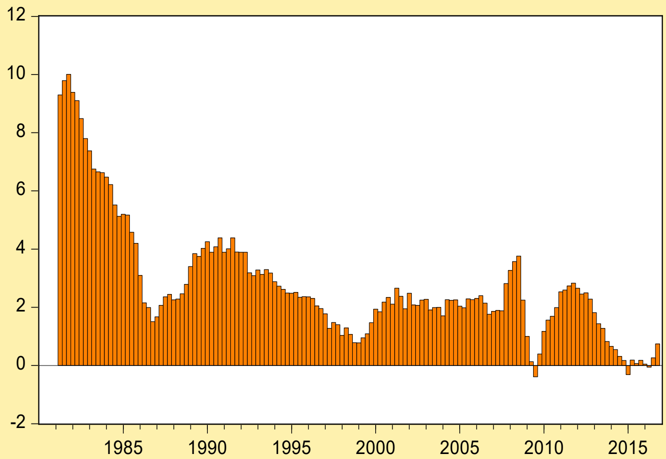
In any way, economies suffering from hyperinflation over several years tend to, ultimately, fall into chaos. Although in most cases, attempts to establish price and/or interest rate controls were enforced, there is no documented evidence that such measures would have been sufficient successful to bring an end to such an episode of hyperinflation. In fact, in almost all cases, these controls would only have led to (further) shortages in the supply of goods. Eventually the costs associated to hyperinflation became intolerable. Over time, money had completely lost its role as a store of value, unit of account and medium of exchange. Barter became more common and unofficial monies, such as for instance cigarettes, which did not suffer from a loss in value caused by inflation, started to replace official paper money. In the end, in almost all cases new money had to be introduced and the tax systems as well as the budget processes had to be reformed.

17.10 A FIRST LOOK AT THE DATA

A first look at the data reveals that since the beginning of the 1999, the euro area inflation rate has mostly been in a corridor between zero and two percent, while prices have definitively been higher two decades ago.

A number of descriptive statistical measures can prove useful in complementing this first analysis.[152] The "mean" represents the average value of the series under investigation and it is obtained by simply adding up the series and, afterwards, dividing the result by the number of observations. In many cases, also the maximum and minimum values of the series under investigation give useful insights. In this case, it can be shown that the mean of inflation was around 1.70, with a maximum value of 3.76% and a minimum value of -0.39% over the sample starting in 1999.

Figure 17.1: Inflation in the Euro Area



Source: ECB data, annual percentage changes.

By contrast, the "median" is represented by the middle value (or the average of the two middle values) of the series when the values are ordered according to size, i.e. from the smallest to the largest value. The median must be seen as a very popular measure in applied empirical work as it represents a robust measure of the centre of the distribution that is much less sensitive to outliers than for instance the mean.[153] The median of euro area inflation stood at, broadly speaking, 1.97% and, therefore, slightly below two percent.

In statistics, the "standard deviation" represents a rather simple tool to measure the variability or dispersion of a given data set. More specifically, a low standard deviation indicates that the data points tend to be very close to the mean, while a high standard deviation reveals that the data are more "spread out". The standard deviation of euro area inflation was around 0.95%, which can be seen as a quite substantial value.

A related concept is the one of "skewness". The latter represents a measure of the data distribution that shows whether large deviations from the mean are more likely towards one side than towards the other. In the case of a symmetrical distribution, deviations on either side of the mean are equally likely. As a consequence, the skewness of a symmetric distribution is zero. A positive skewness is equivalent to saying that the distribution has a long right tail and, therefore, large upward deviations are more likely than large downward ones. By contrast, a negative skewness means that the distribution has a long left tail and, thus, large downward deviations are more likely than large upward ones.

The concept of "kurtosis" is a suitable tool to measure the "peakedness" or flatness of the distribution of a series. It can be shown that the kurtosis of the normal distribution equals exactly a value of 3. If the kurtosis of the series under investigation exceeds the value of 3, the distribution is peaked (i.e. "leptokurtic") compared to the normal distribution. By contrast, if the kurtosis is less than the value of 3, the distribution is flat (i.e. "platykurtic") relative to the normal distribution.[154]

The skewness and kurtosis of euro area inflation were -0.47 and 2.53 respectively and, therefore, euro area inflation can be regarded as being, first, less peaked than the normal distribution. Second, the negative skewness means that the tails of the probability density function do not balance out. In fact, the tail on the left side of the probability density function is longer or "fatter" with the result that large downward deviations are more likely than large upward ones.

Two more stylized facts are worth noting: first, visual inspection shows that inflation almost never stays at an "average" level. Instead, periods of high and periods of low inflation seem to alternate over time. Second, periods of high inflation seem to "cluster" in the sense that such periods show a high level of persistence and tend to prevail over years, if not longer. A similar pattern seems to hold for periods of low inflation. These striking facts would clearly warrant an explanation in the next sections.

17.11 A SECOND LOOK AT THE DATA

Another question relates to the issue of how different economic patterns, such as trends and cycles, would be reflected in the behaviour of the overall euro area headline inflation. In this respect, statistical filtering techniques, the so-called "frequency domain techniques", allow us to disentangle the implications of the various determinants for inflation and to illustrate the effects they unfold over different frequencies.[155]

Figure 17.2: Frequency Decomposition of Euro Area Inflation

Source: ECB data, annual percentage changes.

A simple illustration of these relationships would then start from the decomposition of observed inflation over the past three decades into three components: the "low frequency component" (i.e. those movements in inflation with a periodicity of more than 8 years);

the "business cycle component" (defined as movements with a periodicity of more than 2 years, but less than 8 years) and the "higher frequency component" (defined as movements with a periodicity of less than 2 years).[156] It can then be shown that developments in the low frequency component of euro area inflation tend to mirror headline developments quite closely and in a rather smooth fashion, but at a lower level. By contrast, the business cycle component tends to swing considerably around the zero line, thereby illustrating in an impressive way the effects that business cycles may have on price developments. Finally, the irregular component follows a very volatile pattern.

17.12 A THIRD LOOK AT THE DATA

The above charts point towards anoher striking feature. The inflation rate in the eighties seems to be much higher than the one observed later on. Can this be true? Fortunately, Markov-Switching models (MS-models) – one of a few non-linear time series methods that have been used in the literature – allow us to test for such a hypothesis.

Markov-Switching models have first been introduced into the literature in the context of the modelling of business cycles and, since then, this methodology has been widely used in the analysis of the dating and forecasting of turning points in the business cycle.[157] One particular appealing feature of this methodology lies in one of its key characteristics, namely that the variable of interest is regarded as having a certain probability of switching abruptly among a number of regimes. Seen from that perspective, one might consider to regard "high-inflationary phases" and "low-inflationary phases" as two different regimes, each possessing specific characteristics.[158] In other words, it is assumed that the economy is subject to shifts between high inflation periods and low inflation periods.

Another remarkable feature of the MS-model can be found in the fact that no prior information regarding the dates when the economy was in each regime is required. This stands in stark contrast to other methods which depend heavily upon the exact dating of all the regimes over the history of the series. By contrast, in the case of the MS-model, the probability of being in a particular regime can be inferred from the data.

In this section, the inflationary process in the euro area is modelled by means of an MS-model. More particularly, each observation is classified into one of two regimes, which can in turn be used to predict turning points in inflation when a number of observations in one regime are followed by a number of observations in the other regime.

☑ A Markov-Switching Approach

Assume that there are two regimes, represented by an unobservable process denoted as S_t. Let S_t take the values 1 and 2, depending on the prevailing regime. In this case, the data-generating process (DGP) of the series being modelled, Y_t, will be different in each regime, for example:

(i) $Y_t = \alpha_{0,1} + \alpha_{1,1} Y_{t\text{-}1} + ... + \alpha_{p,1} Y_{t\text{-}p} + \varepsilon_{t,1}$ if $S_t = 1$

(ii) $Y_t = \alpha_{0,2} + \alpha_{1,2} Y_{t\text{-}1} + ... + \alpha_{p,2} Y_{t\text{-}p} + \varepsilon_{t,2}$ if $S_t = 2$

Now suppose further that S_t is a first-order Markov-process, which means that the current regime depends only on the regime in the preceding period (S_{t-1}). The model is then completed by defining the transition probabilities of moving from one regime to another (referred to as "the transition probabilities"):

(iii) $\Pr(S_t = i \mid S_{t-1} = j) = p_{ij}$ where $i, j = 1, 2$

In case of a Markov-process with just two states, a total of four transitional probabilities has to be computed, whereby for the latter $p_{11} + p_{12} = p_{21} + p_{22}$ applies. The distribution of Δp (with a given state of i) is described by the following density function:

(iv) $f(\Delta p_t \mid S_t = i, \mu_1, \sigma^2) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\Delta p_t - \mu_1}{\sigma^2}\right)}$

i.e. Δp is normally distributed with a state-dependent mean value μ_1 and constant variance σ^2. The above conditional density holds for state 1. Similarly, for state 2 the same equation applies, but with μ_2 instead of μ_1 and $\mu_2 \neq \mu_1$. Taken together, a parameter vector of $\theta = (p_{11}, p_{22}, \mu_1, \mu_2, \sigma^2)$ needs to be estimated. This can be done by means of the maximum-likelihood method, in which numeric optimisation methods are employed due to non-linearities.[159]

Source: Hamilton (1989) and Abberger and Nierhaus (2010).

MS-models offer some additional attractive features. For instance, in addition to the parameter vector, these models also allow for the quantification of the so-called "transition probabilities".

The latter basically predict the probabilies of staying in the same regime versus the ones of moving into the alternative regime. In principle, such probabilities can be estimated in two variants, namely for the entire sample (the so-called "smoothed probabilities", thus taking an ex-post perspective), but also in "real time" (the so-called "filtered probabilities").[160]

It has been argued in the literature that the uncertainty situation, in which the monetary policy decision-makers find themselves, is better reflected in the filtered probabilities and it is precisely in such a situation, where MS-models can provide a useful input into monetary policy decision-making.

The dataset used for the analysis consists of quarterly data for euro area consumer prices, spanning a period from 1980.1 to 2016.4. When applying the aforementioned procedure to euro area inflation (i.e. the annual change in euro area consumer prices), the estimation output is as follows:[161]

Variable	Coefficient	Prob.
Low-inflation regime		
Constant	2.16	0.01
High-inflation regime		
Constant	7.31	0.00

Source: own estimations.

Residual diagnostics show overall satisfying properties. Quite obviously, the assumption of two different inflation regimes can be justified by the data: a high inflation period (with a mean of 7.31%) comprising mainly the period from the early 1980s to the end of 1998 and a low inflation period (with a mean of 2.16%), spanning mainly the period from 1999 onwards. This is in line with the view that Stage III of European Economic and Monetary Union seems to have brought about a breakthrough in price stability. And the transition probabilities can be shown to be as follows in the table below. Note that a considerable amount of state dependence in the transition probabilities can be detected with a relatively high probability of remaining in the current regime (0.99 for the low-inflation state and 0.98 for the high-inflation state).

	Regime 1	Regime 2.
Regime 1	0.99	0.02
Regime 2	0.01	0.98

Source: own estimations.

17.13 SUMMARY

- Price indices play a crucial role in modern economies. In order to compute such a price index, the ratio of the costs of the market basket in a specific period and the costs of the same basket in the base period is calculated.
- The concept of a price index should not be confused with the concept of the inflation rate. At a general level, inflation is defined as the rate of change in prices.
- Inflation has a number of negative effects on the economy. For instance, most tax and welfare systems are not really well equipped to deal with inflation, which leads to the emergence of a phenomenon that is known as "cold progression". More broadly, many economists would agree with the idea that inflation can be interpreted as being equivalent to a hidden tax on holding cash. Furthermore, inflation can be seen as implying higher "shoe-leather costs" and higher "menu costs". Finally, there is a high probability that effects on unemployment and the business cycle will materialise.
- The three main price indices used in economics are the GDP deflator, the consumer price index and the producer price index.
- The HICP was specifically developed as a comparable measure of inflation for all member states of the European Union. In essence, the HICP for the euro area reflects a weighted average of the harmonised indices of consumer prices for the individual euro area countries, whereby the weights are based on each country's share of euro area private domestic consumption expenditures.

- The expression "core inflation" refers to that part of inflation that is caused by developments in fundamental factors. By contrast, the term "non-core inflation" reflects the influence of factors other than fundamentals. Constructing core inflation measures can prove very helpful for the monetary policy-maker.
- While the measurement of inflation seems to be easy in theory, in practice, there are some difficulties associated with any attempt to express the overall change in prices in one number.
- A situation in which the economy shows a rapid (and often even accelerating) increase in the general price level that eventually gets out of control and, consequently, results in a rapid loss of the value of its purchasing power is usually called "hyperinflation". Such a phenomenon places a heavy burden on the economy and is, not only from an economic point of view, extremely destructive.
- When applying a frequency decomposition to the euro area HICP, it can be shown that developments in the low frequency component of euro area inflation tend to mirror headline developments quite closely and in a rather smooth fashion, but at a lower level. By contrast, the business cycle component tends to swing considerably around the zero line, thereby illustrating in an impressive way the effects that business cycles may have on price developments. Finally, the irregular component follows a very volatile pattern.
- When applying Markov-Switching techniques, "high-inflationary phases" and "low-inflationary phases" can be distinguished as two different regimes, each possessing specific characteristics.

🕮 Key Concepts

Market basket, inflation, price level, effects of inflation, GDP deflator, producer price index, consumer price index, Harmonised Index of Consumer Prices, measurement problems, hyperinflation, mean, median, standard deviation, skewness, kurtosis, inflation indices, frequency domain techniques, low frequency component, business cycle component, irregular component, inflation regimes.

☑ Questions for Review

- What is the relationship between the price level and the inflation rate?
- Which inflation indices do you know?
- What does the abbreviation"HICP" stand for?
- Which measurement problems have to be mentioned?
- What could various descriptive statistical measures tell us about the history of the euro area inflation rate? Can individual regimes be distinguished?

☑ Digging Deeper

A number of economists have suggested considering a new price index that contains asset and consumer prices in one time series. What would be your guess regarding the mean and the volatility of such a measure?

18 EXCHANGE RATES

18.1 LEARNING OBJECTIVES

In this chapter, we first outline the key features of exchange rate markets. We proceed by having a closer look at various exchange rate systems. We then identify the main determinants of exhange rates over longer-term horizons and over shorter-term horizons. Finally, we take a look at some empirical results.

18.2 BASIC CONCEPTS

Basically all international transactions necessitate the use of exchange rates. In essence, an exchange rate expresses the price of one country's currency in terms of another country's currency. In principle, there are two methods of expressing such an exchange rate, namely, first, in domestic currency units per unit of foreign currency (e.g. in euro per US dollar or EUR/USD or €/$) and, second, in foreign currency units per unit of domestic currency (e.g. in US dollar per euro or USD/EUR or $/€). It is easy to see that the second method is simply the inverse of the former.

For the following considerations, we will adhere to the second definition and express the exchange rate as foreign currency per unit of domestic currency in line with large parts of the literature. As a consequence, a rise in the exchange rate implies that – from the perspective of a euro area resident – more US dollars are obtained per euro, so that the euro has appreciated or, equivalently, the US dollar has depreciated. Quite generally, a rise in the exchange rate will coincide with an appreciation of the domestic currency (i.e. of the euro).[162]

In today's world of financial markets, a variety of well-known symbols have been introduced, which represent specific currencies. For instance, the symbol "$" stands for (US) dollars, the symbol "€" represents (euro area) euros, the symbols "£"and "¥" denote (British) pounds and (Japanese) yen, respectively. The table below lists some of the most popular international currency symbols and the international standard (ISO 4217) codes widely used in the financial world.[163] The use of these codes helps to eliminate any confusion regarding currency names and symbols that can occur during everyday's financial transactions. In this respect, an interesting development could be observed in early June 2012. More specifically, a new Bloomberg-code named "XGD" (as compared to the old code (GRD) standing for Greek Drachma before the beginning of 2001) could be observed. The reason was that some Greek parties had announced to leave the euro area in case of victory and, hence, also to abandon the euro and re-establish the Drachma. Therefore, the markets fearing a Greek exit (a so-called "Grexit") apparently prepared for the worst.[164]

Country	Currency	Symbol	ISO Code
Australia	Dollar	A$	AUD
Canada	Dollar	C$	CAD
China	Yuan	(-)	CNY
Euro area	Euro	€	EUR
India	Rupee	Rs	INR
Iran	Rial	RI	IRR
Japan	Yen	¥	JPY
Kuwait	Dinar	KD	KWD
Mexico	Peso	Ps	MEXP
Saudi Arabia	Riyal	SR	SAR
Singapore	Dollar	S$	SGD
South Africa	Rand	R	ZAR
Switzerland	Franc	SF	CHF
United Kingdom	Pound	£	GBP
United States	Dollar	$	USD

Table: Some international currency symbols
Source: van Marrewijk (2004, p. 24).

Some other concepts are worth mentioning. The expression "spot exchange rate" describes the current exchange rate (i.e. the rate for buying and selling currencies at this point in time). By contrast, the expression "forward exchange rate" stands for the exchange rate that is quoted today, but for payment and delivery at a specific future date.

The real exchange rate denotes the nominal exchange rate adjusted for relative prices between the countries under investigation.[165] By contrast, the effective exchange rate illustrates whether a currency is appreciating or depreciating against a weighted basket of foreign currencies. Against the background of a situation, in which a currency is appreciating vis-à-vis some currencies and – at the same time – depreciating vis-à-vis some other currencies, an effective exchange rate in essence constitutes a useful tool to combine such divergent movements in (bilateral) exchange rates into an overall key (index) number.

18.3 EXCHANGE RATE REGIMES

The way, an authority manages its own currency, is mirrored in the choice of the exchange rate regime. In this respect, the two extreme cases are a system of floating exchange rates and a system of fixed exchange rates. While in the latter case, the home currency is tied to another currency (or basket of currencies), in the former case the exchange rate determination is left entirely to the foreign exchange market. In today's world, flexible exchange rates constitute probably the most common exchange rate regime.

Somewhere between these two solutions, the so-called "managed float" can be found, in which the central bank – via frequent exchange market interventions – keeps the value of the currency within a certain band. A variant of the latter approach is represented by the so-called "crawling peg", in which a predetermined rate of (orderly) depreciation against the foreign currency is maintained.

In case, a sound foreign currency is used either in parallel to the home currency or all on its own, the literature speaks about a so-called "dollarisation". In the latter case, this arrangement helps to avoid any kind of speculative attacks on the domestic currency (as it has ceased to exist).[166]

In case of a currency board, an explicit legislative commitment vis-à-vis a pre-specified foreign currency with a fixed exchange rate exists. This leads to a situation, in which the domestic currency is fully backed by a foreign currency and, therefore, can only expand when more foreign exchange reserves are available. It is easy to see that this leaves relatively limited scope for discretionary policy to the home central bank but, at the same time, such an arrangement also puts a brake on any kind of uncontrolled monetary expansion.[167]

18.4 EXCHANGE RATES IN THE LONG RUN

What are the forces driving exchange rates in the long run? One of the oldest, yet one of the most intuitive models of exchange rate determination is the so-called “purchasing power parity” (“PPP”) theory. Although it is widely acknowledged that the purchasing power parity was first developed in an explicit way by the Swedish economist Gustav Cassel (1866–1945) in 1918, it is often claimed that its origins date back to the writings of the British economist David Ricardo (1772–1823).[168]

In essence, the purchasing power parity of exchange rates is based on the notion of the so-called “law of one price”. The latter idea states that, in a market that can be characterised by competitive pressures and the absence of transport costs and tariffs or any kind of other barriers to trade, identical goods must have one price. In case of deviations, arbitrage forces will equalise goods prices once the prices of goods are expressed in the same currency. Such arbitrage occurs when economic agents exploit price differences to realise a riskless profit by buying the good in the marketplace, where it is cheaper, and selling it in the marketplace, where a higher price can be obtained.

While the literature often refers to “the” purchasing power parity theory, it is fair to say that several variants do exist in parallel. The so-called “absolute version” of the purchasing power parity claims that if the price of a bundle of goods in the home country is compared to the price of an identical bundle of goods sold in a foreign currency (converted by the exchange rate into a common currency of measurement), then prices will be equal. For example, if a bundle of goods costs €100 in the euro area and the same bundle costs $200 in the United States, then the exchange rate (defined as $ per €) will be equivalent to 200 / 100 = 2.00 $/€. In algebraic terms, the absolute version of the purchasing power parity can be stated as:[169]

$$S = \frac{P^A}{P} \tag{18.4.1}$$

where S denotes the exchange rate (defined in terms of foreign currency units per unit of domestic currency), P stands for the price of a bundle of goods in the home country (expressed in the domestic currency), and P^A represents the price of an identical bundle of goods in the foreign country (expressed in terms of foreign currency).[170] Following this version of the purchasing power parity, a rise in the home price level relative to the foreign price level will inevitably lead to a proportional decrease (and, thus, a proportional depreciation) of the home currency against the foreign currency. Taking up the aforementioned example, an increase in the price of the euro area bundle to €150 and an unchanged price of the US bundle, remaining at $200, will then result in a depreciation of the euro to 1.33 $ per €.

In light of some existing imperfections (such as, for instance the existence of transport costs, imperfect information and the distorting effect of tariffs and other forms of protectionism), it is often argued that it is not realistic to expect the absolute version of the purchasing power parity to hold. This notwithstanding, a weaker form of the purchasing power parity, widely known as the "relative version" of the purchasing power parity, can be expected to hold even in the presence of such distortions. Expressed in simple terms, the relative version of purchasing power parity states that the change in the exchange rate will reflect the amount of the inflation differential between the two economies. In algebraic terms, this can be expressed as follows:

$$\Delta s = \Delta p^A - \Delta p \tag{18.4.2}$$

where Δs stands for the percentage change in the exchange rate (i.e. the change in logarithms, hence the small letters), Δp represents the domestic inflation rate and Δp^A is the foreign inflation rate. According to this version of purchasing power parity, if the inflation rate in the euro area equals two percent while its equivalent in the US is four percent, the exchange rate should be expected to increase, that is the euro to appreciate by approximately two percent.

So far, we have also assumed the purchasing power parity to hold for all types of goods. A more subtle distinction for the purchasing power parity distinguishes between "tradable" and "non-tradable" goods.[171] Tradable goods are exposed to the headwinds of international competition, such as most manufactured goods, whereas non-tradable goods are those that cannot be traded internationally (for instance, houses or certain services such as a haircut). The reason underlying such a distinction is that on a priori grounds, the purchasing power parity is more likely to hold for tradable than for non-tradable goods.

The latter result is due to the fact that the prices of tradable goods will tend to be kept "under control" by international competition, while the prices of non-tradable goods will be determined predominantly by domestic supply and demand considerations. What are the implications of such a distinction for purchasing power parity? Let us start by assuming that the theory of purchasing power parity only holds for tradable goods, which means that:

$$S = \frac{P_{TR}{}^A}{P_{TR}} \tag{18.4.3}$$

where S represents the exchange rate, P_{TR} stands for the price of tradable goods in the home country (measured in terms of the domestic currency) and P_{TR}^{A} is the price of tradable goods in the foreign country (in terms of the foreign currency). It can then be shown that the relative price of non-tradable relative to tradable goods will have an impact on the exchange rate.

Taken together, the overall empirical evidence on the purchasing power parity theory is not very supportive, and the results show that, first, at least for some rates, the deviations from purchasing power parity are both substantial and prolonged. Second, it can be shown that exchange rates have been much more volatile than the corresponding price levels.[172] Third, from an empirical perspective, the purchasing power parity seems to hold better in the long run than in the short run. This is due to the fact that fundamentals and arbitrage must be seen as predominantly long-run economic forces. Fourth, purchasing power parity seems to hold better for tradable than for non-tradable goods.[173]

☑ PPP and Tradable Goods

What are the implications of the distinction between tradable and non-tradable goods for purchasing power parity? Let us start by assuming that the theory of purchasing power parity only holds for tradable goods, which means that:

(i) $P_{TR}{}^{A} = S \cdot P_{TR}$

where S represents the exchange rate, P_{TR} stands for the price of tradable goods in the home country (measured in terms of the domestic currency) and $P_{TR}{}^{A}$ is the price of tradable goods in the foreign country (in terms of the foreign currency).

The aggregate price index (P) for the domestic currency consists of a weighted average of the prices of both tradable (P_{TR}) and non-tradable goods (P_{NT}), both being priced in domestic currency. Likewise, the foreign aggregate price index (P^{A}) is made up of a weighted average of the prices of tradables ($P_{TR}{}^{A}$) and non-tradables ($P_{NT}{}^{A}$), both in terms priced in the foreign currency. This yields:

(ii) $P = \alpha \cdot P_{TR} + (1 - \alpha) \cdot P_{NT}$

(iii) $P^{A} = \beta \cdot P_{TR}{}^{A} + (1 - \beta) \cdot P_{NT}{}^{A}$

where α is the proportion of tradable goods in the domestic price index and β is the proportion of tradable goods in the foreign price index. When dividing the latter equation by the former equation, we obtain:

(iv) $$\frac{P^{A}}{P} = \frac{\beta \cdot P_{TR}{}^{A} + (1 - \beta) \cdot P_{NT}{}^{A}}{\alpha \cdot P_{TR} + (1 - \alpha) \cdot P_{NT}}$$

If we divide the numerator by $P_{TR}{}^{A}$ and the denominator by $S \cdot P_{TR}$, this yields:[174]

(v) $$\frac{P^{A}}{P} = \frac{\beta + (1 - \beta) \cdot (P_{NT}{}^{A} / P_{TR}{}^{A})}{(\alpha / S) + (1 - \alpha) \cdot (P_{NT} / S \cdot P_{TR})}$$

Rearranging this expression yields:[175]

(vi) $$\frac{P^{A}}{P} = S \cdot \left[\frac{\beta + (1 - \beta) \cdot (P_{NT}{}^{A} / P_{TR}{}^{A})}{(\alpha) + (1 - \alpha) \cdot (P_{NT} / P_{TR})} \right]$$ and, therefore,

(vii) $$S = \frac{P^{A}}{P} \cdot \left[\frac{\alpha + (1 - \alpha) \cdot (P_{NT} / P_{TR})}{\beta + (1 - \beta) \cdot (P_{NT}{}^{A} / P_{TR}{}^{A})} \right]$$

The last equation must be seen as an important modification to the simple purchasing power parity. In particular, it suggests that the relative price of non-tradable relative to tradable goods will have an impact on the exchange rate. For instance, a rise in the price of non-tradable goods relative to tradable goods in the home country will, ceteris paribus, lead to an increase in the exchange rate and, thus, to an appreciation of the home currency.

Source: Claassen (1980) and Pillbeam (2005).

18.5 EXCHANGE RATES IN THE SHORT TO MEDIUM RUN

While the previous chapter has shown that a long-run relationship between exchange rates and price levels (in the market for goods) exists, the following paragraphs will focus on the analysis of the short- and medium-run equilibrium in financial markets and, thereby, specifically on the relationship between exchange rates and interest rates and the arbitrage forces linking these variables. It is worth noting already at this stage that, since asset prices are typically more volatile than goods prices, one can expect exchange rates to show a higher volatility over shorter horizons than over longer ones.

In line with these considerations, this section focuses exclusively on financial investment opportunities. In today's world, there is a variety of possible investments. For reasons of simplicity, we will – at the current stage – just focus on two alternative investments, namely a domestic asset and a foreign asset. We will further assume that the domestic and the foreign asset under consideration are "perfect substitutes".[176] While the return on domestic bonds is pretty much clear, in case of an investment in a country other than your home country, two factors have to be taken into account, namely the return of the investment per se and changes in the exchange rate. In fact, your overall return will be higher, if the currency, in which your investment is denominated, appreciates relative to your home country. By contrast, your overall return will be lower if the foreign currency depreciates in value.

In equilibrium, interest rate parity states that – when abstracting from risk considerations – investors should earn the same return on financial investments in all countries. If this relationship does not hold, then currency traders will buy and sell currencies and, via arbitrage activities, re-establish the equilibrium.

To ilustrate the functioning of the interest rate parity in a simple example, consider the case of a euro area investor, who can buy a 90-day US-bond that promises 4 percent nominal return. The interest rate is 4%/4=1% (since 90 days are ¼ of the 360-day year). Assume further, that the spot exchange rate is 1.08, which means that you can exchange one euro for 1.08 US-dollar. Suppose further that the 90-day forward rate is 1.06 (which means that you can exchange one euro for 1.06 US dollar in exchange in 90 days from now). Why is the forward rate of relevance in this simple example? This is due to the fact that the euro are investor can receive a 4 percent (annualized) return denominated in US dollar, but if he (or she) ultimately wants to consume goods in the euro area, those US dollars must be converted into euros. The euro return on the investment depends, therefore, on what happens to exchange rates over the next three months. However, the investor can secure the euro return by selling the foreign currency in the forward market.

More concretely, the investor can take the following steps in the investment process: First, he can convert 1000 euro to 1080 US dollar in the spot market. Second, he can invest the 1080 US-dollar in 90-day US-bonds that have a 4% annualized return (or 1 percent quarterly return) and, hence, will pay (1080)(1.01) = 1090.8 US dollar in 90 days. Third, he can decide today to exchange these 1090.8 US dollar 90 days from now by dividing through the 90-day forward exchange rate of around 1.06 into 1029 euro. This investment, therefore, has an expected 90-day return of 1029/1000 euro (= 1.029%, which translates into a nominal return of 4(1.029%) = 4.12%). Note that. in this case, part of the return is coming from the bond itself, but another part stems from the fact that the market believes that the US dollar will strengthen relative to the euro. Note further that by making use of the forward rate today, the investor has eliminated any kind of exchange rate risk.

More generally, it can be shown that, in equilibrium, the following condition holds

$$\frac{F}{S} = \frac{1+i^A}{1+i} \tag{18.5.1}$$

where F denotes the forward exchange rate and S represents the spot exchange rate. Moreover i and i^A stand for the domestic and the foreign interest rate, respectively.

Recalling the convention that – with the exception of interest rates – lower case letters denote the natural logarithm of the respective variable, and using an approximation (namely $\ln(1+x)\approx x$), we can rewrite the last equation as:

$$f - s = i^A - i \tag{18.5.2}$$

This equation then states that the difference between the (logarithm of the) forward rate and the (logarithm of the) spot rate must be equal to the difference between the foreign and the domestic interest rate. In the literature, this expression is generally known as the so-called "covered interest rate parity condition" because you have fully covered your exposure vis-à-vis the return in foreign currency on the forward exchange market. The covered interest rate parity condition provides a powerful and crucial relationship between interest rates on the one side and spot and forward exchange rates on the other side. At the same time, it shows why for a particular currency, forward exchange rates and spot exchange rates might differ for some time.

Now assume that, for some reason, you are either not in the position or not willing to make use of the forward market. In such case, your return in US dollars at the end of 90 days will have to be converted into euros at the then prevailing exchange rate. In other words, the expected exchange rate at the end of the relevant period is the relevant variable for you. Following similar considerations than the ones outlined above then yields the equilibrium condition:

$$\frac{S^e}{S} = \frac{1+i^A}{1+i} \tag{18.5.3}$$

or, alternatively:

$$s^e - s = i^A - i \tag{18.5.4}$$

It is worth mentioning, however, that one of these returns, namely the one on euro area bonds remains certain, whereas the other return, namely the return on US-bonds is subject to some uncertainty and, therefore, needs to be predicted. This is why this equilibrium condition is generally labelled as the "uncovered interest rate parity condition". In essence, this equation states that the difference in the (logarithm of) the foreign and (the logarithm of) the domestic interest rate must be equal to the expected appreciation or depreciation of the domestic currency.

☑ Derivation of the Covered Interest Rate Parity

Suppose, for instance, that you have a certain amount (A) of euros to invest for one time period and you are only interested in the return in euros.[177] What are your alternatives? Well, on the one hand, you can purchase a euro area bond. If the euro area interest rate is equal to i_{EA}, your return at the end of the period (R) will be:

(i) $R=(1+i_{EA}) \cdot A$

An alternative investment would consist of buying a US bond. Since the latter is denominated in US dollars, such an investment would automatically ask for a number of transactions on the foreign exchange market. More precisely, the amount of A euros would first need to be converted into $A \cdot S$ US dollars on the spot market, where S represents the spot exchange rate of the US dollar at the current point in time. Second, the amount of $A \cdot S$ US dollars would need to be invested in US bonds. Now, if the US interest rate is equal to i_{US}, the return of the investment will be equal to $(1+i_{US}) \cdot A \cdot S$ US dollars by the end of the period. You are, however, not interested in the return in US dollars, but only in the return in euros. In other words, you will have to convert these dollars at the end of the period back into euros. This poses a problem, because at the moment you are deciding about your investment, you do not know what the future spot exchange rate of the US dollar is going to be. Fortunately, the forward exchange market provides a solution. Making use of the forward rate (F), you can express your return in euros, which is:

(ii) $R=(1+i_{US}) \cdot (S \,/\, F) \cdot A$

In sum, you exactly know the return to your investment, independent of the fact whether you choose to invest into euro area or US bonds and, like many other participants in financial markets, you will choose the asset with the highest return. As a matter of fact, if the two assets are perfect substitutes and both are held in equilibrium, the return of the two assets must be the same in order to ensure that the market does not prefer one asset over the other. Taken together, this yields the following equilibrium condition for the choice between an investment in domestic and in foreign bonds:

(iii) $(1+i^{A}) \cdot (S \,/\, F) \cdot A = (1+i) \cdot A$

Or, equivalently:

(iv) $\dfrac{F}{S} = \dfrac{1+i^{A}}{1+i}$

Source: Claassen (1980, p. 430).

18.6 ERM II

As already mentioned in earlier chapters, at the current juncture, nineteen countries have joined the euro area and, therefore, introduced the euro as their currency. While the relationship among the euro area countries is, therefore, characterised by the existing irrevocable exchange rates, the relationship between the euro and the currencies outside the euro area is laid down in the so-called "Exchange Rate Mechanism (ERM II)". The ERM II was set up on 1 January 1999 and, thus, succeeded the ERM. Its main purpose consists, first, in helping potential euro area members in their preparation efforts for participation in the euro area and – at the same time – in creating an evaluation mechanism for those countries. Participation in ERM II is, in principle, voluntary although one of the convergence criteria clearly requires participation in the ERM II mechanism without severe tensions for at least two years.[178]

The key characteristica are represented by the fact that the exchange rate of a non-euro area Member State is fixed against the euro and is only allowed to fluctuate within pre-set limits. More precisely, the arrangement involves:

- An agreement about a "central" exchange rate between the euro and the country's currency. The currency is then allowed to fluctuate by up to ±15% above or below this central rate.
- In case the limits are reached, the currency is supported by foreign exchange market interventions to keep the exchange rate against the euro within the ±15% fluctuation band. Interventions are coordinated by the ECB and the central bank of the non-euro area Member State.

- Countries participating within ERM II can unilaterally decide to maintain a narrower fluctuation band, but this decision has generally no impact on the official ±15% fluctuation margin.[179]

In general, the co-ordination of the monetary and exchange-rate policies, and, thus, also the monitoring of ERM II and the related administration lies in the hands of the General Council, of course, in close cooperation with the member state's central bank. In mid-2017, the ERM II included only the Danish kroner (with a narrow fluctuation band of ±2.25%).

18.7 A FIRST LOOK AT THE DATA

The Big Mac Index was first published by The Economist in 1986. It was originally meant to be a humorous illustration of the purchasing power parity which claims that, over the long run, currencies should adjust in a way that a basket of identical goods costs the same everywhere. This notwithstanding, in light of its popularity, the Economist has published regular updates since then every year.

☑ The Big Mac Index

In order to briefly illustrate the derivation of the Big Mac Index, let us revert to the calculations on the "Hamburger Standard" (also called "Burgernomics") published in early-2017. According to these results, buying the Big Mac in Switzerland costs, for instance, $ 6.74 as compared to the United States, where it costs $ 5.30, so the index would suggest that the Swiss Franc is 27% overvalued. The table below shows for various countries the price of a Big Mac in US dollar and the corresponding over- or undervaluation.

Country	*Price in $*	*Over/undervaluation*
Switzerland	$ 6.74	(+27%)
Norway	$ 5.91	(+12%)
Sweden	$ 5.82	(+10%)
United States	$ 5.30	(0%)
Finland	$ 5.21	(- 2%)
Brazil	$ 5.10	(- 4%)
Israel	$ 4.77	(-10%)
Canada	$ 4.66	(-12%)
Denmark	$ 4.61	(-13%)

Source: http//www.statista.com

In this particular case, the relevant basket was just filled with one good, namely the Big Mac, which is made according to the same recipe in almost 120 countries. Given this homogeneity, the Big Mac seems to be particularly suitable for a comparison of international prices. Buying the Big Mac in a specific country for a higher price than in the United States would then suggest that the country's currency would tend to be overvalued.

The so-called "Hamburger Standard" has its limitations. First and foremost, it can be doubted, whether the Big Mac represents a tradable good, given that price differences will (on the demand side) probably not lead to international arbitrage movements. Moreover, price differences between countries can be distorted by taxes, transport costs, property costs, and many more things.

More recently, alternative measures have been developed, among them the so-called "Tall-Latte-Index" (based on a standard product by Starbucks) or the so-called "iPod index", which is based on the prices for an "iPod music player" sold by Apple.

18.8 SUMMARY

- An exchange rate basically expresses the price of one country's currency in terms of another country's currency. In principle, there are two methods of expressing such an exchange rate, namely, first, in domestic currency units per unit of foreign currency and, second, in foreign currency units per unit of domestic currency. It is easy to see that the second method is merely the inverse of the former.
- Other concepts include the "spot exchange rate" (i.e. the rate for buying and selling currencies at this point in time), the "forward exchange rate" (i.e. the exchange rate that is quoted today, but for payment and delivery at a specific future date), the real exchange rate (i.e. the nominal exchange rate adjusted for relative prices between the countries under investigation) and the effective exchange rate (i.e the rate that illustrates whether a currency is appreciating or depreciating against a weighted basket of foreign currencies).
- In today's world, a variety of exchange rate regimes exist. The two extreme cases are a system of floating exchange rates and a system of fixed exchange rates. Other regimes are the so-called "managed float", the so-called "crawling peg", the "dollarisation" and the "currency board".
- The purchasing power parity of exchange rates reflects the long-run relationship between exchange rates and price levels. It is based on the notion of the "law of one price" and states that, in a market that can be characterised by competitive pressures and the absence of transport costs and tariffs or any kind of other barriers to trade, identical goods must have one price. In case of deviations, arbitrage forces will equalise goods prices (once the prices of the goods are expressed in the same currency).

- By contrast, over shorter horizons, an equilibrium in financial markets exists, which is reflected in a relationship between exchange rates and interest rates. This equilibrium is generally known as the "interest rate parity". Again, arbitrage forces linking these variables can be seen as driving disequilibria back to equilibrium.
- Given the fact that asset prices are typically more volatile than goods prices, one can expect exchange rates to show a higher volatility over shorter horizons than over longer ones.
- The relationship between the euro and the currencies outside the euro area is laid down in the so-called "Exchange Rate Mechanism (ERM II), which is characterised by the fact that the exchange rate of a non-euro area Member State is fixed against the euro and is only allowed to fluctuate within pre-set limits.

Key Concepts

Spot exchange rate, bid and ask spreads, appreciation and depreciation, (triangular) arbitrage, effective exchange rates, law of one price, purchasing power parity (PPP), absolute and relative version, tradable and non-tradable goods, transaction costs, fixed investment costs and thresholds, purchasing power parity variants, perfect substitutes, imperfect substitutes, covered interest parity, uncovered interest parity, risk neutrality, ERM II.

☑ Questions for Review

- What is the exact meaning of an exchange rate?
- In which way do spot exchange rates differ from forward exchange rates?
- How can the mechanics of arbitrage be described?
- What could be the reasons underlying persistent deviations between the spot and the forward exchange rate?
- What is the essence of the so-called "law of one price"?
- In which way do the absolute and the relative version of the purchasing power parity differ?
- What are the implications of the distinction between tradable and non-tradable goods for the purchasing power parity?
- How do the different variants of the purchasing power parity perform in empirical tests? Which reasons could be responsible for such empirical results?
- Show, how exchange rates and interest rates are linked! What is the basic idea behind the covered interest rate parity?
- What is the essence of the uncovered interest rate parity?
- What can be said about the functioning of the ERM II?

PART V

19 MONETARY THEORY

19.1 LEARNING OBJECTIVES

In this chapter, we first outline the essence of some inflation theories. We then identify the main determinants of inflation according to these theories, before we focus on the role of expectations for inflation and monetary policy. More concretely, we proceed further by illustrating various types of expectation formation and by discussing their advantages and disadvantages. Afterwards, we draw some conclusions regarding their policy implications. Finally, we have a look at the data.

19.2 THE QUANTITY THEORY OF MONEY

One of the oldest and – at the same time – one of the most intuitive concepts explaing the causes and cures of inflation is the quantity theory of money. The latter provides us with a rather clear and transparent framework for the analysis of the links between money and prices. In order to see this, we start by explaining the so-called "quantity equation of exchange", which states that:[180]

$$M \cdot V = P \cdot TR \tag{19.2.1}$$

where M represents the money stock, TR stands for the volume of real transactions in an economy, P denotes the price level and V the (transactions) velocity of circulation, respectively. The unknown transactions variable is in practice usually replaced by a measure of real income (Y), leading to:

$$M \cdot V = P \cdot Y \tag{19.2.2}$$

One key variable in this equation is velocity, which is generally defined as the ratio of the current value of total nominal transactions to the stock of money. More precisely, velocity can be defined as the frequency with which money is transferred between different money holders and it reflects the stock of money required to service a particular level of nominal transactions. Rearranging this expression in terms of growth rates (whereby the small letters denote logarithms) yields:

$$\Delta m + \Delta v = \Delta y + \Delta p \quad \text{or, alternatively,} \tag{19.2.3}$$

$$\Delta m = \Delta y + \Delta p - \Delta v \tag{19.2.4}$$

According to this identity, the change in the money stock in an economy equals the growth of nominal transactions (approximated by the change in real GDP plus the change in the price level) minus the change in velocity. This is the essence of the "quantity equation of exchange". Expressed in a different way, this just states that the nominal side of the economy must correspond to the real side of the economy at any point in time.

To draw economic conclusions, however, further assumptions about the variables involved in this identity have to be made. Following the classical economists, the growth rates of real income and velocity could be regarded as fixed, at least in the short run. In the case of real income, this was due to the assumption that the economy was regarded as sufficiently flexible and self-correcting forces were strong enough to make real income return to its original level after any kind of shock. The assumption of a constant velocity was due to the fact that velocity was regarded as being dominated by payment habits, which could be regarded as constant, at least over the short run. Setting $\Delta y = \Delta v = 0$, it then follows

$$\Delta m = \Delta p \tag{19.2.5}$$

This is equivalent to saying that if real output and velocity do not change, then the change in money will be reflected in a change in prices. Expressed in other words, in the "old" version of the quantity theory "money is a veil" and the control of inflation is very easy – all it takes is that the central bank controls money supply.

In a more modern version of the quantity theory, in the long run, real income is viewed as being determined by supply-side factors and that self-correcting forces are strong enough to keep the economy moving in the direction of the "potential" or "natural rate" of output. Moreover, besides technological and institutional factors (such as, for instance, the usage of credit cards), velocity can be expected to be driven by a small number of explanatory variables (such as for instance, interest rates), and this relationship can be regarded as stable or, at least, predictable.[181] Finally, the quantity of money in an economy is assumed to be determined independently of the other three variables as it is basically decided upon by the central bank.

These assumptions allow the identity to be transformed into the "new quantity theory of money", which implies a stable relationship between the money stock and the price level. Expressed in terms of inflation, this yields:

$$\pi = \Delta p = \Delta m + \Delta v - \Delta y \tag{19.2.6}$$

One implication of this – the so-called "neutrality" of money – states that changes in the money supply will – in the long run – lead to changes in nominal, but not in real variables. In other words, if the "neutrality of money" holds, changes in the money supply will have no long-run effect on real output or employment.

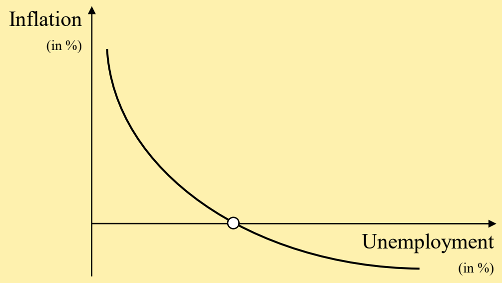
It is worth mentioning, however, already at this stage that although a strong long-run link between money and inflation exists, there are numerous deviations in the short run, which render the forecasting business and the conduct of monetary policy a complicated task. This notwithstanding, the quantity theory remains a very valuable tool that allows for useful insights.

19.3 THE PHILLIPS CURVE

In 1958, the New Zealand economist Arthur W. Phillips (1914–1976) published the results of a statistical study that had investigated the relationship between the change in wages and unemployment for the United Kingdom over a period of 1861 to 1957.[182] For the period under review, the study found an inverse non-linear relationship between the two variables. Phillips' conclusions attracted a lot of attention among economists and, in 1960, the US economists Paul Samuelson and Robert Solow took Phillips' results up and reformulated them in a way that allowed for a more explicit link between inflation and unemployment.[183]

At latest at this point in time, the Phillips curve became extremely popular, since it seemed as if Samuelson and Solow had found the "missing equation" in the Keynesian framework. Assuming the stability of the latter relationship, it could be argued that a government (or a central bank) could not fight inflation and unemployment at the same time. They could either tolerate a reasonably high rate of inflation and achieve a lower unemployment rate or they could fight inflation at the expense of a higher unemployment.

Figure 19.1: Philips Curve



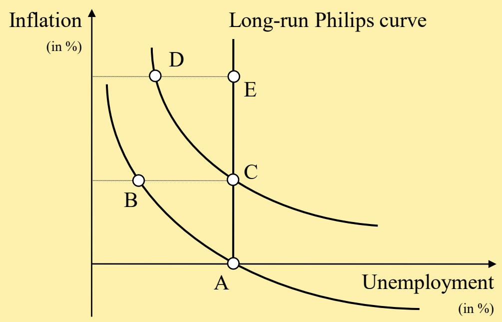
How could the mechanism exactly work? For instance, fiscal policy (or monetary policy) could be used to stimulate the economy, thus raising gross domestic product and lowering the unemployment rate. The related move along the Phillips curve would lead to a higher inflation rate, the cost of enjoying lower unemployment rates. Seen from this perspective, the government or the central bank would face a trade-off between inflation and unemployment and, consequently, a need to prioritize. At the same time, it is fair to say that the government or the central bank could select from a "menu of choice" its preferred option but would, of course, have to pay a price.

The idea of selecting from a menu of choice soon became deeply entrenched in the minds of many policy-makers and, in the course of the late 1960s, attempts to "finetune" the economy became quite popular. In the course of the 1970s, however, many countries started to experience both, high levels of both inflation and unemployment at the same time – a phenomenon that became widely known as the so-called "stagflation". The latter outcome was hard to explain in terms of the traditional Phillips curve and, as a consequence, the concept came under heavy attack with some economists claiming that the concept was "dead" or, at least, subject to shifts in the short run. In the aftermath, a group of economists (headed by Milton Friedman (1912–2006) and Edmund Phelps) offered an intuitive, alternative explanation, which led to the result that the idea of a simple, predictable, persistent and exploitable relationship between inflation and unemployment was abandoned by most macroeconomists.[184]

To begin with, Friedman and Phelps started their notion of an "expectations-augmented Phillips curve" from the assumption of a "natural rate of unemployment", a rate that can be seen as consistent with a stable inflation rate.[185] Now suppose that policy-makers face an inflation-unemployment trade-off marked by the initial curve below. They will then decide in favour of an expansionary policy and, therefore, move the economy from point A to point B, thus reducing the unemployment rate. But in point B, inflation has risen and workers, who do not suffer from the so-called "money illusion", will realise that their real wages have decreased.[186] Consequently, they will adjust their expectations and ask for compensation in form of higher nominal wages.[187]

Assuming that they have sufficient bargaining power, their nominal wages will increase and the initial real wages will be restored. As a consequence, however, firms will demand less labour when facing higher real wages and, thus, the economy will move to point C. Another round of expansionary policy might follow and, in the end, leave the economy in point E. Therefore, any reduction in unemployment below the "natural rate of unemployment" will be temporary and lead only to higher inflation in the long run. In essence, higher employment effects are just temporary.[188]

Figure 19.2: Short-Run and Long-Run Philips Curve



Expressed in other terms, there is a need to distinguish between the short-term Phillips curve and its long-term version, with the long-run Phillips curve being vertical. In the long run, only a single rate of unemployment is consistent with a stable inflation rate. In line with this, in the long run, there is no trade-off between inflation and unemployment.[189]

At the same time, it is obvious that expectations play a key role in the analysis of the Phillips curve as they determine by how much and how fast wages adjust and lead to shifts in the short-run Phillips Curve.

19.4 THE SCANDINAVIAN MODEL OF INFLATION

An alternative explanatory approach is the so-called “Scandinavian model of inflation”. Suppose, for instance, there are two sectors in an economy, namely one that produces “tradable goods” and another one producing “non-tradable goods”.[190] Tradable goods are exposed to the headwinds of international competition, such as most manufactured goods, whereas non-tradable goods are those that cannot be traded internationally (for instance houses or certain services such as a haircut). In other words, the prices of tradable goods will tend to be kept “under control” by international competition, while the prices of non-tradable goods will be determined predominantly by domestic supply and demand considerations.

What are the implications of such a distinction? By construction, the aggregate price index (P) in an economy consists of a weighted average of the prices of both tradable (P_{TR}) and non-tradable goods (P_{NT}). This yields:

$$P = \alpha \cdot P_{TR} + (1 - \alpha) \cdot P_{NT} \tag{19.4.1}$$

where α is the proportion of tradable goods in the domestic price index. Expressed in terms of the change in the price level (i.e. the inflation rate), it then follows:

$$\pi = \beta \cdot \pi_{TR} + (1 - \beta) \cdot \pi_{NT} \tag{19.4.2}$$

Now assume further that the productivity increase in the non-tradable sector is lower than the one in the tradable sector, but both sectors get the same increase in nominal wages. If changes in prices are driven by the difference in the increase in nominal wages and in productivity, it follows:

$$\pi_{NT} = \Delta w - \Delta\, prod_{NT} \text{ and} \tag{19.4.3}$$
$$\pi_{TR} = \Delta w - \Delta\, prod_{TR} \tag{19.4.4}$$

Inserting the two expressions then yields

$$\pi_{NT} - \pi_{TR} = \Delta\, prod_{TR} - \Delta\, prod_{NT} \text{ and, therefore,} \tag{19.4.5}$$
$$\pi_{NT} = \pi_{TR} + \Delta\, prod_{TR} - \Delta\, prod_{NT} \tag{19.4.6}$$

Inserting this expression into the one derived above for the aggregate price index yields:

$$\pi = \beta \cdot \pi_{TR} + (1 - \beta) \cdot [\pi_{TR} + \Delta\, prod_{TR} - \Delta\, prod_{NT}] \tag{19.4.7}$$

whereby the first term can be labelled as ”imported inflation” (since the increase in prices for tradable goods is dictated by international competition), and the second term can be labelled as “structural inflation” (which mirrors the relative differences in the productivity changes of the two sectors). It is obvious that the effect coming from structural inflation is larger if the multiplicative term $(1 - \beta)$, which reflects the impact of the non-tradable sector on the economy, is more substantial. Expressed in other words: if the tradable sector takes the lead in the determination of the nominal wage increase for both sectors (thus creating a “spillover effect”) and the nontradable sector has a lower productivity growth, then an increase in aggregate prices must inevitably result.[191]

19.5 THE P-STAR APPROACH

In two seminal contributions, the US-economists J.J. Hallman, R.D. Porter and D.H. Small have laid down their own re-interpretation of the quantity theory and – at the same time – developed a very popular indicator of inflationary pressures.[192] The starting point is again the well-known quantity theory:

$$P \cdot Y = M \cdot V \tag{19.5.1}$$

When recurring on the level of potential real GDP and the equilibrium level of velocity, the equilibrium price level can be defined as:

$$P^* \cdot Y^* = M \cdot V^* \qquad \text{or, equivalently,} \qquad P^* = \frac{M \cdot V^*}{Y^*} \tag{19.5.2}$$

And similar considerations for the quantity theory result in:

$$P \cdot Y = M \cdot V \quad \text{or, equivalently,} \qquad P = \frac{M \cdot V}{Y} \tag{19.5.3}$$

Dividing and re-arranging then yields:

$$\frac{P^*}{P} = \frac{\frac{M \cdot V^*}{Y^*}}{\frac{M \cdot V}{Y}} = \frac{M \cdot V^*}{Y^*} \cdot \frac{Y}{M \cdot V} = \frac{M}{M} \cdot \frac{V^*}{V} \cdot \frac{Y}{Y^*} \tag{19.5.4}$$

Letting lower case letters again denote logarithms, it then follows:

$$p^* - p = (v^* - v) + (y - y^*) \tag{19.5.5}$$

The left-hand side of this equation is then often labelled as the so-called “price gap”. The first term on the right-hand side then represents the so-called “velocity gap”, which in turn expresses the liquidity overhang or shortfall in an economy. The second term stands for a measure of the so-called “output gap”. And for inflation, it follows that:

$$\Delta p^* - \Delta p = (\Delta v^* - \Delta v) + (\Delta y - \Delta y^*) \tag{19.5.6}$$

The P-Star model has become quite popular as it expresses the price situation in a country in close connection to its two main driving forces, namely the business cycle situation and the liquidity situation, in a very elegant way.[193] In this context, it is worth noting, however, that the empirical evidence seems to be rather mixed. While, for smaller countries, the P-Star model seems to perform worse, for larger countries, the “fit” seems to be substantially better.[194]

19.6 THE TWO-PILLAR PHILLIPS CURVE

In another contribution, Gerlach and Svensson modified the P*-framework to investigate the role of monetary indicators in more detail. In simplified terms, their basic equation reads as follows:[195]

$$\Delta p^* - \Delta p = \alpha + \beta \cdot (\Delta y - \Delta y^*) + \delta \cdot (\Delta m - \Delta m^*) + \varepsilon \tag{19.6.1}$$

where the last term is meant to capture the influence of various monetary indicators. The results show that the "price gap" or, equivalently, the "real money gap" (i.e the gap between current real balances and long-run equilibrium real balances) has substantial predictive power for future inflation for the euro area. More specifically, the real money gap contains more information about future inflation than the output gap and the ECB's money-growth indicator (i.e. the gap between current M3 growth and a reference value).

19.7 THE ROLE OF EXPECTATIONS

So far, the previous considerations have neglected one important aspect of economics – namely the role of expectations. At the same time, we have seen, for instance in the context of the discussion on the Phillips curve, that expectations do play a key role in economics. This leads us to the question, how expectations are formed. A relatively simple pattern of forming expectations about the future rate of inflation could be the following one:[196]

$$ {}_t\pi_{t+1}^{e} = \pi_t \tag{19.7.1} $$

where the expression on the left-hand side describes the expectation for the inflation rate in $t+1$ as it is formed in period t. It is obvious that expectations are formed in a way that assumes the current inflation rate to hold also for the future. In the literature, such a behaviour is often labelled as “static expectations”. It is worth noting that, in the framework of this concept, economic subjects are always “lagging” behind actual developments or, in other words, despite the occurrence of systematic errors, there is no “learning effect”.

It seems, however, more realistic to assume that economic subjects are able to learn over time. This could be the case, if the following expression holds:

$$ {}_t\pi_{t+1}{}^e = {}_{t-1}\pi_t{}^e + z \cdot (\pi_t - {}_{t-1}\pi_t{}^e) \quad \text{with} \quad 0 < z < 1 \tag{19.7.2}$$

Such a behaviour can be summarised as “adaptive expectations”, since economic subjects tend to correct their earlier expectations by the factor z of their previous forecast error. In this context, the factor z can vary between the values of zero (i.e. no correction of the forecast error) and one (i.e. a full correction of the forecast error). In other words: economic subjects tend to follow a “learning by error” behaviour.[197] Such a behaviour is clearly more realistic than the simple static version described above but it is still not fully satisfying. While a learning effect seems to hold now, the behaviour of economic subjects still remains backward-looking and makes use of past realisations of the inflation rate only. The influence of other variables, such as, for instance, the output gap, oil prices, exchange rates or monetary developments remains unnoticed. This seems to be somewhat puzzling as it should be possible to achieve better results by using economic theory and the corresponding empirical methods.

This rationale stands at the heart of the concept of “rational expectations” according to which, economic subjects form their expectations on the basis of three main criteria. First, they use all available and relevant information. Second, they know the economic model that underlies the developments in the economic variable (i.e. inflation) and they are also willing to use it. Third, they try to avoid systematic mistakes.[198] More formally, it follows:

$$ {}_t\pi_{t+1}{}^e = {}_tE(\pi_{t+1}) \tag{19.7.3}$$

where the term on the right-hand side stands for the expected (deterministic) value. Following the concept of rational expectations, quite obviously, the subjective expectation for inflation corresponds to the optimal forecast for inflation, which is derived on the basis of all exogenous and endogenous variables available at time t.

It is important to stress that the concept of ”rational expectations” is by no means identical to the concept of ”perfect foresight”. This is due to the fact that, in reality, economic behaviour is not exclusively based on deterministic considerations but also subject to stochastic shocks, which hit the variables in a more or less random fashion. In case, such a stochastic error term (ε_t) is taken into account, it follows:

$$ {}_t\pi_{t+1}{}^e = {}_tE(\pi_{t+1}) + \varepsilon_{t+1} \qquad (19.7.4)$$

The only deviation of the expected value from the actual value then results from the existence of a stochastic error term, which can, however, not be predicted. At the same time, it is well known that, on average, the error term will take a value of zero, as this is always the case for the expected value of a random variable.[199] In other words: the expected value for inflation will not systematically deviate from the actual value. If rational expectations hold, then on average, the correct inflation rate will be expected, although, on a case-by-case basis, deviations will inevitably result, due to the existence of a stochastic errort term.

While the concept of rational expectations at first glance looks only like a fascinating and very elegant way of handling expectations, it also bears far-reaching implications for monetary policy.[200] To see this, recall that economic subjects tend to make no systematic errors. In other words, all systematic behaviour (i.e. the "reaction function") by the government and the central bank will be embodied in the expectations of economic subjects and, thus, already be foreseen.

It is, therefore, not possible for the government and the central bank to initiate "systematic effects" in relevant economic variables by carrying out a systematic policy. For instance, a central bank cannot create a situation, in which the expected inflation rate "systematically" differs from from the actual inflation rate. When applying these results to the Phillips Curve, the consequences are even more radical. While in their famous critique, Friedman and Phelps admitted the existence of transitory, but not permanent effects on unemployment, the proponents of rational expectations would now claim that no systematic effects on unemployment are possible. This is an amazing result, which in principle renders any systematic economic policy impossible. At the same time, the results open new horizons for central banks: in case, central banks incorporate a change in their systematic behaviour (i.e. their reaction function) and this change is perceived as permanent and credible, markets will embed this change in their information set and, thus, in a way do the work for the central bank.[201]

Finally, it is worth noting that a number of economists do not adhere to these (admittedly elegant mathematical) formulations of expectation formation. In their view, expectations are not driven by changes in economic fundamentals but, instead, predominantly by psychological factors. Moreover, sudden and abrupt changes in expectations themselves must – in their view – be regarded as an important source of "shocks" for an economy.

This view dates back to an idea expressed already in Keynes' work, who described these kinds of "shocks" in expectations by the colourful metaphor of "animal spirits".[202] While it is not intuitively clear, whether these animal spirits reflect a kind of "irrational behaviour", or rather a rational behaviour based on psychological constraints, the idea has become increasingly popular recently.[203]

19.8 A FIRST LOOK AT THE DATA

We start the empirical section by linking GDP growth and the rates of inflation for the HICP and the GDP-deflator to the growth rates for various monetary aggregates over various time horizons. This is done by means of a simple regression analysis, whereby the variables refer to anuual growth rates.[204]

	ΔGDP	ΔHICP	ΔGDP-deflator
Annual growth			
ΔM1	0.08 (0.16)	- 0.14 (0.05)	0.01 (0.96)
ΔM2	0.09 (0.15)	0.53 (0.00)	0.55 (0.00)
ΔM3	0.15 (0.01)	0.46 (0.00)	0.49 (0.00)
6-year growth			
ΔM1	0.39 (0.00)	- 0.01 (0.87)	0.02 (0.88)
ΔM2	0.28 (0.01)	0.42 (0.00)	0.54 (0.00)
ΔM3	0.31 (0.00)	0.40 (0.00)	0.53 (0.00)
12-year growth			
ΔM1	- 0.03 (0.77)	- 0.57 (0.00)	- 0.87 (0.00)
ΔM2	0.13 (0.18)	0.63 (0.00)	0.73 (0.01)
ΔM3	0.11 (0.00)	0.72 (0.00)	0.99 (0.00)

Table: Money, Growth and Inflation over Various Horizons
Source: own estimations based on Dreger et al. (2016), p-values in brackets, figures rounded.

The results show that inflation and money are not closely related over short-run and business cycle frequencies (up to 6 years), irrespective of the aggregate chosen. While the estimate of the narrow aggregate M1 seems completely uninformative for inflation, the coefficients for M2 and M3 are well signed, at least. The coefficients for monetary growth (especially M3) approach unity if growth rates are calculated over sufficiently long periods (i.e. 12 years). As regards the linkages of monetary aggregates with real growth, if anything, a weak relationship over the business cycle frequency (i.e. 6 years) can be found.

19.9 A SECOND LOOK AT THE DATA

An alternative way of looking at the long-run relationship between money and prices could be an investigation in the frequency domain. The underlying rationale lies in the fact that many economic processes are the result of a combination of various components operating on different frequencies or, equivalently, in different spectrums.[205] Indeed, the theory of spectral analysis provides a rigorous framework for extracting specific frequency bands from the data and, against this background, various kinds of band-pass filters have been used in the literature.[206] The general model can be specified as follows:[207]

$$dev(p)_t^{\ f} = \alpha_0 + \alpha_1\, dev(m)_{t-1}^{\ f} + \alpha_2\, dev(y-y^*)_{t-1}^{\ f} + \alpha_3\, dev(s)_{t-1}^{\ f} + \varepsilon_t \tag{19.9.1}$$

where t stands for the time index and f denotes the frequency. In terms of variables, m represents money, $y-y^*$ is the output gap and s stands for the exchange rate. Moreover, the expression *dev* denotes the deviation from the respective sample mean (in annual growth rates).

Following Assenmacher-Wesche and Gerlach (2007), Andersson (2008 and 2011), Benati (2009) and Haug and Dewald (2012), we divide developments in consumer inflation into three time horizons, namely the short run (up to two years), the medium run (two to eight years) and the long run (eight years and beyond). The table below then shows the results in more detail.[208]

	Short run	Medium term	Long run
Money	0.01 (0.98)	0.05 (0.42)	0.23 (0.00)
Output gap-	- 0.01 (0.60)	0.16 (0.00)	- 0.08 (0.45)
Exch. rate	- 0.03 (0.14)	0.02 (0.04)	- 0.02 (0.33)

Table: Results of Frequency Decomposition
Source: own estimations, figures rounded, p-values in brackets.

The results show that, over the short-term horizon, none of the considered variables affects consumer inflation and, thus, fluctuations in consumer inflation that last up to two years are either noise, or may be explained by past values or seasonal effects. It is interesting to note, however, that as the frequency increases, the fundamentals come to the fore. Over the medium term, positive and significant effects from the output gap enter into the picture. Beyond the eight-year cycle, neither the output gap, nor the exchange rate seem to exert an influence on consumer prices. By contrast, positive and significant effects from monetary developments can be observed. Taken together, the results speak in favour of a close monitoring of monetary developments over longer horizons. Over shorter- to medium-term horizons, however, the output gap seems to be of relevance.

19.10 A THIRD LOOK AT THE DATA

Another way of looking at the empirical advantages of a careful analysis of monetary growth would be to investigate in more detail whether today's monetary growth helps to predict tomorrow's inflation. In the economic literature, this is often done by use of the so-called "Granger causality tests". When applying such tests for a window of ten years and testing for the causalities between (long-run) monetary and (long run) price developments, we find that the (null) hypothesis of money causing prices cannot be rejected at conventional significance levels, whereas the opposite causality can be rejected. [209]

Null hypothesis	F-statistic	P-value
Money does not cause inflation	3.01	0.01
Inflation does not cause money	1.99	0.08

Table: Results of Granger Causality Tests
Source: Own estimations.

Taken together, these results seem to speak in favour of a role for monetary developments in the information set of the monetary policy decision-makers.

19.11 SUMMARY

- There is a variety of approaches aiming at explaining inflation. Among them are the quantity theory (in an old and a new version), the Phillips curve (in a short-run and a long-run version), the Scandinavian model of inflation, the P-Star approach and the two-pillar Phillips curve.
- The concept of expectations is crucial for economics. Among the expectation mechanisms discussed in the literature are static expectations, adaptive expectations and rational expectations. Rational expectations must be seen as having far-reaching implications for the conduct of economic policy. More recently, the concept of "animal spirits" has regained some popularity.

🕮 Key Concepts

Quantity theory of money, Scandinavian model of inflation, P-Star approach, static expectations, adaptive expectations, rational expectations, systematic errors, unsystematic errors, stochastic error term, animal spirits, implications for economic policy, credibility, regression analysis over various time horizons, frequency decomposition, short-term frequency, medium-term frequency, long-term frequency, Granger causality tests.

☑ Questions for Review

- What is the essence of the quantity theory of money?
- What is at the core of the Scandinavian model of inflation?
- What are the key messages of the P-Star approach?
- What is the essence of the concept of static expectations?
- What is at the core of the concept of adaptive expectations?
- What are the key messages of the concept of rational expectations?
- In which way do rational expectations impact on economic and monetary policy?
- What can be said about the results between money and prices based on various frequencies?

20 MONETARY POLICY

20.1 LEARNING OBJECTIVES

In this chapter, we extend the basic model in various respects in order to outline the essence of monetary policy. To begin with, we provide a brief historical overview and explain the functions and forms of money. In the next step, we take a closer look on the channels of monetary policy transmission before entering the debate on the time lags of monetary policy. We then proceed by discussing the issue of rules versus discretion and various monetary policy strategies. Finally, we have a closer look at the data.

20.2 MONEY: HISTORY, FORMS AND FUNCTIONS

So far, we have treated "money" only at a very basic level. However, it is certainly no exaggeration to say that "money makes the world go round" and that modern economies could not function without money. But important questions remain: What is the essence of money? Why do we need it? What does it exactly comprise?

☑ **Functions of Money**

Money is a key feature in today's modern economic life. This notwithstanding, from a purely theoretical perspective, it remains unclear what exactly money is. Economists, therefore, often define that "money is what money does" and, consequently, describe money quite generally in terms of the three main functions it provides, namely the function as a medium of exchange, as a store of value, and as a unit of account.[210]

By far the most important function of money is the function as a medium of exchange. This stems from the fact that, if money did not exist, all transactions would need to be carried out by barter, that is via the direct exchange of goods. A barter system can, however, be extremely burdensome as it implies a "double coincidence of wants" between two transacting parties. This is the case because, in essence, a successful deal to be made would require at the same time the presence of a supplier and a demander, whereby the supplier has exactly the good the demander asks for (in the right amount, quality, colour etc.) on offer, while the demander has exactly the good, the supplier wants to obtain, available.

If money keeps its value over time, it can – in addition – serve as a store of value. This has the additional advantage that the act of purchasing and selling goods can be separated in terms of timing, thus allowing for the existence of intertemporal phenomena, such as, for instance, savings and investment. It is obvious that some goods have a natural advantage as a store of value compared to other goods. More particularly, goods that are durable, not easily reproducable, relatively scarce, easily transportable and divisible can better fulfil the role of money.

Finally, money also serves as a unit of account, in the sense that it provides a common measure of the value of goods and services being exchanged. The latter function is due to the fact that, even if the difficulty of the double coincidence of wants is overcome, people would still have to find the exact "exchange" ratio between, say, bread and haircuts or between haircuts and shoes. This "exchange ratio", namely the number of loaves of bread worth one haircut, is also called the "relative price". In a market place, the relative price would have to be set for each pair of goods and services and, of course, everybody involved in the exchange of goods would need all the information about the terms of trade between all goods.[211]

As a matter of fact, the greater the number of goods being exchanged, the more difficult it becomes to gather information on all possible "exchange rates".[212] In other words: collecting information on these "relative prices" involves substantial information costs for the participants in a barter economy. The latter problem can, however, be mitigated if one of the existing goods serves as a unit of account (a so-called "numéraire"). In this case, the value of all goods can be expressed in terms of this "numéraire" and the number of prices, which consumers have to identify and to remember can be reduced substantially.

☑ Forms of Money

Over time, the nature and the character of goods serving as money have considerably changed. Nowadays, it is widely agreed in the literature that the evolution of money depends on a number of factors, such as the relative importance of trade and the state of development of the economy.

After thousands of years of barter, some cultures moved on to the use of commodity money. In this regard, a variety of items have served as commodity money, including the wampum (beads made from shells) of the American Indians, cowries (brightly coloured shells) in India, whales' teeth in Fiji, tobacco in the early colonies in North America, large stone disks on the Pacific Island of Yap and cigarettes and liquor in post-World War II Germany.[213]

The system of commodity money then evolved into a system of metallic money. By introducing metallic money, ancient societies tried to overcome the problems associated with using decaying commodities as money. It is not entirely known, when and where exactly metallic money was used for the first time. According to some sources, however, metallic money came into use in around 2000 B.C. in Asia, although in some periods, its weight does not seem to have been standardised nor its value certified by the rulers. In fact, chunks or bars of gold and silver were used as commodity money since they were easy to transport, did not decay and were more or less easily divisible.[214]

Europeans were among the first to develop standardised and certified metallic coins. The Greeks introduced silver coins around 700 B.C. The Romans, who had previously used cumbersome bronze bars called "aes signatum" as money, adopted the Greek innovation of using official coins and were the first to introduce a bi-metal scheme using both the silver denarius and the gold aureus.

The Chinese began using paper money around 800 A.D. under Emperor Hien Tsung and continued to do so for several hundred years. This paper money had no commodity value at all and was money only by imperial decree, or so-called "fiat money" (i.e. money without intrinsic value).

Faced with the difficulties to conduct long-distance trade and the risk of being robbed with coins, the Italian city-states were the first to introduce certificates of indebtedness (“obligations”) as a means of payment. Debtor and lender were mentioned in the certificates, a payment date was fixed, and the amount of gold or silver noted. Soon, merchant bankers began to trade these obligations with first evidence of such contracts dating back to 1156.

Obligations continued to be used for centuries, until the economic turmoil caused by the Thirty Years’ War made rulers, such as the Swedish kings, start to prefer paper money. This was subsequently introduced by the Bank of England in 1694 and the Banque Générale de France in 1716. The advent of paper fiat money in Europe marked the beginning of a new phase in the evolution of money. The responsibility for establishing and regulating the system of fiat money in a country was now taken over by the governments, but other public or private institutions such as central banks and the financial system played an increasingly crucial role in the success of the national currency.

The evolution of money has not stopped. These days, various forms of intangible money have emerged, among them so-called “electronic money” (“e-money”), which first appeared in the 1990s. This kind of money can be used to pay for goods and services on the internet or using other electronic media.

☑ Monetary Definitions in the Euro Area

In practice, a central bank has to decide which assets have a monetary character and, therefore, should be classified as “money” and which ones do not. Such a distinction is not an easy task since many different financial assets are close substitutes and the nature and characteristics of financial assets, transactions and means of payment are changing over time.

As a matter of principle, the ECB’s definitions of euro area monetary aggregates are based on (harmonised) definitions of the money-issuing sector and the money-holding sector as well as of specific categories of monetary financial institution (MFI) liabilities. In this context, the money-issuing sector comprises MFIs resident in the euro area. By contrast, the money-holding sector includes all non-MFIs resident in the euro area (excluding the central government sector). Based on conceptual considerations and empirical studies and in line with international practice, the Eurosystem has defined a narrow (M1), an “intermediate” (M2) and a broad monetary aggregate (M3). These aggregates differ with regard to the degree of liquidity of the assets they include.[215]

M1 includes currency (i.e. banknotes and coins), as well as balances that can immediately be converted into currency or used for cashless payments, such as overnight deposits. M2 comprises M1 and, in addition, deposits with an agreed maturity of up to two years or redeemable at a period of notice of up to three months. These deposits can be converted into components of narrow money, but some restrictions may apply, such as the need for advance notification, penalties and fees. M3 comprises M2 and certain marketable instruments issued by the resident MFI sector. These marketable instruments are repurchase agreements, money market fund shares/units and debt securities with a maturity of up to two years (including money market paper). A high degree of liquidity makes these instruments close substitutes for deposits.

It is easy to see that broader monetary aggregates (i.e. aggregates that include various assets) are less affected by substitution effects between those asset categories than narrower definitions of money and, hence, are more stable. This can be illustrated in the table below:

Definition	M1	M2	M3
Currency in circulation	X	X	X
Overnight deposits	X	X	X
Deposits with an agreed maturity of up to 2 years		X	X
Deposits redeemable at notice of up to 3 months		X	X
Repurchase agreements			X
Money market fund (MMF) shares/units and money market paper			X
Debt securities issued with a maturity of up to 2 years			X

Table: Definitions of Euro Area Aggregates
Source: ECB (1999b), p. 35.

Holdings by euro area residents of liquid assets denominated in foreign currencies can be close substitutes for euro-denominated assets. Therefore, the monetary aggregates include such assets if they are held with MFIs located in the euro area.

20.3 THE MONETARY POLICY TRANSMISSION PROCESS

The process by which changes in the central bank's policy interest rates work their way through the economy and, ultimately into prices, is called the "transmission process" of monetary policy. While in earlier times, some economists have referred to this process as a "black box", over the recent decades, economic research has made enormous efforts to explore in more detail the various channels through which monetary policy actions affect aggregate demand and prices. This notwithstanding, the process remains complex and there is some uncertainty left about the timing and the relative importance of specific linkages. In today's literature, it is widely agreed that some of these channels warrant particular attention. Among the latter, quite often, an interest rate channel, an exchange rate channel, some asset price channels, a credit channel and an expectations channel can be found.[216] While the relative importance of the individual channels might vary over time and according to the economic situation, these transmission channels jointly influence the overall level of demand for goods and services.

The so-called "interest rate channel" probably represents the main transmission channel of monetary policy and it postulates that an expansion of the money supply (or, equivalently, a reduction in the key interest rate of the central bank) sets in motion similar changes in a variety of other interest rates, such as, for instance, bank's lending and deposit rates (and, therefore also in mortgage rates, rates for consumer loans and for deposits at financial institutions).[217] A decline in those rates then reduces both the cost of borrowing and the money paid on interest-bearing deposits, which tends to encourage borrowing, spending and investing, and to discourage saving. The opposite happens when interest rates rise. It is important to note that the fact that prices are sticky (at least in the short run) leads to a decline in real interest rates, to which firms and consumers respond by adjusting their investment and spending patterns.[218]

While the direction and pace of changes in market interest rates are almost always influenced by changes in the central bank's policy rate, it is important to note that there is usually not a one-to-one correspondence. This is due to the fact that lending rates are also influenced by market forces, the degree of competition among lenders in given markets, and the perceived credit-worthiness of borrowers.

☑ Interest Rate Pass-Through in the Euro Area – Empirical Results

There are a number of empirical studies that investigate the interest rate pass-through in the euro area. When applying rather sophisticated methods, it is generally found that the pass-through from official interest to market interest rates is complete for (money) market interest rates up to three months, but not for market interest rates with longer maturities. As regards the time profile, the immediate pass-through of changes in market interest rates to bank deposit and lending rates is found to be at most 50%, whereas the final pass-through is typically found to be close to 100%, in particular for lending rates.

Source: De Bondt (2005).

The second channel mentioned in the literature is often labelled as the so-called "exchange rate channel". In essence, it describes the effect of an expansionary monetary policy (that is mirrored in changes in (real) interest rates) on the exchange rate.[219] In general, a decline in euro area interest rates relative to the rates in other countries makes euro-denominated assets less attractive to foreign (and domestic) investors, which can lower the demand for (and, thus, the value of) the euro vis-à-vis other currencies. As a consequence, the depreciation of the euro makes many imported goods (and often euro area goods that compete with them) more expensive over time, and makes many euro area products cheaper in foreign markets, typically boosting the demand for them and, hence, aggregate output.

The third channel for the transmission of monetary policy, the so-called "wealth channel" (or, alternatively, "asset price channel") in essence postulates that changes in interest rates also have an effect on the prices of various assets such as bonds, stocks, and real estate. A decrease in interest rates, for example, can spur the prices of these assets, thus increasing household wealth, which in turn may encourage borrowing and spending. There are different types of transmission channels involving asset prices mentioned in the literature, among them Modigliani's life cycle model (stating that consumption is determined by the lifetime resources of consumers[220]), Tobin's Q theory (stating that the ratio of the market price of firms and replacement cost of capital, the so-called "Q", will play a role for the investment decisions of firms[221]) and, more generally, the effects that an increase in stock and real estate prices will have on corporate and household balance sheets and, hence, on their net worth that serves as collateral for lending to companies and households. This, in turn, tends to increase lending, investment spending and, hence, higher aggregate spending.

☑ Moral Hazard and Adverse Selection

The term "moral hazard" in essence describes the behaviour of an individual willing to take more risks because the costs will not be borne by the individual itself, but by others. This could, for instance, be the case, when a car owner decides to drive more aggressively, knowing that the insurance will cover for possible damages. Similarly, at the macroeconomic level, it could well happen that banks take more risk assuming that they are "too big to fail" and will, eventually, be saved by the government.[222]

The terms "adverse selection" or "negative selection" basically derive from the insurance business, where it describes the situation of a bad outcome, which is in essence due to asymmetric information. The US-economist G. Akerlof has demonstrated this, using the example of the market for used cars.[223] In principle, there are good used cars ("cherries") and bad used cars ("lemons"). While the seller is fully informed about the quality of his car, the buyer cannot know beforehand, whether he is confronted with a cherry or a lemon. The buyer will, therefore, have the best guess that this is a car of average quality and this will form the basis of his bidding behaviour. This, in turn, implies that the owners of good used cars will never be able to get a fair price and will, therefore, withdraw from offering their cars at this market, hence causing an overall reduction in the average quality of the cars offered for sale. As a matter of fact, buyers will revise downward their expectations, implying that the owners of moderately good cars will also withdraw. At the end of the day, only the lemons remain on offer.

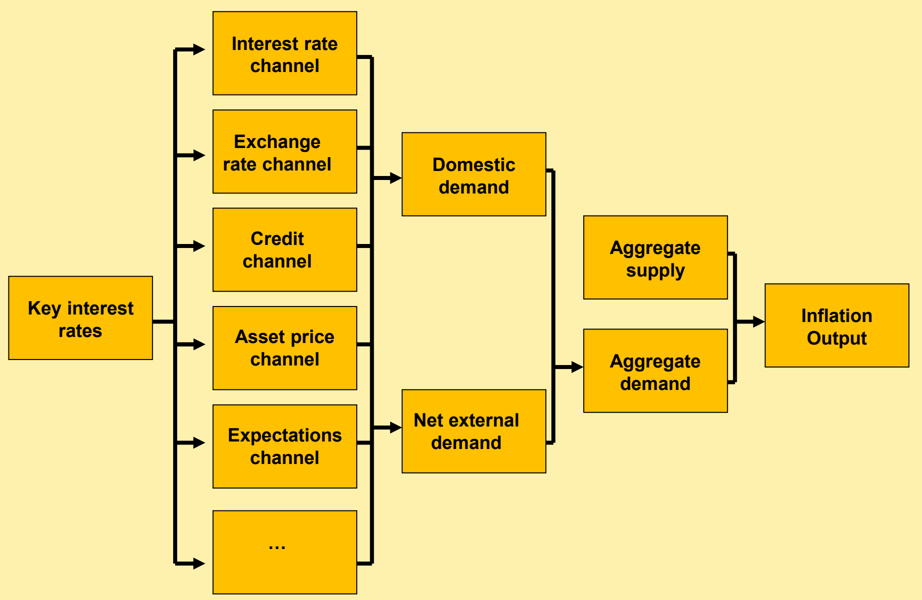
Source: Akerlof (1970), Stiglitz and Weiss (1981).

Another monetary policy transmission channel, the so-called "credit channel" has accentuated the role of asymmetric information in financial markets. The credit channel embodies in essence two different variants.[224] In the context of the so-called "bank lending channel", the expansionary central banks' monetary policy actions increase commercial banks' deposits and, hence, allow for an expansion in the amount of loans. The latter expansion in loans will then cause investment and consumer spending to rise, contributing to an acceleration of growth and, possibly, inflation. By contrast, the so-called "balance sheet channel" arises from asymmetric information in credit markets. In these markets, the basic problem consists of the fact that firms with a lower net worth have less collateral to offer and, therefore, losses resulting from adverse selection tend to be more severe. At the same time, the lower net worth also might give rise to moral hazard problems, since owners might be tempted to engage into riskier projects. Since the engagement in riskier projects might increase the probability of the lender to default, a decline in net worth might lead to a decline in lending and, hence, in investment spending. An expansionary monetary policy might then be followed by a rise in equity prices and, therefore, in net worth. This, in turn, leads to more collateral available for loans and, together with the accompanying improvement in the cash flow situation, the banks' potential losses from adverse selection and moral hazard tend to shrink.

The fifth channel is the effect of changes in interest rates on people's expectations of future interest rates, growth, and inflation. These expectations often affect decisions of firms and households about current saving and investment choices, and they affect wages, the prices of goods and services, and asset prices. If, for example, an expansionary monetary policy would be carried out and, consequently, inflation were expected to rise in the future, longer-term interest rates would typically rise to reflect this expectation (i.e. the so-called Fisher effect).[225]

Finally, in the context of the so-called "risk-taking channel", substantial swings in financial intermediaries' and investors' risk perceptions can, at times, threaten normal access to credit for the purpose of financing entrepreneurial activity in the economy.[226] Taken together, it follows for the monetary policy transmission:[227]

Figure 20.1: Transmission Process of Monetary Policy



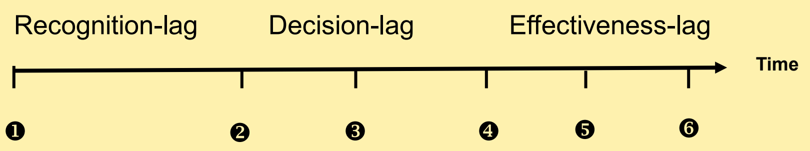
This admittedly quite simple overview already shows that the transmission process of monetary policy must be regarded as a very complex phenomenon. While it does not constitute a "black box" anymore, economists are still far away from a complete understanding. At the same time, it is clear that no "automatisms" are at work. Sometimes, channels have amplified effects and, on other occasions, channels are "blocked", depending on the general state of the economy, the concrete situation in some important sectors, the global environment and many things more.

20.4 TIME LAGS OF MONETARY POLICY

Notwithstanding the complexity of the monetary policy transmission process and the variety of variables involved, it is worth noting that all channels share one common characteristic, namely the fact that the effects of monetary policy actions need time to fully materialise. Expressed in other words, the time-lags between the emergence of an economic problem and the full impact of the respective policy measure can be quite substantial.

In this respect, the economic literature often distinguishes an “inside-lag” (comprising a “recognition-lag” and a “decision-lag”) and an “outside-lag” (including an “effectiveness-lag”).[228] These key concepts are illustrated in a schematic way in the chart below.

Figure 20.2: Time-Lags of Monetary Policy



❶ Unwarranted development
❷ Development reflected in the data
❸ Decision taken by the central bank
❹ Measures are set into force by central bank
❺ Effect within the banking sector
❻ Effect within the non-banking sector

The expression "inside-lag" in essence mirrors the time span it takes between the emergence of a problematic development and the introduction of the corrective action by monetary policy-makers. In this context, the "recognition-lag" covers for the fact that, before a policy action can be taken, the existence of the problem must be properly ascertained within the data. In this respect, it is worth noting that economic data often become available only with a lag. For instance, while exchange rates are basically available on the spot (that is "in real time"), data on inflation or money are generally available one month later and GDP data are usually reported with a lag of one quarter and, sometimes, even more. Once the data have been collected, in a subsequent step, a careful analysis and evaluation (including quality and reliability checks) needs to be carried out in order to ensure the unsatisfying outcome does not represent just a mere statistical reporting error, but in fact points towards the emergence of an actual problem.

Once the policy-makers have identified the problem, they need to take a decision on suitable policy measures. Such a decision could easily take days, weeks or months, especially in case governments and parliaments have to be involved. Moreover, after a suitable course of action has been selected and negotiated, appropriate steps towards an implementation of that policy need to be taken. Such a time-consuming procedure is clearly not the case for central banks for two reasons. First and foremost, in modern times their decision-making bodies will be able to hold a conference (or, if needed, a teleconference) at very short notice. Second, the implementation of the measures can be set into force rather quickly, if not (more or less) instantaneously. Therefore, different from fiscal policy, a considerable "decision-lag" may not arise for monetary policy.

This stands in stark contrast to the length foreseen for the "outside-lag" (i.e. the time span it takes after a policy action is selected and implemented up to the point, where the impact is fully felt in the economy). In fact, the effectiveness-lag can easily take from six months up to two years for a monetary policy action to have its full impact reflected in the economy.[229]

Taken together, it can be concluded that monetary policy does encounter substantial time lags. While the decision lag and the implementation lag are probably relatively short for a central bank, the effectiveness lag seems to be considerably longer. Moreover, these lags must be seen as "long and variable", as they tend to vary – among other things – with the business cycle, the state of the economy, the general sentiment and many things more.[230]

The existence of long and variable lags in the process of monetary policy transmission bears important and far-reaching implications for the actual conduct of monetary policy by central banks as it basically implies the obligation for central banks to act in a completely forward-looking manner. This, in turn, demands from central bankers to take action even when no problems can be detected in the data. As a consequence, such a behaviour might lead to the fact that central bankers are accused of "fighting chimaera". This, however, cannot be avoided in the practice of central banking since if central bankers wait until the problem materialises in the data, it is too late to keep the situation under control. In a nutshell, the central bank has to remain continuously vigilant and to anticipate developments in order to take the appropriate measures at the right time. It goes without saying that this task is further complicated by the existence of considerable real life uncertainties.[231]

20.5 RULES AND DISCRETION IN MONETARY POLICY

What is then the "best policy" in light of the aforementioned observations? It is fair to say that, even at this point in time, there is no universal, agreed view on this issue. Traditionally, economists have often been grouped into two categories, namely into "Keynesians" and into "monetarists".

Keynesians have traditionally advocated a more activist and discretionary monetary policy. Their views are based on a number of key assumptions.[232] First and foremost, the private sector is inherently unstable and the self-correcting forces in the economy tend to be weak and slow, thus surrendering the economy to wide cyclical fluctuations. Against this background, monetary and fiscal policy can be of use in stabilizing the economy and achieving better outcomes. Second, while indeed a number of transmission channels are at work, the interest rate channel and the exchange rate channel are among the most important ones. Third, more generally, the level of knowledge in economic theory and policy as well as in empirical techniques is sufficient to render active policies successful.

What is the concrete policy advice advocated by Keynesian economists for monetary policy? In essence, the central bank should stand ready to intervene actively in case of need. More generally, money supply (or, to be more precise, its rate of growth) should be increased during recessions and increased during boom and inflationary periods.

By contrast, another group of economists (among them the well-known US-economist Milton Friedman) held the view that the best approach in monetary policy is to follow a "rule-like behaviour", such as, for instance, to let money supply grow at a constant rate. Advocates of this kind of policy have often been called "monetarists". Monetarists have also based their argumentation on a number of key assumptions. First, the private sector is inherently stable and, therefore, in a position to deal with shocks and return to equilibrium on its own afterwards. Second, the transmission of monetary policy works through a variety of channels and with "long and variable lags", so that considerable uncertainty is the rule rather than the exception. In the extreme case, it cannot be safely excluded that monetary policy materialises in an ill-timed manner. Third, notwithstanding the official independence of central banks, politicians will always try to exert an influence on monetary policy-makers and to use the powerful instrument of monetary policy for their own purposes.[233]

What is the concrete policy advice advocated by monetarist economists? In essence, the central bank should follow a rule. For instance, it could follow the so-called "Friedman rule" which suggests to let money grow at a constant rate, regardless of the rate of inflation and unemployment prevailing in the economy.[234] In this context, the increase in money is derived from the rate growth of potential output in the economy. While several other variants for monetary rules exist, it is fair to say that the Friedman rule has received most attention.[235]

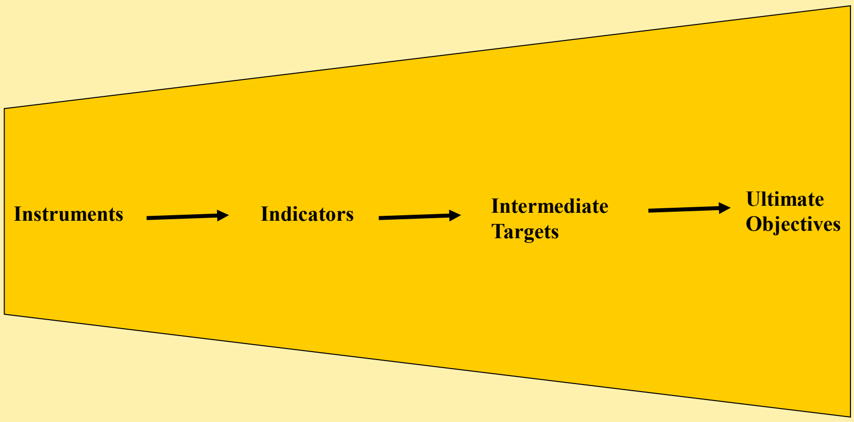
Another reason to advocate monetary policy rules came from another strand of the literature and was based on the existence of the so-called "time inconsistency problem".[236] This phenomenon basically refers to the observation that policy-makers always face an incentive to change their policies once they have announced it and markets have reacted accordingly. For instance, suppose a central bank announces a stability-oriented monetary policy and, assuming credibility of the monetary authority, the private sector reacts by agreeing on low wage increases. Immediately after that, the central bank could boost monetary growth and, thus, stimulate the economy. Given the people know about this temptation, they will be less willing to embark on low wage increases. One way to break this vicious circle is to tie the central bank's hand with a rule, thus eliminating any possibility to surprise the markets with discretionary actions.

This, however, is not the only viable solution. In an influential article, the US economist Kenneth Rogoff came up with a very intuitive idea. In essence, he proposed the delegation of monetary policy to a central banker who is more risk averse to inflation than the government (a so-called "conservative central banker").[237] A few years later, the US economist Carl Walsh took up the issue and suggested that the government should design the central banker's remuneration in a way that makes it contingent upon realized inflation (i.e. a so-called inflation contract").[238]

20.6 THE CONDUCT OF MONETARY POLICY

Notwithstanding this fundamental decision about the right balance between rules and discretion to be struck, some more strategic decisions warrant the attention of the monetary policy-makers. The underlying problem arises from the observation that the ultimate objectives of monetary policy, that are often laid down in more detail in the mandate of central banks, are not under direct control of the central bank. Moreover, as we saw in earlier sections in more detail, the process of monetary policy transmission takes time, is subject to long and variable lags and, moreover, to considerable uncertainties (as illustrated in the chart below by means of the widening confidence interval).

Figure 20.3: Instruments, Intermediate Targets and Indicators



The fact that monetary policy actions can take a significant amount of time to work their way through the system has led most central banks to search for and to finally find an alternative solution. If a variable can be found that, first, has a close relationship (or, technically speaking, a high correlation[239]) with the ultimate objective of monetary policy, second, can be controlled by the central bank with a sufficient degree of precision, and, third, can be more easily observed at an earlier stage of the process, the central bank could base its monetary policy actions towards the behaviour of this so-called "intermediate target", thus saving valuable time.[240]

However, even these intermediate targets cannot be directly influenced by the central banks instruments. In fact, the instruments affect the intermediate target variables through another set of variables called "monetary indicators". The latter are generally used to assess the direction and strength of the monetary policy stance and, therefore, they are of considerable help for the decision-makers in central banks. Among the latter, especially the monetary base and various types of interest rates have proven to be very popular.[241] Seen from a time perspective, intermediate target and indicator variables are to be found between the ultimate objectives and the instrument variables (or "tools").

☑ Key Variables for Monetary Policy

Ultimate Objectives (or "Goals")
Price stability, economic growth, high employment, stability of financial system, (…).

Intermediate Targets
Monetary aggregates, exchange rates, inflation forecast, credit, (…).

Indicators (or "Operational Targets")
Monetary base (or high-powered money), short-run interest rates (overnight rate, EONIA), (…).

Instruments (or "Tools")
Open market operations, reserve requirements, key central bank interest rates, (…).

It is worth noting that the large number of objectives listed below does not necessarily imply that all goals are of equal relevance for all central banks. In reality, different goals have received different weights in different countries, times and regimes. Moreover, not all objectives may necessarily be compatible with each other. For instance, the objective of price stability may eventually conflict with the goals of high employment in the short run, while this may clearly not hold for longer horizons.

Taken together, these deliberations may very well explain why a central bank is not in a position to fight against an unsatisfactory development (for instance in form of a high inflation rate) in the same month. In fact, there is nothing that a central bank can do against an unsatisfactory development in today's inflation – it will simply be too late. The central bank can only influence future inflation rates.[242]

20.7 MONETARY POLICY STRATEGIES

The deliberations on the conduct of monetary policy also provide us with an ideal starting point for a closer investigation of some monetary policy strategies. In this context, the expression "monetary policy strategy" of the central bank is often used to describe the more medium-term procedure selected by a central bank to ensure the achievement of its final objectives via the appropriate use of the available monetary policy instruments.[243] The strategies commonly referred to in the literature are exchange rate targeting, monetary targeting, and inflation targeting, but, more recently, also price level targeting and nominal GDP targeting.[244]

Exchange rate targeting is a strategy that has successfully been followed by many countries that have (in one way or another) been subject to some kind of exchange rate constraints. In practice, this strategy involves fixing a currency in relation to another currency (or a basket of currencies) where, in principle, the concrete arrangement can take many forms, such as, for instance, the establishment of a fixed exchange rate regime or of a crawling target (or peg), in which the currency is foreseen to depreciate at a steady rate.

A strategy of exchange rate targeting can indeed claim a number of advantages. From a general perspective, this can be expected to facilitate trade and investment between the two countries and, thereby, to prove especially useful for small open economies (the so-called "SMOPECs"), where external trade forms a large part of their GDP. At the same time, the strategy can also be used as a device for controlling inflation since, among other reasons, the stabilisation of the exchange rate allows for a stabilisation of the overall price level (via the stabilisation of the prices of imported goods). As a consequence, those countries can import the price stability of the "anchor country" and, thus, gain credibility and an anchoring of inflation expectations to the ones of the anchor country. Finally, it is a very simple and easy-to-understand strategy.

This notwitstanding, it is worth noting that this strategy does not only embody a complete loss of control over domestic monetary policy, but it also implies that instabilities in the anchor country are imported, thus leading to a higher volatility in output and prices.

Moreover, such an exchange rate target might – under certain circumstances – also be tested by the markets and, therefore, trigger speculative attacks.[245]

A second strategy that has in the past been very popular is monetary targeting. In fact, monetary targeting can be seen as one of the traditional strategies of monetary policy. It basically involves the control of the ultimate objective (i.e. inflation) by use of pre-announced intermediate targets for the growth rates of a specific monetary aggregate. Such a strategy rests in essence on three conditions. First, there must be a close relationship (i.e. in a technical sense, a high correlation) between money and prices. Second, monetary developments must – in some sense – be controllable by the central bank. Third, the strategy must be combined with more or less flexible exchange rates, since otherwise, the danger exists that the central bank loses control over the process of money creation. It is obvious that, if just one of the aforementioned conditions is not fulfilled, then either the monetary signal is blurred or the control of the central bank over monetary developments gets lost.

The charme of monetary targeting lies in its theoretical foundations and the fact that it allows the central bank to cope predominantly with domestic considerations in its monetary policy decision-making process. Other advantages refer to the central bank's ability to immediately signal the monetary policy stance and, thereby, to pin down inflation expectations and to stress the accountability of central banks. At the same time, it is fair to say that the monetary targeting implemented by central banks in practice has never been similar to the one advocated at the time by the famous US-economist and nobel prize winner Milton Friedman, who had argued heavily in favour of a constant growth rate of money, irrespective of the state of the economy. In reality, central banks have always used a more flexible version of monetary targeting or, in other words, relied on a kind of "pragmatic monetarism".[246]

A major shortcoming of monetary targeting is that – at least in its simplest variant – its success depends to a significant extent on a predictable and reliable relationship between nominal income and base money, as expressed by income velocity. If the relationship weakens, monetary targeting would cease to work properly.[247]

Inflation targeting (or, alternatively, inflation forecast targeting) is a relatively new and quite popular approach in central banking. Although it is sometimes reported in a different way in the literature, it was originally rather a compromise solution rather than a theoretically superior solution. In essence, this approach focuses on the developments of the inflation forecasts in relation to a publicly pre-announced medium-term numerical inflation target. A higher-than-foreseen inflation forecast would then lead to an increase in central bank interest rates and vice versa. The forecasts, thus, play a decisive role in policy-making as well as in the communication of the central bank.[248]

The advantages of inflation targeting are obvious. The strategy works even if the basic stable relationship between money and prices is blurred and it, nevertheless, allows to concentrate on domestic conditions (different from exchange rate targeting). It is also an easy-to-understand and easy-to-communicate strategy. Moreover, it helps to focus the political debate on what a central bank can do on a sustainable basis (i.e. to control inflation), rather on than what it cannot do (i.e. to raise output growth, lower unemployment, or increase external competitiveness). It is also claimed that, under this framework, investors know the target inflation rate and, therefore, can more easily anticipate interest rate changes and factor these into their investment decisions. Proponents of inflation targeting regard this concept as being conducive to increased economic stability.

At the same time, some disadvantages have to be mentioned. The implementation of a regime of inflation targeting places a high burden on communication and transparency. It is also obvious that inflation targeting is not a "silver bullet" in the sense that it does not automatically guarantee success. The latter is due to the fact that monetary policy lags are by their very nature long, variable and uncertain. Therefore, the success of this strategy critically hinges on the quality of the inflation forecasts.

☑ Inflation Targeting Countries and Year of Introduction

New Zealand (1990), Canada (1991), United Kingdom (1992), Sweden (1993), Finland (1993), Australia (1993), Spain (1995), Czech Republic (1997), Israel (1997), Poland (1998), Brazil (1999), Chile (1999), Colombia (1999), South Africa (2000), Thailand (2000), Corea (2001), Mexico (2001), Iceland (2001), Norway (2001), Hungary (2001), Peru (2002), Philippines (2002), Guatemala (2005), Slovakia (2005), Indonesia (2005), Romania (2005), Turkey (2006), Serbia (2006) and Ghana (2007).

Source: Roger (2009).

The strategy of price level targeting is very close to the one of inflation targeting in the sense that they both establish targets for a specific price index (such as, for instance, the CPI), with the crucial difference consisting of the fact that in the latter case, the central bank focuses on the rate of change in prices, whereas in the former case, the central bank makes an attempt to target the price level. To illustrate this point, suppose a government would increase the value-added tax (VAT) and this increase would feed through into an increase in the general price level by 2% (raising the price level from a theoretical base of 100 to 102). This will eventually cause a jump in the inflation rate in a particular month but afterwards, the inflation rate might remain stable again. Against this background, an inflation-targeting central bank might be tempted to ignore the one-off jump and, then, concentrate on maintaining a stable inflation rate afterwards. The same would, however, not hold for a central bank adhering to price level targeting, since the latter would need to take vigorous action in order to restore the original price level by making it decline again to the target level (of 100).[249] It can be expected that this could imply more forceful action to be taken than required in the case of an inflation targeting. In line with this, price level targeting is generally considered as a policy stance that would create more variability in inflation and employment in the short run (as compared to inflation targeting). Therefore, a strategy of price level targeting is in fact a very ambitious strategy that has so far not been followed by any central bank in practice.[250]

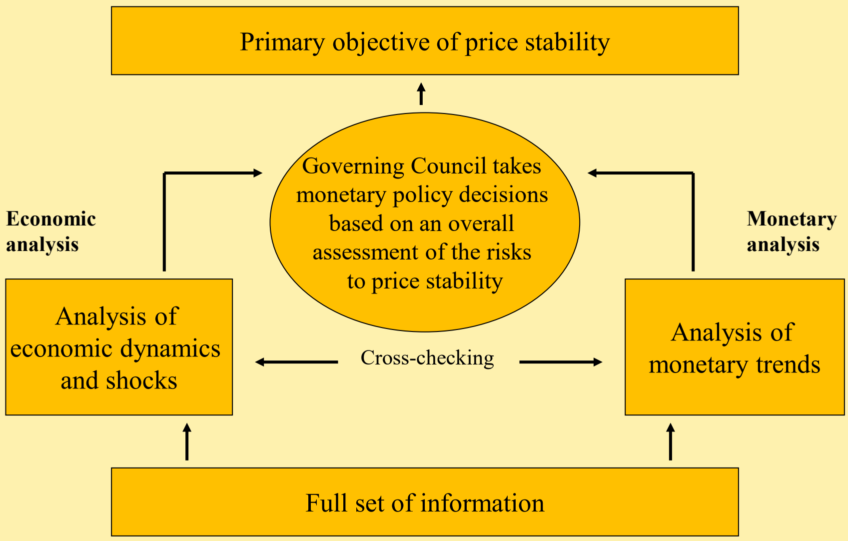
As the name suggests, in a framework of nominal GDP targeting, central banks aim at targeting a certain level or growth rate of nominal GDP (defined as the nominal value of all final goods and services produced in the economy within one year).[251] The basic idea behind this concept is that it can help to stabilize output fluctuations (i.e. to smooth the business cycle). Suppose for instance, the central bank sets a target for growth of nominal GDP (say 4%), which could be evaluated on the basis of 2% growth in real GDP and another 2% for the target inflation rate. If real GDP growth is below potential (say, by just 1%), the central bank is supposed to carry out expansionary monetary policy measures in order to achieve an inflation rate of 3% (and, thereby, the target of 4% for nominal GDP growth). Under normal circumstances, the expansionary monetary policy stance will boost the economy and, finally, move it back to the potential growth path, thus stabilizing output fluctuations. By contrast, if the economy is above its potential and is overheated (say real GDP grows by 3%), there are inflationary pressures. In this case the central bank should follow a restrictive monetary policy stance and try to lower the inflation rate to 1% (in order to hit 4% target of nominal GDP growth). Taken together, during expansions the central bank carries out a contractionary monetary policy and during recessions, the central bank conducts an expansionary policy. This should stabilize output fluctuations and render business cycle swings less severe.[252] It is worth noting that a strategy of GDP targeting does not rely on a money-inflation nexus and, at the same time, by construction it also allows for the central bank to be equipped with a dual mandate.

This notwithstanding, in the literature, there have been some arguments against such a nominal income targeting procedure.[253] To begin with, by contrast to inflation targeting which seems to offer a sufficient degree of flexibility, a strategy of nominal income targeting does not offer many "escape clauses". Second, it is claimed that the concept of inflation is better understood by the public than the concept of nominal GDP. Third, it is argued that inflation targeting is preferable, because data on prices are obtained more frequently than nominal GDP data. Finally, some economists have mentioned a general lack of transparency as a major drawback of such a policy, which leaves the market guessing quite often on the monetary policy course.

20.8 THE MONETARY POLICY STRATEGY OF THE ECB

Notwithstanding the fact that the ECB's monetary policy strategy embodies a number of the key elements of the literature on monetary policy strategies, it is in a way unique as it does not follow any of these strategies.[254] In essence, the ECB's assessment of the risks to price stability rests on two complementary analytical perspectives, commonly referred to as the two "pillars".[255]

Figure 20.5: The ECB's Monetary Policy Strategy



Source: ECB (1999, modified 2003).

In this context, the first perspective tries to identify the short-term to medium-term determinants of price developments, with a specific focus on real activity and financial conditions in the economy. This is rooted in the basic insight that price developments over those horizons are influenced largely by the interplay of supply and demand in the goods, services and factor markets. Accordingly, the ECB has labelled this perspective as the "economic analysis".[256]

By contrast, the second perspective aims at identifying the possible risks to price stability over medium-term to longer-term horizons. This pillar is generally referred to as the "monetary analysis" since, by its very nature, it tries to reveal the signals that can be disclosed from the long-run relationship between money and prices. In the interpretation of the ECB, this serves mainly as a means of cross-checking, from a medium to long-term perspective, the short to medium-term indications for monetary policy coming from the economic analysis.

It goes without saying that the choice of the ECB's monetary policy strategy needs to be seen against its specific background.[257] Given the fact that, in the beginning of its term, the ECB was confronted with a considerable degree of uncertainty and a number of practical problems, it had to adopt a new and distinct monetary policy strategy of its own; a strategy that was designed to ensure that all relevant information is used and that appropriate attention is paid to different perspectives and the cross-checking of information.[258]

☑ A Look into the Introductory Statement of 20 July 2017

Ladies and gentlemen, the Vice-President and I are very pleased to welcome you to our press conference. We will now report on the outcome of today's meeting of the Governing Council, which was also attended by the Commission Vice-President, Mr Dombrovskis.

Based on our regular economic and monetary analyses, we decided to keep the key ECB interest rates unchanged.

[…]

Let me now explain our assessment in greater detail, starting with the economic analysis. Euro area real GDP increased by 0.6%, quarter on quarter, in the first quarter of 2017, after 0.5% in the last quarter of 2016. Incoming data, notably survey results, continue to point to solid, broad-based growth in the period ahead. The pass-through of our monetary policy measures is supporting domestic demand and has facilitated the deleveraging process. The recovery in investment continues to benefit from very favourable financing conditions and improvements in corporate profitability. Private consumption is supported by employment gains, which are also benefiting from past labour market reforms, and by increasing household wealth. Moreover, the global recovery should increasingly lend support to trade and euro area exports. However, economic growth prospects continue to be dampened by a slow pace of implementation of structural reforms, particularly in product markets, and by remaining balance sheet adjustment needs in a number of sectors, notwithstanding ongoing improvements.

The risks surrounding the euro area growth outlook are broadly balanced. On the one hand, the current positive cyclical momentum increases the chances of a stronger than expected economic upswing. On the other hand, downside risks primarily relating to global factors continue to exist.

Euro area annual HICP inflation was 1.3% in June, down slightly from 1.4% in May, mainly due to lower energy price inflation. Looking ahead, on the basis of current futures prices for oil, headline inflation is likely to remain around current levels in the coming months. At the same time, measures of underlying inflation remain low and have yet to show convincing signs of a pick-up, as domestic cost pressures, including wage growth, are still subdued. Underlying inflation in the euro area is expected to rise only gradually over the medium term, supported by our monetary policy measures, the continuing economic expansion and the corresponding gradual absorption of economic slack.

Turning to the monetary analysis, broad money (M3) continues to expand at a robust pace, with an annual rate of growth of 5.0% in May 2017, after 4.9% in April. As in previous months, annual growth in M3 was mainly supported by its most liquid components, with the narrow monetary aggregate M1 expanding at an annual rate of 9.3% in May 2017, unchanged from April.

The recovery in the growth of loans to the private sector observed since the beginning of 2014 is proceeding. The annual growth rate of loans to non-financial corporations remained stable at 2.4% in May 2017, while the annual growth rate of loans to households increased to 2.6%, from 2.4% in April. The euro area bank lending survey for the second quarter of 2017 indicates that credit standards for loans to enterprises and loans to households for house purchase have further eased and that loan growth continues to be supported by increasing demand. The pass-through of the monetary policy measures put in place since June 2014 continues to significantly support borrowing conditions for firms and households and credit flows across the euro area.

To sum up, a cross-check of the outcome of the economic analysis with the signals coming from the monetary analysis confirmed the need for a continued very substantial degree of monetary accommodation to secure a sustained return of inflation rates towards levels that are below, but close to, 2%.

[…]

We are now at your disposal for questions.

Source: http//www.ecb.int.

20.9 A FIRST LOOK AT THE DATA

For various reasons, it is also worth looking in more detail at the relative shares of the various components in M3. This is shown in the table below for the end of the year 2016.

Component	Share
Currency in circulation	9.4%
Overnight deposits	53.8%
Deposits with an agreed maturity of up to 2 years	11.6%

Component	Share
Deposits redeemable at notice of up to 3 months	19.1%
Repurchase agreements	0.6%
Money market fund (MMF) shares/units and money market paper	4.6%
Debt securities issued with a maturity of up to 2 years	0.8%

Table: Percentage shares of components of M3
Source: own calculations, ECB data, end-2016, figures rounded.

First, the figures demonstrate in a quite impressive way that, in modern economies, relatively little of the stock of broad money is in physical currency. For example, in the end of 2016, only around nine percent of the broad monetary aggregate M3 consisted of currency in circulation (i.e. banknotes and coins). At the same time, it is obvious that overnight deposits as well as the two categories of deposits represent the major share of the stock in M3. This underlines the importance of having these instruments included in a well-defined and realistic definition of monetary liquidity.

At the same time, a closer look at some descriptive measures for the (annual) growth rates of the various monetary aggregates reveals that the pattern seems to be rather volatile. As regards the annual growth rate of M1, the mean and standard deviation over the historical period spanning more than three decades are 7.05% and 2.52%, repectively.

By contrast, the corresponding figures for M2 are 5.92% (with a standard deviation of 2.19%) and 6.13% (with a standard deviation of 2.69%) for M3. The maximum of the three series can be found for M1 with a value of 12.4%, whereas the minimum is observed for M3 with -0.15%. As will be shown in later sections in more detail, M3 and M2 tend to follow quite similar patterns, while M1 seems to behave quite differently over protracted periods.

20.10 A SECOND LOOK AT THE DATA

We continue the empirical section by having a closer look at some key features of the monetary transmission mechanism in the euro area. In this context, Vector Autoregressive Models ("VAR models") have become very popular in empirical economics.[259]

In such a framework, monetary policy effects have often been described in terms of reactions of the other variables in the system to an unexpected rise (i.e. a "shock") in short-term interest rates.[260] The resulting dynamic response patterns of the reactions of these other variables to a shock are then often illustrated in terms of the so-called "impulse response functions".[261] In economic terms, these impulse response functions then describe how a change in monetary policy affects other macroeconomic variables, other things equal.

In case of the model propagated by Peersman and Smets (2003), the underlying system includes as key variables the euro area HICP, real GDP, nominal M3 and a short-term nominal interest rate. In addition, a linear trend, a commodity price index and an oil price index were used as exogenous explanatory variables.[262] Since the focus of this approach is on the long-run relationships between the variables, the VAR is estimated in levels and solved for its dynamic responses. As is quite common in the literature, the three-month interest rate is chosen as the policy variable.

☑ VAR-Models for the Monetary Transmission Mechanism

The general representation of a VAR-Model can be written as follows:

(i) $Y_t = A + BY_{t\text{-}1} + C(L)X_t + \varepsilon_t$

where Y_t is a vector of several (euro area) variables measured over the same sample period (t = 1, .., T), A is a vector of absolute terms, B is a vector of autoregressive coefficients, C is a vector of exogenous variables and ε is a vector of error terms. The vector X is included to allow for a contemporaneous influence of exogenous variables such as, for instance, oil prices. This specification implicitly assumes that there is no feedback from the domestic variables to the exogenous variables. In line with these considerations, a standard VAR widely used in the literature would read as follows:

(ii) $Y_t = A + BY_{t\text{-}1} + C(L)X_t + \varepsilon_t$

(iii) $Y'_t = [s_t \quad y_t \quad p_t]$

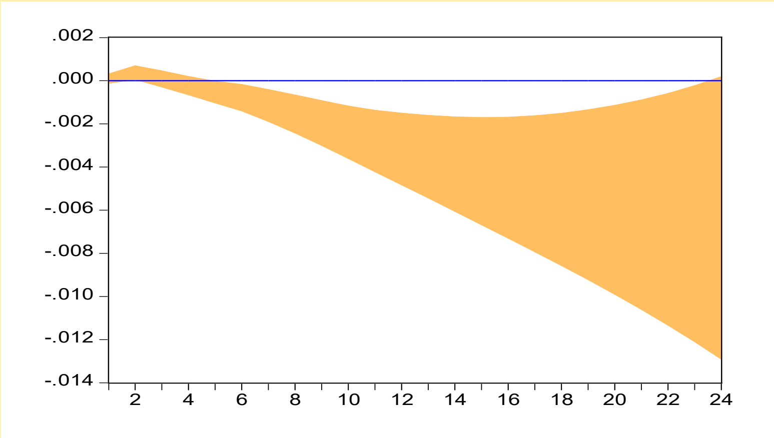
(iv) $X'_t = [oilp_t]$

where s stands for a short-term interest rate, p, y and $oilp$ stand for a consumer price index, real GDP and the oil price, respectively. The small letters – with the exception of the interest rate – would denote logarithms.

Source: Peersman and Smets (2003).

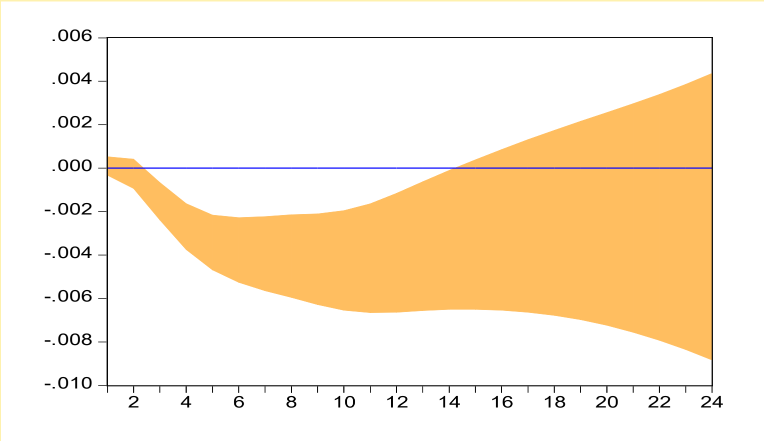
The charts then illustrate the reaction of (euro area) real GDP and the (euro area) HICP in response to a transitory upward movement (i.e. a one-off shock) in the interest rate by 100 basis points and the respective 65% confidence interval.[263] The reactions of the variables included in the system are then shown for a time horizon of 24 quarters.[264] According to the results, the increase in the short-term interest rate leads to an immediate decline in real income, reaching its trough after six quarters.

Figure 20.6: Reaction of Price Level



Source: Own calculations based on Peersman and Smets (2003), reactions shown as percentage deviations from baseline, euro area data.

Figure 20.7 Reaction of Real GDP



Source: Own calculations based on Peersman and Smets (2003), reactions shown as percentage deviations from baseline, euro area data.

After 24 quarters, however, the effect seems to have faded away, pointing towards long-run neutrality of money. Moreover, the rise in the short-term interest rate is followed by a significant decline in decline in the HICP. Taken together, these results are fully in line with theoretical considerations.

20.11 SUMMARY

- The English word "money" is of Roman origin. In ancient Rome, the words "Monetor" or "Moneta" meant an advisor (i.e. a person who warns or who makes people remember). Hence the words "money" and "mint" are derived from the Latin name.
- Money serves as a medium of exchange, as a store of value and as a unit of account.
- The forms of money have changed over time. Among the forms worth mentioning are commodity money, metallic money, paper money and fiat money. Paper money was – and still is – legal tender only by government decree.
- In line with international practice, the Eurosystem has defined a narrow (M1), an "intermediate" (M2) and a broad monetary aggregate (M3). These aggregates differ with regard to the degree of liquidity of the assets they include.
- In today's literature, there is widespread agreememt that a variety of monetary policy transmission channels do exist. Among them are the interest rate channel, the exchange rate channel, some asset price channels, the credit channel and an expectations channel. While the relative importance of the individual channels

might vary over time and according to the economic situation, these transmission channels jointly influence the overall level of demand for goods and services.
- Monetary policy does encounter substantial time lags. While the decision lag and the implementation lag are probably relatively short for a central bank, the effectiveness lag seems to be considerably longer. Moreover, these lags must be seen as "long and variable", as they tend to vary – among other things – with the business cycle, the state of the economy, the general sentiment and many things more.
- Regarding the question of which policy to follow best, economists have been traditionally grouped into two camps, namely "Keynesians" and "monetarists". Keynesians have advocated a more activist and discretionary monetary policy, whereas monetarists have advocated pursuing a more rule-like behaviour.
- Another reason to advocate monetary policy rules is based on the existence of the so-called "time inconsistency problem". This phenomenon basically refers to the observation that policy-makers always face an incentive to change their policies once they have announced it and markets have reacted accordingly. Other proposals to overcome this so-called "inflationary bias" have been suggested by Rogoff and Walsh.

📖 Key Concepts

Money, mint, medium of exchange, store of value, unit of account, commodity money, metallic money, paper money, fiat money, interest rate channel, exchange rate channel, asset price channels, credit channel, expectations channel. inside-lag, outside-lag, recognition-lag, decision-lag, effectiveness-lag, Keynesians, activist policy, monetarists, monetary policy rules, time inconsistency problem, Rogoff's "conservative central banker", inflation contract, exchange rate targeting, monetary targeting, inflation targeting, price level targeting, nominal GDP targeting, instabilities in money demand, Goodhart's Law, Issing's Law.

☑ Questions for Review

- Where does the word "money" come from?
- Which functions can be attributed to money?
- Which forms of money do you know?
- Do you think that another good, say cigarettes, could take over the functions of money?
- Which euro area monetary aggregates do you know? How are they exactly defined?
- Which monetary policy transmission channels do you know?
- Which kind of time lags of monetary policy do you know and what can be said about their length?
- What are the basic assumptions underlying the Keynesian and the monetarist view and how would their corresponding policy advice differ?
- What is the essence of the "time inconsistency problem? What was the essence of the proposals by Rogoff and Walsh?
- Which different monetary policy strategies do you know?

21 CONVENTIONAL AND UNCONVENTIONAL MONETARY POLICY

21.1 LEARNING OBJECTIVES

In this chapter, we aim at shedding more light at the actual stance of monetary policy. We start with a discussion about some key concepts, such as for instance the money multiplier and the Taylor rule, before entering the debate on the zero lower bound and the respective effects. We then proceed by discussing the concept of unconventional monetary policy. Afterwards, we take a deeper look into the measures taken by the European Central Bank and their specific purposes. Finally, we have a closer look at the data.

21.2 THE MONEY MULTIPLIER

In previous sections we have seen that, following international conventions, most central banks define and monitor (at least) a narrow, an intermediate and a broad monetary aggregate. In this context, the different types of money are usually classified as "M"s.

But there is another monetary aggregate that deserves particular attention, namely the so-called "monetary base" (or, alternatively, the "central bank money stock" or "high-powered money"). It consists of currency in circulation (CU) and the reserves held by commercial banks with the central bank (RE). This yields $MB=CU+RE$. Why is the monetary base so important? Its popularity is basically due to the fact that the central bank can almost entirely and directly control this monetary aggregate. In order to illustrate this, let us take a brief look at a simplified and highly stylised balance sheet of a central bank. The latter looks as shown below:

The asset side includes holdings of assets vis-à-vis the foreign sector and the domestic government as well as credit to domestic commercial banks. More particularly, the holdings of foreign assets comprise the central bank's international reserves.

Stylised balance sheet of a central bank

Assets	Liabilities
Claims vis-à-vis the foreign sector	Currency in circulation
Claims vis-à-vis the government	Deposits of domestic banking sector
Credit to the domestic banking sector	Net balance of other assets and other liabilities

The liabilities' side of the balance sheet comprises currency in circulation and deposits of commercial banks.[265] Why do commercial banks hold deposits within the central bank? This is in essence required by law as a number of central banks (among them the ECB) force banks to hold deposits within the central banks in order to (at least partially) back for commercial banks' liabilities. It is easy to see that the first two positions on the liabilities' side together just add up to the monetary base.

Moreover, given that – besides the deposits – the central bank can also determine the amonnt of currency in circulation, it can be concluded that, in principle, the amount of central bank money available to the economy is under close control of the central bank. Should a central bank decide to increase the central bank money stock, it simply lengthens its balance sheet by means of appropriate operations.[266] Seen from an acounting perspective, changes in the monetary base can derive from any kind of change on the asset side.

☑ Multiple Money Creation

How is money created? How much? And by whom? From a monetary policy perspecrtive, these are crucial questions. Indeed, it can be shown that commercial banks are able to create additional money by multiplying the base money created by the central bank through fractional reserve banking. Expressed in other words, through fractional-reserve banking, the modern banking system expands the money supply of a country beyond the amount initially created by the central bank.

Let us look at this phenomenon in more detail. In essence, two types of money can be distinguished in a fractional-reserve banking system, namely, first currency originally issued by the central bank and, second, bank deposits created at commercial banks. When a commercial bank loan is extended, new deposits and, therefore, new commercial bank money is created. Because of this money creation process by the commercial banks, the money supply of a country is usually a multiple larger than the money issued by the central bank. The exact mechanism being at work is typically called the "money multiplier". The size of the multiplier is, among other things, determined by the reserve ratio.

In the process of money creation, two kinds of restrictions have to be taken into account. First, banks are required to hold a certain ratio of their deposits at the central bank. This ratio (rr) is called the reserve ratio. Second, banks face a so-called "cash-holding ratio" (k), which in essence means, that a certain percentage share of bank deposits have to be held in cash in order to prepare for possible cash withdrawals from customers. For didactial reasons, however, we abstract from the existence of the cash-holding ratio for the time being, when illustrating the functioning of such a process by means of a simple example.

Suppose that the process starts with an injection of € 400 of central bank money as a deposit into Bank A. Bank A takes € 80 (i.e. 20%) and sets it aside as reserves. Subsequently, it loans out the remaining € 320 (i.e. 80%) to a customer. In the next step, the loan recipient deposits his € 320 in Bank B. Bank B then sets aside € 64 as reserve and lends out the remaining € 256 to another customer. The latter customer deposits € 256 with Bank C and so on and so forth. It is easy to see that by means of new loans, additional deposits are created at each stage and, since deposits, form part of the monetary definition, the money supply is expanded. But how large is the increase in money supply? It can be shown that, if the reserve ratio is rr, then the money multiplier corresponds to the reciprocal, namely $m = 1/rr$ and it represents the maximum amount of money, commercial banks can create for a given quantity of reserves. Given the fact that the multiplier can be shown to be $m = 1/rr$ for a reserve ratio of $rr=0.2$ (i.e. a reserve ratio of 20%), the multiplier would equal a value of 5. In case, the cash-holding ratio is additionally taken into account, it can be shown that the multiplier changes to $m = 1/(rr-rr\cdot k+k)$. And, if on top of the existing reserve ratio, a cash-holding ratio of 25% (i.e. $k=0.25$) can be assumed, then the multiplier can be shown to equal $m = 1/(0.2-0.2\cdot 0.25+0.25)=2.5$.

But this process only describes the maximum amount of money that an initial deposit can be expanded to with a given reserve ratio. It assumes, for instance, that any kind of loans the commercial banks offer are immediately and to their full extent demanded by the private sector; in reality a quite unrealistic assumption. In order to get a more realistic picture, we have to recur on another model.

What is the exact relationship between the monetary base and the other monetary aggregates? This is a very interesting question, To begin with, let us start by assuming a multiplicative relationship to hold between M1 and the monetary base (*MB*).

$$M1=m\cdot MB \tag{21.2.1}$$

We also know from previous deliberations that the monetary base is defined as the sum of currency (*CU*) and reserves (*RE*):

$$MB=CU+RE \tag{21.2.2}$$

And M1 has been defined as the sum of currency (*CU*) and deposits (*DE*). It thus follows:

$$M1=CU+DE \tag{21.2.3}$$

Let us now assume that banks are required to hold a certain ratio of their deposits at the central bank. This ratio (*rr*) is called the reserve ratio. It then follows:

$$RE = rr \cdot DE \tag{21.2.4}$$

Moreover, most people would like to hold a part of their money in the form of currency. The currency deposit ratio (*k*) measures, how much currency people want to hold as a ratio of their deposits. It then follows:

$$CU = k \cdot DE \tag{21.2.5}$$

Taken together, it follows that:

$$M1 = m \cdot MB \quad \text{or, equivalently,} \tag{21.2.6}$$
$$M1/MB = m \quad \text{or, equivalently} \tag{21.2.7}$$
$$(CU+DE)/(CU+RE) = m \tag{21.2.8}$$

At the same time, it also follows that:

$$M1 = k \cdot DE + DE = (k+1) \cdot DE \quad \text{and} \tag{21.2.9}$$
$$MB = k \cdot DE + rr \cdot DE = (k+rr) \cdot DE \tag{21.2.10}$$

And hence:

$$\frac{\left[(k+1) \cdot DE\right]}{\left[(k+rr) \cdot DE\right]} = \frac{(k+1)}{(k+rr)} = m \tag{21.2.11}$$

The term m is called the "money multiplier". It basically tells us by how much $M1$ exceeds the monetary base. If the reserve ratio and the currency deposit ratio can be regarded as fixed during the process, by controlling the monetary base, the central bank could control $M1$. The money market multiplier equals $1/rr$, if the public holds no currency ($k=0$) and it is equal to 1 if all deposits are held in the form of reserves.

It is easy to see that – from an economic perspective – the money supply process then turns into a two-step procedure. In the first step, the central bank directly controls the amount of base money and by doing this, in a second step, it indirectly influences the broader monetary aggregates.[267] The indirect influence, however, critically hinges on the stability of the two factors determining the multiplier, namely the reserve ratio and the currency deposit ratio. This became obvious in the course of the financial crisis, when banks reacted to the worsened macroeconomic environment by starting to accumulate excess reserves. As could be expected, the prevailing stable link broke down and, therefore, central bank money creation did not translate into commercial bank money creation but, instead, remained in the form of (unlent) excess reserves.

This leads us to another important point. It is worth mentioning, that the approach to control money supply via changes in the monetary base would only work in an accurate way, if the multiplier would prove to be relatively stable. In reality, however, this has not always been the case. Moreover, it has been shown that an alternative to the control of money supply, namely the control of interest rates, might be much more effective.[268] This is due to the fact that in case, money demand proves to be particularly unstable (i.e. subject to erratic shifts), the combination with a given level of money supply will inevitably result in unforeseeable swings in the interest rate (i.e. the price in the money market). If, by contrast, the interest rate is set, the erratic changes in money demand will be reflected in instabilities in money supply behaviour. Should the central bank, however, decide to fully accommodate the latter movements, it might end in a situation of a "de facto" management of interest rates. Under such a policy, interest rates are more or less officially declared and the amount of money, that is demanded, is then exactly supplied to the market. In other words: the central bank is effectively fixing the interest rate for the money market and, thereafter, managing the desired supply through open market operations to ensure that the market price for money is the same as the central bank's desired rate.

21.3 TAYLOR RULES

What are the factors driving the actual monetary policy decisions of central banks? In 1993, the US-economist John B. Taylor advocated a simple monetary policy rule that soon became famous under the heading "Taylor rule". His rule postulated a linear relationship between the short-term interest rate (the key policy instrument of the central bank) and some key macroeconomic determinants. In its simplest version, the rule can be written as follows:[269]

$$i_t = r_t^* + \pi_t^* + \beta \cdot (\pi_t - \pi^*) + \gamma \cdot (y_t - y^*) \qquad (21.3.1)$$

where π_t stands for the inflation rate, π^* represents the desired (or acceptable) rate of inflation and $(y_t - y^*)$ denotes the output gap. Moreover, β and γ mirror the weights assigned to the objectives by the monetary authority.

In essence, this rule links the monetary policy instrument (i.e. the interest rate) to the ultimate objectives of monetary policy, namely the deviation of inflation from its target value and the deviation of output from potential output. More particularly, it recommends a tight monetary policy, when inflation is above its target and output is above its full employment level, and vice versa. Moreover, in case, both inflation and output are at their desired levels, the interest rate should just equal the equilibrium nominal interest rate, which is composed of the equilibrium real rate and equilibrium inflation.

What are the concrete values to be used for the calibration of the correct interest rate level? In his original study, Taylor assumed a real equilibrium rate of 2% and a growth rate for potential output of around 2.2%. As regards the inflation objective, he selected a value of 2%. Finally, the weights were – as a rule of thumb – chosen to be of equal magnitude (i.e. 0.5).

Quite obviously, the Taylor rule has a number of advantages. First, it is simple, easy to understand and intuitively convincing. Moreover, the determinants of central banking behaviour are fully in line with the mandates of most central banks. Third, empirical estimates for a variety of countries tend to give the correct signs and plausible magnitudes. Insofar, the Taylor rule seems to show a rather good empirical "fit". Finally, the rule can – under certain assumptions – shown to be micro-founded.[270]

The standard Taylor rule postulates a linear relationship between the interest rate and its determinants. This must not necessarily be the case although such a form generally is the result of the (assumed) minimisation of a quadratic loss function under restrictions (as shown in the box below). Following more recent studies, the simple Taylor rule can be modified in a way that mirrors the data even better. Consider a standard Taylor rule which, in its very basic form, models a central bank's interest rate (i) as a function of the inflation rate (π), the inflation objective (π^*) and the output gap ($y - y^*$):[271]

$$i_t = \alpha + \beta\left(\pi_t - \pi^*\right) + \gamma(y_t - y^*) \tag{21.3.2}$$

In practice, however, estimations of Taylor rules are carried out by including a smoothing term. This smoothing is introduced in the standard Taylor rule by assuming that the current interest rate is determined by weighting the interest rate target of the Taylor rule and the lagged interest rate according to the following equation:

$$i_t = (1-\rho)\cdot i_t^* + \rho \cdot i_{t-1} + \varepsilon_t \tag{21.3.3}$$

where the target interest rate i^* is derived from eq. (18.3.1) and represents the Taylor rule interest rate. Using some algebra we can derive the Taylor rule with interest rate smoothing, which can be expressed as follows:[272]

$$\begin{aligned} i_t = {} & (1-\rho)\alpha + (1-\rho)\beta(\pi_t - \pi^*) + (1-\rho)\gamma(y_t - y^*) \\ & + \rho i_{t-1} + \varepsilon_t \end{aligned}, \tag{21.3.4}$$

where ρ represents the smoothing parameter.

The inclusion of an interest rate smoothing term is often justified on the basis that central banks appear to adjust interest rates in a gradual fashion, being adverse to large interest rate movements, thus slowly bringing the interest rate towards its desired setting or "target" level.

☑ Deriving A Monetary Policy Reaction Function

The basis for the following considerations can be found in a quadratic loss function (QL). Such a formulation makes perfect sense for two reasons. First and foremost, it can be shown that the quadratic loss function leads to a linear decision rule. Second, such a formulation implies that, while small deviations lead only to small losses, large deviations result in larger losses. This seems to be an absolutely realistic assumption. The loss function can be expressed as follows:

(1) $QL = \alpha \cdot (\pi - \pi^Z)^2 + (1-\alpha) \cdot (i - i^Z)^2$

Where π denotes the inflation rate and *i* the interest rate, respectively. The suffix *Z* stands for the target values of the respective variables and α is a coefficient, which reflects the relative weighting of the central bank. We further assume a linear restriction which, in essence, reflects the reduced form of the macroeconomic model as is assumed to be valid by the central bank:

(ii) $\pi = \beta_0 + \beta_1 \cdot X + \beta_2 \cdot i$

where *X* stands for an exogenous variable. Minimising the loss function under the linear restriction can be done by means of the so-called "Lagrange approach":

(iii) $V = \alpha \cdot (\pi - \pi^Z)^2 + (1-\alpha) \cdot (i - i^Z)^2 + \lambda \cdot (\pi - \beta_0 - \beta_1 \cdot X - \beta_2 \cdot i)$

Minimisation is then equivalent to setting the partial derivatives equal to zero:

(iv) $\delta V / \delta \pi = 2 \cdot \alpha \cdot (\pi - \pi^Z) + \lambda = 0$
(v) $\delta V / \delta i = 2 \cdot (1-\alpha) \cdot (i - i^Z) - \lambda \cdot \beta_2 = 0$
(vi) $\delta V / \delta \lambda = \pi - \beta_0 - \beta_1 \cdot X - \beta_2 \cdot i = 0$

And rearranging the equations and solving for the interest rate (i) yields:

(vii) $i = -\dfrac{\alpha\beta_2}{(1-\alpha)} \cdot (\pi - \pi^Z) + i^Z$

This would imply that the actual interest rate has to be increased if the target interest rate has risen or if deviations of the actual inflation rate from its target value have materialised. It is also worth noting in this context, that the equation contains parameters of the (assumed) macroeconomic model as well as reaction parameters of the central bank. In other words: the identification problem in reduced-form models arises.

Source: Missong and Herrault (1990).

In practice, the high degree of inertia or smoothing in the policy interest rate generally turns out to be quite significant. A number of statistical as well as more fundamental reasons might explain this result. Its inclusion might, for instance, be explained on the basis of an interest rate smoothing behaviour by central banks in their conduct of monetary policy, by data uncertainty or, according to other studies, by the fact that monetary policy inertia is just an illusion and reflects the misspecification of the empirical policy rules which fail to take into account serially-correlated shocks and, instead, display substantial partial adjustment.[273]

Another important point relates to the size of the inflation parameter (β). If the latter is larger than unity, then the rule indicates that an increase in the real interest rate is induced whenever there are observed signs of inflationary pressures, thus exerting a stabilising effect on inflation (this is usually denoted as the so-called "Taylor principle").

A final issue consists of the fact that most authors interpret the Taylor rule as a monetary policy reaction function. It is, however, a well-known fact that this is not the case. The Taylor rule is a so-called "reduced-form" model, which combines preference parameters of the central bank as well as parameters of the underlying macro-model.[274]

☑ Empirical Results for Euro Area Taylor Rules

A number of studies have estimated Taylor rules for the euro area using various samples, frequencies and specifications. Below is a brief overview about some selected results:

Author	α	ρ	β	γ
Peersman and Smets (1999)	3.87	0.76	1.20	0.76
Gerlach and Schnabel (1999)	2.40	(-)	1.58	0.45
Clausen and Hayo (2002)	4.07	0.86	2.15	2.12
Gerdesmeier and Roffia (2005)	1.80	0.87	1.93	0.28
Ullrich (2003)	1.97	0.23	1.25	0.29

where α represents the constant, β denotes the coefficient for the (contemporaneous or foward-looking) inflation rate, γ stands for the output gap coefficient, and ρ for the lagged interest rate parameter.

Note, that in all cases the coefficients show the expected signs and the Taylor principle is fulfilled.

Source: Various studies.[275]

21.4 MONETARY POLICY AND THE ZERO LOWER BOUND

Traditionally, central banks in most countries conduct monetary policy by setting key interest rates. More precisely, they usually set a target for the overnight interest rates in the interbank money market.[276] In the course of the recent financial crisis, however, most central banks approached or even reached the zero lower bound (ZLB) for interest rates, which seriously constrained their ability to carry out further conventional monetary stimulus. Given the fact that additional monetary easing was clearly warranted, most central banks decided to make use of unconventional monetary policy measures.

☑ The Zero Lower Bound for Interest Rates

Where is the Zero Lower Bound (ZLB) for Interest Rates? One way to approach this issue is by use of the relationship linking the nominal and the real interest rate. This yields:

(i) $i = r + \pi$ or, alternatively,
(ii) $r = i - \pi$

where i stands for the nominal interest rate, r for the real rate and π for inflation. Assuming that the nominal interest rate converges to zero but does not decline below that level, it follows that:

(iii) $r = -\pi$

This leads us to conclude that if real interest rates are the ones that matter for aggregate demand, they can be pushed into negative territory (although nominal interest rates normally cannot). But once, nominal interest rates hit the zero lower bound, real rates remain stuck at the negative level of the inflation rate.

Source: Mahajan (2015).

Broadly speaking, the latter measures embraced three main categories. First, they included new (or expanded) credit facilities which in essence aimed at resolving specific market failures. Second, they comprised elements of "forward guidance" on the very low level of policy rates over extended policy horizons. Third, they included large-scale purchases of government securities. These were generally targeted towards a reduction in (longer-term) interest rates and, thereby, towards a stimulation of the real economy. It is worth mentioning at this stage, however, that the terminology is far from being unambiguous in this respect. More particularly, while the FED carried out "large-scale asset purchases" ("LSAP"), the Bank of England selected the expression "quantitative easing" ("QE") for its purchase program. By contrast, the ECB's action is officially termed as "expanded asset purchase program" ("APP").

☑ Shadow Rates

With interest rates stuck at the zero lower bound in many countries, traditional macro-models started to become more and more useless since they showed no meaningful variation, even when economic conditions changed. Consequently, economists started to refer back to the concept of "shadow rates".

The shadow rate is a concept that came up in a finance context first. In fact, it has been advocated by US-economist Fisher Black (1938–1995), one of the co-authors of the well-known Black-Scholes-formula. Given the fact that – from a technical perspective – short-term interest rates cannot turn negative, but from a historical perspective, they have moved into negative territory, Black suggested to interpret interest rates as options. In light of the substantial computational burden associated with it, the concept got forgotten for many years, but was rediscovered in the period following the financial crisis. Since then, economists have started to construct several variations of Black's original work and estimated rates that, first, continue to move at the zero lower bound like the policy rate and, second, correlate with macroeconomic variables even at the zero lower bound. Against this backgrund, shadow rates provide more realistic results than many standard models and – at the same time – prove to be more useful in measuring the monetary policy effects created by central banks.

Source: Krippner (2012a, b), Wu and Xia (2016).

Other definitions used in the literature distinguish between the following forms of unconventional monetary policies:

- A policy of "quantitative easing", whereby the central bank buys financial assets from commercial banks and other private institutions (with newly created money) in order to inject a (pre-determined) quantity of money into the economy. Consequently, such an easing increases the size of the balance sheet of the central bank through an increase of its monetary liabilities (i.e. base money).
- By contrast, a policy of "qualitative easing" generates a shift in the composition of the assets of the central bank towards less liquid and riskier assets, holding constant the size of the balance sheet. The less liquid and more risky assets can be private securities as well as sovereign or sovereign guaranteed instruments.
- At the same time, a so-called "credit easing" triggers an increase in the money supply by the purchase of private sector assets such as corporate bonds and residential mortgage-backed securities (but not of government bonds). These purchases increase the monetary base in a way similar to a purchase of government securities.

As already mentioned, the basic idea behind such an unconventional monetary policy is to exert pressure on the prices of the targeted assets, thereby driving prices up and lowering their yields. Some of the multiple channels, having been at work (either directly or indirectly) are the following ones:[277]

- first and foremost, the purchases led to higher prices of the bonds purchased (and, thereby, lower yields). To the extent, financial institutions sold the government bonds to the central bank, they were likely to rebalance their portfolios towards riskier and higher-return assets (such as, for instance, equities, credit and loans in the case of banks), thus increasing the related prices and lowering the respective yields (the "so-called "portfolio effects");
- similarly, such purchases could be expected to lead to a depreciation of the home currency (the so-called "exchange rate effects") which, especially in case of the euro area with a relatively strong export sector, boosted exporter's margins and production, thus fostering growth;
- the higher asset prices (triggered by such purchases) tended to increase investor's wealth (thus paving the way for the so-called "wealth effects"), which as a consequence fuelled consumption and investment. In parallel, the latter effect improved bank's capital (the so-called "bank capital effects") and, thereby, the willingness to lend. Moreover, consumption and investment could be expected to be stimulated by lowering of debt-servicing costs on existing debt;
- the rather rigorous reactions by the central bank (in case of the ECB supported by the explicit liaison with its quantitative definition of price stability) demonstrated central bank's ability and willingness to do whatever it takes to meet its objectives, thus triggering confidence effects, re-anchoring inflationary expectations and, thereby, pinning down real interest rates (the so-called "inflation expectations effects");
- the reduction in longer-term interest rates directly translated into lower funding rates for sovereigns (thus creating additional "seignorage income"). This paved the way for (modest) increases in public spending or tax cuts in the euro area (the so-called "fiscal policy effects"); and finally,
- to the extent, the package was supported by "forward guidance", it could be expected to influence market participants' expectations of the future path of the policy rate and, thus, the term structure of interest rates (the so-called "signalling effect").

How can the impact of such measures be assessed and quantified? This is clearly not an easy task. In particular, several issues tend to substantially complicate such an assessment. To begin with, it is difficult to separate the specific impact of such measures from the effects of other factors (such as, for instance, macroeconomic developments, changes in inflation expectations or other central bank initiatives) that impacted in parallel on the prices and yields of such debt instruments at the same time.[278] Second, the effects on inflation and economic activity are not easy to quantify, as the lags are long and variable and data are often subject to substantial revisions. Third, and perhaps most importantly, an overall judgment suffers from the major shortcoming that the counterfactual is not known with certainty.

When summarising the results indicated in the literature so far, the following key conclusions emerge:

- As regards the effects on financial markets, most studies confirm that liquidity measures appear to have substantially contributed to a reduction in yields (and, in parallel, to declines in interbank market spreads, which contributed to reducing funding problems) and a revival of activity in the targeted markets segments. At the same time, the credit facilities appear to have helped to restore the functioning in the specific markets, to unfold significant confidence effects (in demonstrating the central bank's willingness to intervene whenever deemed appropriate) and, finally, to have a measurable impact on credit conditions and lending.[279]
- As regards the effects on prices and real economic activity, the unconventional monetary policy measures have been explicitly geared towards developments in the real economy. This begs the question for the success in this area. Once again, keeping in mind that the counterfactual is not known with certainty, the available evidence overwhelmingly points towards a successful stabilisation of the economic recovery and the prevention of a further disinflation (or even deflation).[280]
- As regards the effects on central bank's balance sheets, it has been shown that the measures taken by central banks have been reflected in the size as well as in the composition of central bank's balance sheets. More concretely, the changes in the composition have been mirrored in a lenghtening of the average maturity as well as an increase of the risk profile of central banks' portfolios. This evidence should not come as a surprise in light of the fact that most central banks have embarked on the purchases of riskier assets, accompanied by a relaxation in collateral.[281] It is also worth mentioning that – so far – the changes in the balance sheets have overall proven to be profitable for central banks.

Besides these generally positive effects, some other aspects have to be mentioned that have been openly criticized in the public:

- To begin with, it has been mentioned that the non-standard monetary policy measures have triggered distributional effects. Indeed, it cannot be denied that the effects of those measures on bond markets have initiated portfolio reallocations into stock and real estate markets, thus creating wealth effects for stockholders. Similarly, savers are penalized at the expense of debtors. From a more general perspective however, it could be argued that also conventional monetary policy measures tend to unfold distributional effects, although the latter have not been deeply investigated in the literature so far.[282]

- Another criticism refers to some doubts about the fact that the asset purchases of government debt can be interpreted as a monetary financing of government debt by central banks. Indeed, such a financing of government debt is widely seen with great scepticism by economists as this tends to threaten the independence of central banks and, thereby, lead to credibility problems.[283]
- Last but not least, concerns about a possible emergence of financial stability risks have been expressed. Indeed, it cannot been denied that the non-standard monetary policy measures might force financial institutions to move into riskier assets not least due to a "search for yield" behaviour, thus triggering an excessive risk taking and, thereby, contributing to the build-up of vulnerabilities in the financial system.

21.5 THE ECB'S MONETARY POLICY IN TIMES OF FINANCIAL CRISIS

In additon, a number of specific issues have complicated the ECB response quite substantially. To begin with, as regards the timing aspect the shock waves of the financial crisis reached the euro area later, but with considerable vehemence and a differing impact on different countries. Second, as regards the appropriate monetary policy response, it has to be kept in mind that the euro area is more bank-financed than market-financed. Third, as regards the peculiarities of the crisis and by contrast to other central banks, the ECB even faced a denomination risk (i.e. the perception by the markets that the existence of the euro might be under threat).[284] Fourth, the ECB's actions had to respect the provisions of the Treaty on the Functioning of the European Union, which prohibits the Eurosystem from conducting purchases of sovereign debt that are interpreted as sovereign bailouts (as laid down in Article 125) or monetary financing (as laid down in Article 123).

It is impossible to do full justice to the ECB's monetary policy actions in an introductory text, but a few events clearly stand out and deserve particular mentioning.

☑ October 2008 to April 2010: Banking Crisis

The first phase of the global financial crisis was dominated by an acute banking crisis. The ECB reacted by implementing the so-called "Enhanced Credit Support", which comprised various non-standard measures aiming at the support of financing conditions of banks and the flow of credit to the private sector. These measures were set into force in October 2008 and complemented in May 2009.[285]

☑ May 2010 to July 2011: Beginning Sovereign Crisis

The second phase of the global financial crisis was characterised by the beginning sovereign debt crisis. On 10 May 2010, the ECB initiated the so-called "Securities Markets Programme (SMP)". The latter was launched in response to tensions in some segments of the financial market, in particular in the euro area sovereign bond markets. In the context of this programme, Eurosystem interventions were carried out in the euro area public and private debt securities markets to ensure depth and liquidity in dysfunctional market segments and to restore the proper functioning of the monetary policy transmission mechanism.[286]

It is worth noting that, in line with the provisions of the Treaty on the Functioning of the European Union, Eurosystem purchases of government bonds were strictly limited to secondary markets. Moreover, in order to ensure that liquidity conditions are not affected, all purchases were fully neutralised through liquidity-absorbing operations.

As regards the success of this action, it has sometimes been claimed that the interventions have been ineffective. It is a fact, however, that the effectiveness can in the end only be judged in relation to the counterfactual scenario that could have been observed, had the intervention not been carried out. This notwithstanding, empirical investigations seem to show that the SMP purchases had a favourable, albeit short-lived impact on both the level and the volatility of government bond yields and, thus, contributed in a positive way to market functioning.[287]

☑ Hawks and Doves in Monetary Policy

Over past decades, it has become quite common among central bank watchers to characterise monetary policy decision-makers along the metrics of "hawks" or "doves". While it is not entirely clear, where this distinction comes from and when it was used for the first time, it is well possible that it derives from the military jargon.

In this respect, "doves" stand for a more expansionary monetary policy (i.e. for persons who prefer other objectives, such as for instance, low unemployment over low inflation), whereas "hawks" tend to advocate a "tight" monetary policy (i.e. these persons assign a top priority to keeping inflation low).[288]

In times of unconventional monetary policy, another nuance has been added to this discussion. More particularly, "hawks" have then been defined as decision-makers that oppose to quantitative easing fearing the possible emergence of asset market imbalances, whereas "doves" tend to favour it. From a more general perspective, it might, however, be argued that the notion of being a "hawk" or a "dove" could change according to the situation.

☑ August 2011 to May 2013: Intensification of Crisis

The third phase of the global financial crisis saw a re-intensification of the financial and sovereign debt crisis that proceeded in form of a "circulus vicious". The main measures taken by the ECB consisted, first, of two three-year longer-term refinancing operations (in the words of President Draghi "die dicke Bertha"), in which the ECB allotted €489.19 bn in December 2011 and €529.53 bn in February 2012 (for a maturity of 36 months with an option for early repayment after one year). The background consisted of renewed turbulences in sovereign debt markets in the second half of 2011, which quickly spilled over to the banking system. As a consequence, the access of euro area banks to market-based funding came under strain.[289]

The LTROs were aimed at alleviating these adverse funding conditions and banks were able to satisfy their additional liquidity needs. While the full supportive impact of the three-year LTROs took a certain time to unfold, funding conditions for banks have since then generally improved, and there has been increased issuance activity and a re-opening of some segments of funding markets.[290]

The LTROs were by design constructed as a euro area-wide policy tool and, therefore, as an instrument that is directed to all banks in the euro area. In fact, however, it could not come as a surprise that banks from the south of the euro area ended up using it more than others because they were the ones most affected by the liquidity crisis taking place at the time in the European banking sector. More precisely, banks in Spain, Italy, Greece, Ireland and Portugal accounted for 70% to 80% of the total borrowing since 2010. As a mirror-image, banks from the north – which had benefited from inflows of capital in search of safety – reduced their reliance on the ECB operations to minimum levels.[291]

On 26 July 2012, quite surprisingly, the President of the European Central Bank made the following announcement during a conference in London: "But there is another message I want to tell you. Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough".[292] Consequently, on 6 September 2012, the ECB announced a new instrument, the so-called "Outright Monetary Transactions" (in view of many market participants "the bazooka"). In that meeting, an overwhelming majority of the Governing Council agreed to "address severe distortions in government bond markets, which originate from, in particular, unfounded fears on the part of investors of the reversibility of the euro".[293] Markets regarded this "fully effective backstop" as credible and, consequently, "tail risks" for peripheral countries were reduced significantly.[294] It turned out that this announcement substantially helped the peripheral economies to buy the necessary time to implement the consolidation and reforms needed to provide fundamentals consistent with continued euro area participation.[295]

The Securities Markets Programme (SMP) was decided to be terminated with immediate effect, with the ECB retaining its senior creditor status for bonds purchased under the SMP. Existing programme countries could also qualify for the OMT, once they had regained bond market access. Moreover, the ECB also adjusted its collateral eligibility rules by taking a number of concrete measures, which – taken together – were, however, foreseen to have an overall neutral effect on the amount of collateral available.[296]

It is definitely worth noting, that the announcement of the new Outright Monetary Transactions (OMT) had a remarkable effect on European bond yields even without the programme having ever been used.[297]

☑ June 2013 to May 2014: Communication Innovations

In its meeting on 4 July 2013, the ECB's Governing Council introduced another new element into the discussion, namely the element of "forward guidance". In the press conference, President Draghi informed the public that, based on an unanimous decision, the Governing Council "expects the key ECB interest rates to remain at present or lower levels for an extended period of time. This expectation is based on the overall subdued outlook for inflation extending into the medium term, given the broad-based weakness in the real economy and subdued monetary dynamics".[298] This was clearly an innovation in the ECB's communication strategy, aiming at clarifying the future path of key interest rates (and, thereby, reducing uncertainty and interest rate volatility).[299] At the same time, this clearly represented a novelty for the ECB, being well known to "never pre-commit", since it introduced for the first time an explicit bias into its decision-making.[300]

☑ June 2014 to end 2016: Emerging Deflationary Risks and Recovery

The fifth phase of the global financial crisis was dominated by the emergence of deflationary risks for the eurozone. Fuelled by a sharp decline in oil prices, disinflationary pressures arose. Fearing a possible de-anchoring of inflation expectations and a self-reinforcing negative spiral (via second-round effects) and being faced with interest rates not far from zero, the ECB had to resort to a new approach to expand its monetary stance. This approach relied on a combination of three instruments.[301]

The first instrument comprised further reductions in interest rates. As a result, the ECB was the first among the major central banks that entered the uncharted territory of a negative deposit rate.[302] In fact, the negative interest rate on the deposit facility – in liaison with an environment of excess reserves – successfully pinned down overnight rates at negative levels, thus providing additional stimulus.

The second instrument consisted of the asset purchase programme (APP) of private and public sector securities. This programme was launched on 22 January 2015 to accompany the existing purchase programmes for asset-backed securities and covered bonds. The APP was supposed to include the combined monthly purchases of public and private sector securities.[303] As regards timing aspects, the APP was foreseen to be carried out until end-September 2016 and to last until a sustained adjustment in the path of inflation could be observed, that is in line with the ECB's definition of price stability (i.e. an inflation rate of "below, but close to, 2%" over the medium term).[304] As regards the distributional aspects, the purchases of securities issued by euro area governments and agencies were based on the Eurosystem NCBs' shares in the ECB's capital key.

By compressing risk premia along the yield curve, the APP has contributed to depress the term structure of interest rates. This effect materialised directly in the respective market segments for covered bonds, asset-backed securities (ABS), sovereign and corporate bonds.[305]

The third instrument included the targeted longer-term refinancing operations (TLTROs), which were announced on 5 June 2014 and modified on 22 January 2015 and are specifically aimed at fostering bank lending to the private sector subject to the ongoing bank deleveraging.

Taken together, a variety of studies seem to confirm the overall success of the ECB's non-standard monetary policy measures. More particularly, the announcement of outright monetary transactions (OMT), for instance, seems to have significantly reduced sovereign bond yields in most member countries.[306] In the same vein, the securities market program (SMP) had a measurable effect on yields of sovereign bonds, particularly for those countries that were covered by the program.[307] Moreover, the long-term refinancing operations (LTROs) were found to contribute to re-establish the functioning of the bank lending channel and, thereby, to have stimulated credit growth.[308] Finally, unexpected ECB balance sheet enlargements exerted a measurable positive impact on economic activity and prices in the euro area.[309]

Towards the end of 2016, there were clear signs of an economic recovery in the euro area continuing at a moderate, but steadily firming pace and broadening gradually across sectors and countries. In addition, sentiment indicators suggested that the cyclical recovery might gain further momentum.

When comparing these results to the ones reported for other countries, it needs to be kept in mind that conditions obviously vary because financial structures differ. Indeed, in the euro area, corporate debt financing takes mainly place via banks, as opposed to capital markets in the United States. This notwithstanding, the programmes of both the Bank of England and the Bank of Japan were effective and the respective economies are almost as bank-based as the euro area.[310]

☑ Hysteresis

As mentioned in earlier chapters, economists tend to distinguish between short-run and long-run effects. At the same time, it is a widely accepted view that variables, such as for instance unemployment and GDP are believed to evolve along long-run equilibrium values labelled as the "natural rate of unemployment" and "potential output." The latter variables are determined on the basis of structural factors and, once short-run shocks have "died out", unemployment and GDP should, in principle, return to their long-run levels.

This notwithstanding, some economists have started to discuss quite intensively the existence and implications of a phenomenon called "hysteresis". What is behind the debate? Hysteresis derives from the Greek word meaning "lagging". If hysteresis holds, it is conceivable that higher unemployment (caused by a crisis) might become permanent and that the long-run natural rate of unemployment may substantially deviate from the pre-crisis level even after the recovery. Similarly, several years of negative growth could ultimately reduce potential output in the longer-term. It is obvious that the existence of such a phenomenon might ask for a more active policy measures than otherwise.

Source: Blanchard and Summers (1986).

21.6 A FIRST LOOK AT THE DATA

We start the empirical section by having a closer look at some simple considerations related to a Taylor rule for the euro area. As shown in earlier paragraphs, the general specifation looks as follows:

$$i_t = r_t^* + \pi_t^* + \beta \cdot (\pi_t - \pi^*) + \gamma \cdot (y_t - y^*) \qquad (21.6.1)$$

where i_t is the nominal policy rate and r_t^* is the (average) real equilibrium interest rate. Moreover, π_t stands for the inflation rate, π^* represents the desired rate of inflation and $(y_t - y^*)$ denotes the output gap (i.e. the deviation of current real GDP from its potential or natural rate). Furthermore, α and β mirror the weights assigned to the objectives by the monetary authority. In essence, this rule links the monetary policy instrument (i.e. the interest rate) to the ultimate objectives of monetary policy, namely the deviation of inflation from its target value and the deviation of output from potential output.

The concrete specification of this rule then asks for a measure of inflation. In this respect, most studies focusing on the euro area consider developments in the headline HICP, i.e. the measure for headline inflation as the relevant variable in the euro area. This is in line with the price index used by the ECB to measure price stability (i.e. a year-on-year percentage change in the harmonised index of consumer prices). This notwithstanding, in principle, also core inflation measures might be used. The latter measures exclude the most volatile components from the HICP and thus should give a better picture of "underlying" inflation.

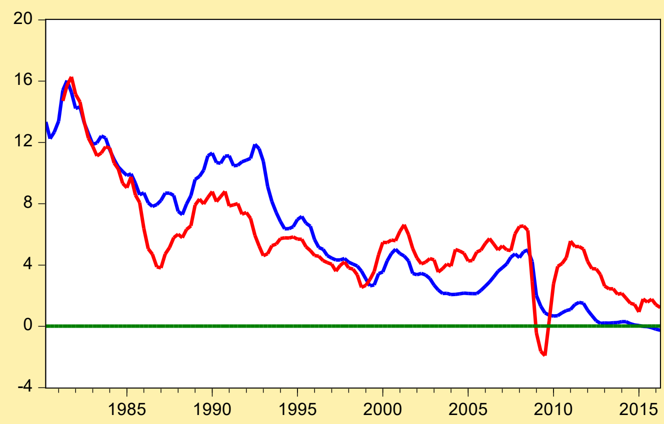
Following this, the specification further asks for a measure of the output gap. In principle, a variety of methods to quantify the latter exists, among them simple statistical measures (for instance linear and quadratic trend approximations) as well as filtering techniques (e.g. the Hodrick-Prescott Filter) as well as published quantifications of some international organisations (e.g. the European Commission, the IMF and the OECD). As a consequence, these constitute differences among authors which should be kept in mind when comparing across studies.

Once the measure of the main variables has been chosen, there are basically two ways to proceed.

- One way would be to carry out calibration exercises. In this case, one should first attribute precise values to the parameters. In practice, these values could be selected according to the literature (for instance, 1.5 for inflation and 0.5 for the output gap as suggested by Taylor could be picked).
- The other way to proceed would be to literally confront the rule with the real data and estimate the parameters. Therefore, the estimation method chosen would be important.[311]

It should also be noted that experience shows that the parameter estimates might be rather sensitive to the specification of the rule with respect to inflation (e.g. forward-looking versus backward-looking specification) as well as the measure and method for constructing the potential output needed to derive the output gap.[312]

Figure 21.1: Taylor Rule for the Euro Area



Source: ECB data.

In line with some results from the literature, we calibrate a rule with the parameters 1.5 and 0.5 and use the growth in real GDP instead of the output gap itself as a determinant.[313] Note, how closely this simple Taylor rule mirrors actual developments over large parts of the sample. Major deviations occur in the years 1985 and 2010. Towards the end of the sample, the actual interest rate even slightly turns negative.

21.7 A SECOND LOOK AT THE DATA

But how often do such monetary policy actions occur in reality? The table below illustrates the interest rate decisions of the ECB's Governing Council since the start of the year 1999. A number of results emerge from that table.

First of all, decisions seem to have been mostly taken in the first meeting of the month. This is, however, not too surprising, given that the Governing Council announced on 8 November 2001 to have monetary issues only on the agenda of the first meeting. Second, given the fact that there have been just 41 changes in, broadly speaking, almost twenty years, the modal (or most frequent) event is clearly not to change interest rates. This is also in in line with the frequency of changes observed in other central banks worldwide. Third, from the table, it can also be inferred that, when official rates for the euro area do change, the changes are either 25 or 50 basis points. Only in one case, a decision to lower by 75 basis points has been taken. This is also similar to the changes in central bank rates observed in the United States and other OECD countries.[314]

Phase	Date	Level (in %)	Change (in %)
I	22/12/1998	3.00	(-)
	08/04/1999	2.50	- 0.50
II	04/11/1999	3.00	+ 0.50
	03/02/2000	3.25	+ 0.25
	16/03/2000	3.50	+ 0.25
	27/04/2000	3.75	+ 0.25
	08/06/2000	4.25	+ 0.50
	31/08/2000	4.50	+ 0.25
	05/10/2000	4.75	+ 0.25
III	10/05/2001	4.50	- 0.25
	30/08/2001	4.25	- 0.25
	17/09/2001	3.75	- 0.50
	08/11/2001	3.25	- 0.50
IV	06/12/2002	2.75	- 0.50
	06/03/2003	2.50	- 0.25
	05/06/2003	2.00	- 0.50
V	01/12/2005	2.25	+ 0.25
	02/03/2006	2.50	+ 0.25
	08/06/2006	2.75	+ 0.25
	03/08/2006	3.00	+ 0.25
	05/10/2006	3.25	+ 0.25
	07/12/2006	3.50	+ 0.25
	08/03/2007	3.75	+ 0.25
	06/06/2007	4.00	+ 0.25
	09/07/2008	4.25	+ 0.25
VI	08/10/2008	3.75	- 0.50

Phase	Date	Level (in %)	Change (in %)
	06/11/2008	3.25	- 0.50
	04/12/2008	2.50	- 0.75
	15/01/2009	2.00	- 0.50
	05/03/2009	1.50	- 0.50
	02/04/2009	1.25	- 0.25
	07/05/2009	1.00	- 0.25
	07/04/2011	1.25	+ 0.25
	07/07/2011	1.50	+ 0.25
	03/11/2011	1.25	- 0.25
	08/12/2011	1.00	- 0.25
VII	05/07/2012	0.75	- 0.25
	02/05/2013	0.50	- 0.25
	07/11/2013	0.25	- 0.25
	05/06/2014	0.15	- 0.10
	04/09/2014	0.05	- 0.10
	02/03/2016	0.00	- 0.05

Table: Changes in key interest rates in the euro area
Note: Main refinancing rate of the ECB, source: http//www.ecb.int.

21.8 SUMMARY

- The monetary base (or, alternatively, the amount of central bank money available to the economy) is in principle under the control of the central bank. As a consequence, the money supply process then turns into a two-step procedure. In the first step, the central bank directly controls the amount of base money and by doing this, in a second step it indirectly influences the broader monetary aggregates. The indirect influence, however, critically hinges on the stability of the two factors determining the multiplier, namely the reserve ratio and the currency deposit ratio.
- The Taylor rule is a simple and intuitive monetary policy rule that was first advocated by the US economist John Taylor and soon became quite popular. The rule basically

postulates a linear relationship between the short-term interest rate (the key policy instrument of the central bank) and some key macroeconomic determinants.

- In recent years, however, nominal interest rates have reached the zero lower bound in many countries. This has posed substantial challenges to central banks as it has limited the ability to stimulate the economy in the traditional way thus, ultimately, leading to the use of uncontroversial measures. Moreover, in this context, traditional models started to become more and more useless with rates artificially stuck at the zero lower bound, where they show no meaningful variation even when economic conditions change. Consequently, economists have started to refer to the concept of "shadow rates" in order to substitute for the central bank's policy rate during zero-bound years.
- The developments that followed the 2007–09 financial crisis prompted central banks to implement a series of unprecedented policy interventions. It cannot be denied that without those measures, the macroeconomic outcomes would have been much worse. This notwithstanding, some debate is still ongoing as regards the associated costs and benefits of non-standard monetary policy measures. On the one hand, supporters have argued that such tools have proven successful in calming financial markets and in improving credit and economic conditions. On the other hand, critics have doubted the effectiveness of these measures and stress the potential risks, such as a deterioration in financial stability, adverse consequences for central bank credibility and independence or a widening of the income distribution.

🕮 Key concepts

Money multiplier, Taylor rule, interest rate smoothing, Taylor principle, large-scale asset purchases (LSAPs), quantitative easing (QE), expanded asset purchase program (APP), enhanced credit support, Securities Market Programme, three-years longer-term refinancing operations, Outright Monetary Transactions, Forward Guidance, negative deposit rates, ABS purchase programme and covered bond purchase programme.

☑ Questions for review

- What is the economic meaning of the monetary base? How can it be used to achieve a certain growth in a broader monetary aggregate?
- What is the essence of a Taylor rule? What is behind the Taylor principle?
- Which euro area non-standard monetary policy measures do you know? What was their exact sequence and what was their concrete purpose?
- Which kind of effects can be distinguished?

PART VI

22 OPEN ECONOMY ISSUES

22.1 LEARNING OBJECTIVES

In this chapter, we will have a closer look at open economy issues. We start by elaborating the concept of the balance of payments and some important sub-accounts. We then proceed by taking a closer look at the international monetary system and, thereby, especially at some currency systems prevailing over historical periods as well as some international organisations, such as the Bank for International Settlements, the International Monetary Fund and the World Bank. Finally, we have a look at some data.

22.2 THE BALANCE OF PAYMENTS

In modern economies, international transactions usually form a substantial part of economic activity. These transactions are recorded in the so-called "balance of payments accounts". The balance of payments (BoP) represents a statistical framework that basically summarises in a systematic way, for a specific period (typically a year), the currency and commodity flows that take place between an economy and the rest of the world.[315]

In essence, the compilation of the balance of payments is carried out following a double-entry accounting system, where every external transaction is summarised in two entries (in the language of accounting, a so-called "credit" and a so-called "debit"), with exact equal values but opposite signs. Like many other statistics, the compilation of the BoP relies on the key concept of "residence". In line with international definitions, residence refers to the economic territory of the main business and not to nationality.

The balance of payments includes two important sub-accounts, namely the so-called "current account" and the so-called "capital account". This notwithstanding, a number of other sub-accounts are also worth mentioning.

The so-called "goods and services account" (or alternatively "balance of trade in goods" and "balance of trade in services") records the transactions of goods and services. This balance gets a credit entry when goods leave a country, and transactions that make foreign goods and services enter a country are recorded as debits. Hence, exports are a credit and imports are a debit. Surplus on this account is popularly called "net exports".

The so-called "current account" records all transactions on the goods and services account, adding to it special transactions referred to as "unilateral transfers". As the name suggests, unilateral transfers are transactions that can be described as "one way traffic" – they leave the country without any expectation of repayment. Classical examples for such transfers are foreign aid, retirement payments to retirees abroad and military personnel expenditures.

The so-called "capital account" records all capital transactions of a country with the rest of the world. When foreign residents buy domestic financial assets, such as, for instance stocks, bonds, or government securities, there is a capital inflow into the economy. From an accounting perspective, these transactions are booked as credit on the capital account. By contrast, when domestic residents purchase foreign financial assets, a capital outflow materialises and these transactions are recorded as debit. Thus, one speaks of a surplus in the capital account when capital inflows exceed capital outflows.

The so-called "official reserves account" records all transactions that occur at government level or at central bank level of a country. Clearly, when a central bank has a great amount of foreign reserves in its balance sheet, this is recorded in form of a credit position on this balance.

Finally, there is a position covering statistical discrepancies, which is called "errors and omissions". These discrepancies can – at times – be quite substantial. Taken together, the balance on goods and services, the current account balance, the capital account balance and the official reserve settlement balance are the four major balances of the BoP.[316]

The three main economic variables that influence the BoP are GDP, the exchange rate and the interest rate. A higher GDP typically leads to higher imports and, thus, to a decrease in net exports. The effects of an interest rate change are reflected on the capital account rather than the current account. If domestic interest rates are higher than foreign ones, foreigners will tend to purchase domestic financial assets, thus creating a capital inflow and hence a surplus on the capital account of the BoP. Similarly a reduction in the domestic interest rate can create capital outflows as domestic residents will tend to buy more foreign financial assets. Exchange rate changes can also have an effect on the balance of payments by making imports and exports change. Under normal conditions, an appreciation of the home currency – that is an increase in the value of the home currency – will make exports to the rest of the world more expensive and imports from the rest of the world cheaper and, consequently, a decline in net exports can be expected. Similarly, a depreciation of the domestic currency will be accompanied by a rise in exports and a decline in imports, thus increasing net exports.

There are various approaches to explain the behaviour of the BoP. A first approach is of Keynesian nature. As it relies – among other things – on one famous mathematical condition developed by the two economists Alfred Marshall and Abba Learner, the so-called

"Marshall-Lerner-condition" (which relates to the sum of the elasticities of the demand for exports and imports), it is also often called the "elasticity approach". A second approach, the so-called "absorption approach" was developed in 1951 by the US economist Sidney Alexander (1916–2005). As the name states, the approach relates the changes in the BoP to the difference between net exports and the domestic part of total expenditure (the so-called "absorption"). A third approach relies on capital flows and, thus, basically on monetary considerations to explain the main sources of the changes in the BoP, hence the name "monetary approach" to the BoP.

22.3 SOME INTERNATIONAL MONETARY ORGANISATIONS

☑ The Bank for International Settlements

The Bank for International Settlements (BIS) is an intergovernmental organisation with members that include entirely central banks and national monetary authorities. In essence, the BIS acts as a "bank for central banks" and – at the same time – it constitutes a centre for international central bank cooperation, among other things by serving as a meeting place for central banks.

The BIS was established in 1930 in Basel (Switzerland) and originally set up in the context of the Young Plan to channel German war reparation payments to other European states, payments that were imposed by the Treaty of Versailles. In later years, the reparations became less important and, consequently, the BIS was redirecting its activities more towards cooperation among central banks, especially regarding monetary and financial stability issues.

Today, the BIS not only covers a wide range of banking services for its members, but also acts as a key forum to promote discussion and policy analysis.

☑ Member Central Banks of the BIS

Members of the BIS are the central banks or monetary authorities of the following countries: Bank of Algeria, Central Bank of Argentina, Reserve Bank of Australia, Central Bank of the Republic of Austria, National Bank of Belgium, Central Bank of Bosnia and Herzegovina, Central Bank of Brazil, Bulgarian National Bank, Bank of Canada, Central Bank of Chile, People's Bank of China, Bank of the Republic Colombia, Croatian National Bank, Czech National Bank, Danmarks Nationalbank (Denmark), Bank of Estonia, European Central Bank, Bank of Finland, Bank of France, Deutsche Bundesbank (Germany), Bank of Greece, Hong Kong Monetary Authority, Magyar Nemzeti Bank (Hungary), Central Bank of Iceland, Reserve Bank of India, Bank Indonesia, Central Bank of Ireland, Bank of Israel, Bank of Italy, Bank of Japan, Bank of Korea, Bank of Latvia, Bank of Lithuania, Central Bank of Luxembourg, National Bank of the Republic of Macedonia, Central Bank of Malaysia, Bank of Mexico, Netherlands Bank, Reserve Bank of New Zealand, Central Bank of Norway, Central Reserve Bank of Peru, Bangko Sentral ng Pilipinas (Philippines), National Bank of Poland, Bank of Portugal, National Bank of Romania, Central Bank of the Russian Federation, Saudi Arabian Monetary Agency, National Bank of Serbia, Monetary Authority of Singapore, National Bank of Slovakia, Bank of Slovenia, South African Reserve Bank, Bank of Spain, Sveriges Riksbank (Sweden), Swiss National Bank, Bank of Thailand, Central Bank of the Republic of Turkey, Central Bank of the United Arab Emirates, Bank of England, Board of Governors of the Federal Reserve System (United States).

Source: http\\www.bis.org.

☑ The International Monetary Fund

The International Monetary Fund (the so-called "IMF") is an intergovernmental organisation with its headquarters being located in Washington (D.C). It was founded in July 1944 in Bretton Woods (New Hampshire) and assigned the task of dealing with unresolved financial problems of the time. In line with this objective, the role of the IMF consists first and foremost in overseeing the global financial system by closely monitoring the policies of its member countries and, thereby, in particular those policies that exert an impact on exchange rates and the balance of payments.[317]

The financial set-up of the IMF is quite unique: upon entry, each member of the IMF is assigned a quota, which is in essence based on its relative size in the world economy. Over the past decades, these quotas have occasionally been altered in order to reflect the changing global economic realities. A member's quota will then form the basis for its subscription, its voting weight, access to IMF funding, and allocation of the so-called "Special Drawing Rights" ("SDR").[318]

☑ The World Bank

Another of the so-called "Bretton Woods institutions" created after World War II is the World Bank, also headquartered in Washington (D.C.). The World Bank is an international organization consisting of five agencies that provide financial and technical assistance to developing countries around the world with the aim of reducing global poverty. In essence, the World Bank makes long-term low-interest loans to countries for projects which are economically sound but cannot get private sector financing. In doing so, the World Bank acts as a major borrower in the world's capital markets (where it enjoys a high rating since the repayment of its bonds is guaranteed by member governments), but it also draws on grants from donor nations.

22.4 SOME INTERNATIONAL CURRENCY REGIMES

Over the past centuries, the international monetary system (i.e. the the regimes by which different national currencies are exchanged for each other) has undergone quite substantial changes that are worth looking at in more detail.

☑ The Gold Standard

Before World War I (and between the two world wars), an international monetary system existed, in which currencies were defined in terms of gold – a system known as the "Gold Standard".[319] At the time, countries decided to keep their gold reserves in central banks in order to ensure the credibility of their currency. Currencies in the form of coins and banknotes were also declared convertible into gold at a fixed parity, so that the money supplies were in essence tied to gold.

Great Britain (at that time the principal trading nation in the world) was effectively the first country to set up a gold standard in 1816. Following this, between the 1870s and 1914 (and briefly again between the two world wars), the major countries of the world operated on the gold standard and, given the fact that all trading nations agreed to exchange their currencies for gold at a fixed rate, this led de facto to a "quasi-automatic" determination of fixed exchange rates between the countries. Moreover, the gold standard provided a way of setting accounts between countries with different national currencies.

From a historical perspective, the gold standard can be seen as a very successful policy regime that provided the world with a period of unusually high stability, economic growth and prosperity. This notwithstanding, when World War I broke out in 1914, many countries began printing more and more money in order to pay for the war, thus paving the way for hyperinflation to come. With more money circulating, most countries had to suspend the convertibility of their currencies into gold as its increased quantity was no longer balanced by the national gold reserves.

☑ The Gold Exchange Standard

The Gold Standard finally collapsed in 1931, but the system was revived at an international conference held in Bretton Woods (New Hampshire) in 1944. At this conference, a revised form of the gold standard (the so-called “gold exchange standard” or, alternatively, the “dollar exchange standard”) was agreed upon, whereby the exchange rates of the national currencies of the major economic powers were pegged to the US dollar and the US dollar was declared convertible into gold at a fixed price of $35 per ounce of gold. In practice, this meant that central banks stood ready to provide dollars in exchange for their national currency (by using their reserves of international currencies), if needed.

While the system of the “dollar exchange standard” at first glance looks like a (more successful) variant of the original Gold Standard, it was far more than that. In particular, one novelty deserves specific attention, namely the fact that exchange rates were fixed but adjustable. In case one of the currencies deviated too much from its appropriate or “fundamental” value, the parity could be adjusted. This ability to adjust exchange rates in case of fundamental disequilibria must be seen as the key distinction between the Bretton Woods system and the Gold Standard.

☑ Floating Exchange Rates

The Bretton Woods System functioned quite effectively for around three decades after the World War II. It got, however, into troubles when the US dollar became increasingly overvalued and the United States refused to take the necessary steps in order to maintain its international credibility. The system collapsed in 1971, when the United States unilaterally terminated the convertibility of the US dollar into gold (in the literature often referred to as the “Nixon shock”) and since then most countries have allowed the exchange rates of their currencies to “float”, thus paving the way for the “modern era”. In parallel, the currencies of the major economies have remained pure fiat money.

22.5 A FIRST LOOK AT THE DATA

A deeper look into euro area data for the balance of payments in the end of 2016 shows the following details:

Current Account	359.4
Capital Account	352.8

Note: EUR billions, net transactions, ECB data.

Is the current account surplus a reason for concern? No, not really. Indeed, most economists would tend to think that euro area goods are competitive in international markets, since foreigners express a substantial demand for euro area goods.

Is the capital account surplus a reason for concern? In this respect, different views have been expressed. To begin with, one could argue that foreigners lend money (via net capital imports) to the euro area because they regard it as a financially sound economic region. Moreover, the capital inflows provide funds for business expansion. At the same time, large inflows into the euro area are equivalent to large capital outflows from other nations, thus reducing their liquidity for investment and restraining growth in these countries. Furthermore, capital inflows can easily change direction in a very abrupt manner. Such sudden wirthdrawals of funds can at times create substantial problems to economies.

22.6 SUMMARY

- The balance on goods and services, the current account balance, the capital account balance and the official reserve settlement balance are the four major balances of the BoP.
- There are various approaches to explain the behaviour of the BoP, namely the “elasticity approach”, the “absorption approach” and the “monetary approach”.
- Some important international monetary institutions are the Bank for International Settlements, the International Monetary Fund and the World Bank.
- When taking a look at international currency regimes, from a historical perspective, the Gold Standard, the Gold Exchange Standard and the Bretton Woods System have to be mentioned.

📖 **Key concepts**

Balance on goods and services, current account balance, capital account balance, official reserve settlement balance, gold standard, gold exchange standard, dollar exchange standard, Bretton Woods System, World Bank, International Monetary Fund, Bank for International Settlements.

☑ **Questions for review**

- Which main sub-accounts of the balance of payments do you know?
- Which currency systems do you know?
- Which international organisations do you know?

23 GROWTH THEORY

23.1 LEARNING OBJECTIVES

In this chapter, we will have a closer look at the rate of economic growth an economy faces and its main determinants. We then proceed by taking a closer look at the underlying theory of economic growth, which – albeit occasionally still being subject to heated and continued discussions in the literature – in essence builds on some simple and intuitive ideas.[320] Finally, we have a look at the growth figures in the euro area and set them into an international context.

23.2 SOME BASIC CONSIDERATIONS

The expression “economic growth” generally refers to a longer-term trend increase in an economy’s production. In full analogy to microeconomic theory, production can be expressed in terms of a production function that links output to a small set of input factors. According to the standard production function used in growth theory, the production of real GDP (Y) depends at any point in time on the quantity of the factor inputs, capital (K) and labour (N) and on the behaviour of an additional factor called A (for “autonomous growth”). In a more formal way, this can be expressed as follows:[321]

$$Y = A \cdot K^{b} \cdot N^{1-b} \tag{23.2.1}$$

Following this expression, real GDP equals to the product of an autonomous factor (A) and a geometrically weighted average of capital (K) and labour (N). Moreover, the weights b and $1-b$ add up to one and represent the elasticity of GDP to an increase in either input factor. Two key features of this specification are particularly noteworthy. First, an equal percentage increase in both input factors, namely capital and labour, raises real output by the same percentage. This phenomenon is generally labelled as “constant returns to scale” and is due to the fact that b and $1-b$ add up to unity. Second, there is a direct one-to-one response of real GDP to the autonomous growth factor A.

☑ Levels and Growth Rates

In this box, we want to show that if $Z = X \cdot Y$ then $\Delta z = \Delta x + \Delta y$ holds. Why is that? Let ΔZ be the increase in Z when X increases by ΔX and Y by ΔY. Then, by definition, the following holds:

(i) $(Z + \Delta Z) = (X + \Delta X) \cdot (Y + \Delta Y)$

If both sides are divided by Z, it follows that

(ii) $\frac{Z + \Delta Z}{Z} = \left(\frac{X + \Delta X}{X}\right) \cdot \left(\frac{Y + \Delta Y}{Y}\right)$

since dividing by Z is the same than dividing by $X \cdot Y$. Simplifying this expression yields:

(iii) $1 + \frac{\Delta Z}{Z} = \left(1 + \frac{\Delta X}{X}\right) \cdot \left(1 + \frac{\Delta Y}{Y}\right)$ or, equivalently:

(iv) $(1 + \Delta z) = (1 + \Delta x) \cdot (1 + \Delta y)$

The latter term can for small values of Δx and Δy be simplified to:

(v) $\Delta z = \Delta x + \Delta y$

Source: Adapted from Blanchard (1997), p. A10.

So far, we have been talking about the level of real GDP. But at the end of the day, we want to know more about the determinants of the growth rate of real GDP. If we denote the percentage change in Y with Δy as in earlier chapters and take note of the rule that the growth rate of the product of several variables equals the sum of the growth rates of the individual components, it follows:[322]

$$\Delta y = \Delta a + b \cdot \Delta k + (1 - b) \cdot \Delta n \tag{23.2.2}$$

Seen from this perspective, the growth rate of real GDP (Δy) equals the growth rate of autonomous growth (Δa) plus a weighted average of the growth of capital (Δk) and labour (Δn) with the respective weights b and $1 - b$.

We can further extend our deliberations and express growth of real GDP per person. The (implicit) assumption that the growth rate of the population equals the growth rate of employment allows us to express the growth rate of real GDP per person by deducting the growth rate of the population (Δn) from the growth rate of real GDP (Δy). It then follows:

$$\Delta y - \Delta n = \Delta a + b \cdot \Delta k + (1 - b) \cdot \Delta n - \Delta n \tag{23.2.3}$$

$$\Delta y - \Delta n = \Delta a + b \cdot \Delta k + \Delta n - b \cdot \Delta n - \Delta n \tag{23.2.4}$$

$$\Delta y - \Delta n = \Delta a + b \cdot (\Delta k - \Delta n) \tag{23.2.5}$$

This equation basically states that the growth in real GDP per person equals the growth in the autonomous factor plus the growth of capital per person. Insofar, the two sources of growth of an economy are the growth of an autonomous factor plus the growth of capital per person.

23.3 GROWTH OF CAPITAL PER PERSON

But what are the sources of growth underlying capital per person? Indeed, when taking into account some of the results derived in previous chapters, we can further refine the present results. Recall that under certain assumptions, such as no government deficit and no foreign trade, savings equal investment:

$$S = I \tag{23.3.1}$$

Moreover, total investment (I) can – by definition – be divided into net investment (I_{net}) and replacement investment (D):

$$I = I_{net} + D \tag{23.3.2}$$

In addition, replacement costs can be assumed to be a fixed fraction (the "depreciation rate" (d) of the capital stock (K):

$$D = d \cdot K \tag{23.3.3}$$

Finally, net investment is equal to the change in the capital stock from one period to the next (ΔK).

$$I_{net} = \Delta K \tag{23.3.4}$$

These individual key elements can be combined if we substitute all equations into equation (20.3.1). It then follows:

$$S = \Delta K + d \cdot K \tag{23.3.5}$$

This expression states that savings equal the change in capital plus the depreciation rate times the capital stock. In the next step, we divide both sides of the equation by the capital stock (K). It then follows:

$$\frac{S}{K} = \frac{\Delta K}{K} + d \tag{23.3.6}$$

Next, we multiply the left-hand side of the equation by the term Y/Y:

$$\frac{S \cdot Y}{K \cdot Y} = \frac{\Delta K}{K} + d \tag{23.3.7}$$

The latter expression can be simplified if we take into account that s denotes the ratio of total (real) savings to (real) GDP (that is $s{=}S/Y$). Following our earlier convention, we denote the percentage change in the capital stock ($\Delta K/K$) by ΔK:

$$s \cdot \frac{Y}{K} = \Delta k + d \tag{23.3.8}$$

Next we solve this expression for ΔK:

$$\Delta k = s \cdot \frac{Y}{K} - d \tag{23.3.9}$$

Finally, we subtract Δn from both sides of the equation:

$$\Delta k \text{-} \Delta n = s \cdot \frac{Y}{K} - d - \Delta n \tag{23.3.10}$$

Recall that we are interested in the growth of capital per person ($\Delta k - \Delta n$) because it is one of the two main determinants of real GDP per person. And the equation above states that ($\Delta k - \Delta n$) in turn depends on the average savings rate (s), the output to capital ratio (Y/K), the depreciation rate (d), and the population growth rate (Δn). We can also interpret our findings in an alternative way by stating that the total available amount for savings relative to the capital stock (that is, $s \cdot (Y/K)$) can be used for three purposes – namely for replacing old capital (d), for equipping new workers with capital (Δn), or for allowing the capital stock to grow faster than the growth in labour input ($\Delta k - \Delta n$).

The policy implications are straightforward. The growth of capital per worker depends on four determinants, three of which are beyond the scope of government policy (Y/K, d, and Δn) and one of which (s) can be affected by policy actions. The Y/K ratio does not depend on policy, but rather on the nature of the production function. The depreciation rate (d) depends on the types of capital purchased in the past and how long they are going to last, and the growth rate of the population (Δn) depends on birth and death rates as well as, for instance, immigration. Therefore, an increase in the growth rate of capital per person can only be influenced if the government can change the savings rate.

It is worth mentioning that the concept of savings underlying the previous deliberations consists of savings available for private investment. For the sake of simplicity, the concept of total available savings can be divided into its main components, that is household savings plus savings by firms plus the government surplus minus the trade surplus.

☑ The New Economy from a Growth Perspective

During the four years 1995–99, US productivity growth experienced a strong revival and – with a level of 2–2.5% per year compared to the usual 1–1.5% per year – achieved growth rates exceeding the one of the early 1970s significantly. Accordingly, many observers declared this happy state as the "New Economy".[323] Following them, the Internet and the accompanying acceleration of technical change in computers and telecommunications had led to an Industrial Revolution equal in importance, or even more important, than the Second Industrial Revolution of 1860–1900. It was also claimed that this revolution had ushered in a "Golden Age" of economic prosperity. The US economist R.J. Gordon referred to this state as the "Goldilocks Economy". While there is no generally accepted definition of this phenomenon, three key characteristics of such a New Economy seem to stand out. First, a permanently higher potential growth rate of the economy with an increase in the growth rate of trend (total factor) productivity, with the latter being attributable predominantly by the revolution in the Information and Communication Technologies (ICT). Second, a permanent reduction in structural and frictional unemployment. Third, a reduction in the variation in the growth rate of output. From the monetary policy perspective, what seemed to be of particular importance is the claim that the New Economy has increased the "speed limits" of the economy. Expressed in other terms, the New Economy was said to be able to operate at higher rates of growth than the "Old Economy", without necessarily generating an acceleration of inflation. While the subsequent recessions discredited many of the more extreme predictions made during the boom years, from today's perspective it seems, however, that some of the gains of the late 1990s may endure. The future will tell us.

Source: Issing (2004).

A policymaker willing to stimulate available savings and, thereby, growth in capital per person ($\Delta k - \Delta n$) can thus follow several approaches. Household savings and business savings can be boosted by tax incentives, or the government surplus can be raised by a shift in the mix of policy towards a tighter fiscal policy. Finally, a trade surplus is accompanied by an outflow of capital abroad, thus reducing the funds available for domestic investment, while a trade deficit is accompanied by an inflow of capital from abroad that adds to the available pool of savings.

23.4 GROWTH IN THE AUTONOMOUS FACTOR

So far, our main emphasis has been on how to raise growth in capital per person, one of the two basic determinants of growth in real GDP per person. But what exactly is the meaning of the other determinant, the growth in the autonomous factor (Δa), and how can it be influenced? Recall from earlier sections that the following relationship holds:

$$\Delta y - \Delta n = \Delta a + b \cdot (\Delta k - \Delta n) \qquad (23.4.1)$$

A logical approach could be to estimate the magnitude of the main elements Δy, Δn, Δk, and b. Then the final element Δa can be calculated as the residual. As a consequence, the residual then simply includes all those sources of growth that are not explicitly taken into account in the determinants of the equation. In line with this view, it has also been called a "measure of our ignorance".[324]

Against this background, A is often interpreted as representing the impetus of the technology available, such as, for instance, innovations, improvements in the production process and management techniques. Hence Δa stands for an improvement in the technology employed. Seen in this way, the production function mirrors the two factors involved in economic growth, namely factor accumulation and improvements in efficiency.

Since a change in A stands for the change in GDP that is not explained by changes in the level of inputs (capital and labour) used and, therefore, is equivalent to a faster growth in output per unit of input, it is in the literature often summarised by the expression "total factor productivity". In principle, total factor productivity can be measured by:

$$\Delta a = \Delta y - b \cdot \Delta k - (1 - b) \cdot \Delta n \qquad (23.4.2)$$

It is worth noting that following the seminal contributions by the US economist Robert Solow to the theory of growth, the annualised growth rate of A is also often called the "Solow residual". As mentioned above, over longer periods of time, the Solow residual is an approximation of technological change. Over shorter periods of time, however, it could also reflect the effect of the business cycle.

Can the government influence the growth of the autonomous factor? It is easy to see that, while a part of Δa (namely the emergence of innovations) is outside the scope of policy action, another part can be influenced by a variety of different government policies, such as, for instance, support for research and development, subsidies for education, and government capital formation measures.

23.5 A FIRST LOOK AT THE DATA

How much is the growth rate for the euro area? A very simple way of quantifying the latter would consist in an estimation that makes use of a linear trend. Using a sample from the first quarter of 1980 to the fourth quarter of 2016, we regress the (log of) real GDP on a linear time trend. This yields:

$$Log(Y) = y = 15.5 + 0.005 \cdot Trend \qquad (23.5.1)$$

Since we made use of quarterly data, we have to multiply the slope coefficient by 400 to get the annual trend increase for euro area growth over that period. This is a figure of roughly 2.0%. Not too bad, but there are countries that have performed much better.

23.6 SUMMARY

- Sustained divergences in the economic growth rates of individual nations over long periods of time can create substantial differences in living standards.
- The production function expresses real GDP in terms of the factor inputs (capital and labour) and an autonomous factor that reflects the influence of research, innovation, and other factors.
- An increase in the growth rate of real GDP per person requires either an increase in the growth rate of capital per person or an increase in the growth rate of the autonomous growth factor.
- The achievement of faster growth in capital per person asks for a higher ratio of savings to income. This, in turn, requires either a higher government surplus or tax incentives for household and business savings.
- The autonomous factor A is often interpreted as representing the technology available, such as, for instance, innovations, improvements in the production process and management techniques. Hence Δa stands for an improvement in the technology employed.
- Seen in this way, the production function mirrors the two factors involved in economic growth, namely factor accumulation and improvements in efficiency.

☑ Key Concepts

Economic growth, production function, factor inputs, autonomous growth factor, constant returns to scale, sources of growth, output per unit of input, total factor productivity, "Solow residual".

☑ Questions for Review

- How can a production function be characterised?
- What are the factors that determine growth in capital per person?
- What are the factors behind growth in the autonomous factor?
- What is the meaning of the "Solow residual"?
- In which sense does the production function mirror factor accumulation and improvements in efficiency?

☑ Digging Deeper

One issue in macroeconomic analysis has been the differing advice provided by economists to policy-makers regarding the role of savings during business cycles and for longer-term growth. What could be the key question there?

PART VII

24 LIST OF SYMBOLS AND ABBREVIATIONS

AD = *Aggregate Demand*
AS = *Aggregate Supply*
C = *Consumption*
c^{LR} = *Marginal propensity to consume out of permanent income*
€ = *Euro*
ε = *Elasticity*
EX = *Exports*
FV = *Future value*
I = *Investment*
i = *Nominal interest rate*
IM = *Imports*
i_{ST} = *Short-term nominal interest rate*
i_{LT} = *Long-term nominal interest rate*
k = *Cash holding coefficient (or currency deposit ratio)*
L = *Liquidity*
M = *Money*
MV = *Market value of the existing capital stock*
n = *Number of years*
P = *Price level*
PV = *Present value*
π = *Rate of inflation*
π^e = *Expected inflation rate*
Q = *Quantity*
Q = *(in Tobin's investment theory) the ratio of market value of the existing capital stock to its replacement cost*
QL = *Quadratic Loss (Function)*
r = *Real interest rate*
rr = *Reserve Ratio*
R = *Return*
RC = *Replacement cost of a firm's capital stock*
RE = *Reserves*
δ = *Standard deviation of a distribution*
δ^2 = *Variance of a distribution*
S = *Spot exchange rate*
t_c = *(percent) corporation tax*

t_r	=	*(percent) tax rebate on investment expenditure*
V	=	*Velocity of money*
Y	=	*Real GDP*
Y_D	=	*Disposable Income*
Y^N	=	*Nominal GDP*
Y^P	=	*Permanent income*
Y^T	=	*Transitory income*
*	=	*Equilibrium value*
^{A}	=	*Foreign variable*

25 GLOSSARY

Absolute Income Hypothesis: a theory of consumption advocated by John Maynard Keynes, stating in essence that current consumption is a function of current income. This hypothesis has also often been termed as the "theory of the day-labourer".

Accelerator Theory of Investment: an economic approach that models investment as a linear proportion of changes in output, as derived from a given production technology.

Adverse Selection (or, alternatively, "negative selection"): an expression that basically derives from the insurance business, where it characterises the situation of a bad outcome, which is – in essence – due to the existence of asymmetric information.

Aggregate Demand Curve (AD): the graphical location of all equilibria between prices and real income that emerge out of an unchanged IS curve and a changing LM curve. Along the AD curve, the market for goods and the money market are in equilibrium.

Aggregate Supply Curve: the graphical location of all equilibria that show – for various price levels – the corresponding real output, for which firms maximise their profits. Along the AS curve, firms are in equilibrium.

Animal Spirits: a colourful metaphor used by J.M.Keynes to explain that expectations are not driven by changes in economic fundamentals but, instead, predominantly by psychological factors.

Arbitrage: the simultaneous purchase and sale of a financial asset in order to exploit price differences and to realise a (risk-free) profit.

Asset Price Channel: one of the transmission channels of monetary policy.

Automatic Stabilizer: a fiscal policy variable that tends to reduce the amplitude of business cycle fluctuations, without the need for a deliberate decision by economic policy-makers.

Balance of Payments: a statistical framework that basically summarizes in a systematic way, for a specific period, the currency and commodity flows between a country and the rest of the world.

Bank of England: the central monetary authority of the United Kingdom, located in London.

Bank of Japan: the central monetary authority of Japan, located in Tokyo.

Basis Point: one basis point is equivalent to 0.01 percentage point.

Baumol Tobin Model: a money demand approach suggested by the US economists William Baumol and James Tobin. The model basically shows that the transactions demand for money depends not only on income but also on the interest rate.

BIS: Bank for International Settlements, located in Basel (Switzerland).

Brexit: a term commonly used in the press to describe the UK's decision to leave the European Union, following a majority vote in a referendum held on 23 June 2016.

Business Cycle: an expression that basically describes the fluctuations of real economic activity around its trend. The term "business fluctuations" is often used as a synonym in the literature.

Capital Account: a subaccount of the balance of payments that basically measures the flow of financial capital taking place between a country and the rest of the world.

Classical Economics: one school of economic thought that, among others, has its roots in the work of Adam Smith, David Ricardo and Jean-Baptiste Say (1767–1832).

Complementary Goods: a term describing the relationship between two goods. Given the fact that the goods complement each other, a decrease in the price of one good does not only raise the demand for this good, but also for the complementary good.

Convergence Criteria: the set of criteria that a member state of the European Union must fulfil in order to join the European Monetary Union.

Correlation Coefficient: a measure of the degree of association between two variables.

Credit Channel: one of the transmission channels of monetary policy.

Currency Area: a geographic area, in which the same currency holds.

Current Account: a subaccount of the balance of payments that basically measures the flows of goods and services and transfer payments taking place between a country and the rest of the world.

Cyclical Deficit: a deficit caused by the automatic increase in welfare expenditures and decrease in tax revenues occurring during a recession.

Cyclical Unemployment: the kind of unemployment that occurs over the business cycle.

Depression: an expression that is generally used to describe a recession, that is exceptional in scale as well as in duration.

Discouraged workers: those without jobs that, at some stage, simply give up looking for work and, therefore, are no longer counted as unemployed.

Dollar Exchange Standard: an expression used to describe the exchange rate system established in the Bretton Woods agreement. In this framework, the US dollar was tied to gold and the other member currencies were tied to the US dollar.

ECB: European Central Bank, the monetary authority of the euro area.

Economic Pillar: one of the two pillars that form part of the ECB's monetary policy strategy.

Elasticity (i.e. price elasticity): a concept measuring the degree with which a demand or supply curve reacts to a change in price.

EMI: European Monetary Institute.

EMU: European Economic and Monetary Union.

Exchange Rate Channel: one of the transmission channels of monetary policy.

Exchange Rate Mechamism II (ERM II): an exchange rate arrangement that was set up on 1 January 1999. Its main purpose is to help potential euro area members in their preparation for participation in the euro area and, at the same time, to create an evaluation mechanism for those countries.

Exchange Rate Targeting: one of the basic monetary policy strategies which basically involves fixing a currency in relation to another currency (or a basket of currencies).

Euro: the name of the currency of the euro area.

European Union (EU): an economic and political union currently consisting of 28 independent member states.

Eurosclerosis: an expression coined by the German economist Herbert Giersch in the 1970s. According to Giersch, eurosclerosis embraces three main ingredients, namely excessive government regulation, rather generous unemployment benefits and relatively high European tax rates.

Eurosystem: the central banking system that consists of the 19 national central banks (NCBs) in the euro area and the ECB.

Exchange Rate: the price of a currency expressed in terms of another currency.

Executive Board: one of the decision-making bodies of the European Central Bank.

Expenditure Approach: one of the approaches of calculating GDP as the value of expenditure on the final goods and services produced.

Federal Reserve Board (Board of Governors of the Federal Reserve System): A committee that consists of seven members and establishes monetary policy in the United States.

Federal Reserve System (Fed): consists of twelve regional Federal Reserve Banks located in major cities throughout the United States and a seven-member Federal Reserve Board of Governors with headquarters in Washington (D.C.).

Fiat Money: money that is given value only by a government decree.

Fiscal Dividend: an expression describing the fact that periods of good economic performance could result in a "quasi-automatic" increase in government's tax revenues.

Fiscal Drag: an expression describing the fact that, in case the higher tax revenues are not spent by the government or used for tax cuts, then the fiscal dividend might translate into a tendency of contractionary pressure on the economy.

Fisher Effect: a concept originally advocated by the US-economist Irving Fisher that explains the exact relationship between the nominal interest rate, the real interest rate and expected inflation.

FOMC: Federal Open Market Committee.

Flow Variable: an amount measured over a given unit of time.

Frequency Decomposition: a statistical technique that (in one of its variants) in essence decomposes a time series into three components, namely into a low frequency component, into a business cycle component and into a higher frequency component.

Frictional Unemployment: the kind of unemployment that refers to people, who are in the process of changing jobs.

Fundamental Psychological Law: a hypothesis originally brought forward by the British economist J.M. Keynes stating that a rise in income would lead to an increase in consumption, but not by as much as the increase in income.

GDP per Capita: an economic measure that takes account of GDP and the size of the population.

GDP Targeting: one of the basic monetary policy strategies basically aiming at targeting a certain level or growth rate of nominal GDP.

General Council: one of the decision-making bodies of the European Central Bank.

Gold Standard: a monetary system in which currencies were convertible into gold at a fixed parity and, consequently, exchange rates between coutries were fixed.

Governing Council: one of the decision-making bodies of the European Central Bank.

Government Deficit: the government deficit (surplus) basically explains by how much public sector expenses fall below (exceed) tax revenues. Similarly, the government debt represents, broadly speaking, the accumulation of public sector deficits run up in the past.

Grexit: a term commonly used in the press to describe a possible exit of Greece from the euro area.

Gross Domestic Product (GDP): an economic concept that corresponds to the market value of economic production of a particular country during a specified period, usually that time period is one year.

Gross Investment: the total spending of a firm on newly produced physical capital (i.e. fixed investment) and on inventories (i.e. inventory investment).

Gross National Product (GNP): an economic concept that measures the value of all final goods and services produced by domestic entities irrespective of their location.

Haavelmo Theorem: an economic concept that describes the fact that a balanced budget increase is not neutral, but expansive with respect to income.

Histogram: a chart that contains on its horizontal axis the variable of interest, whose values are divided into suitable intervals and the number of observations in that class is indicated by the height of the corresponding rectangles.

Hyperinflation: A situation, in which the economy shows a rapid (and often even accelerating) increase in the general price level that eventually gets out of control and, consequently, results in a rapid loss of the value of its purchasing power.

Hysteresis: In an economic context, the expression "hysteresis" describes the phenomenon that economic effects can become persistent even after their initial causes have disappeared. Among other things, this would imply that, even after some negative shocks have "died out", unemployment and GDP do not return to their long-run levels but keep on deviating for quite some time.

IMF: International Monetary Fund, located in Washington, D.C., USA.

Income Approach: one of the approaches of calculating GDP as the sum of factor payments, such the wages, interest, profits, and rents paid to factors of production.

Inflation: a sustained increase in the general price level of an economy, eventually leading to an ongoing loss of the purchasing power of money.

Inflation Targeting: one of the basic monetary policy strategies basically aiming at the developments of the inflation forecasts in relation to a publicly pre-announced medium-term numerical inflation target.

Interest Rate: the price charged to a borrower for the loan of a certain amount of money.

Interest Rate Channel: one of the transmission channels of monetary policy.

IS Curve: the geometric location of all combinations of interest rates and income that are compatible with an equilibrium in the market for goods.

Juglar Fixed Investment Cycle: one specification of the business cycle.

Keynesian Economics: an economic school that has its roots in the work of the British economist John Maynard Keynes (1883–1946).

Kitchin Inventory Cycle: one specification of the business cycle.

Kondratieff Cycle (or Kondratieff Wave): one specification of the business cycle.

Kurtosis: a statistical tool to measure the "peakedness" or flatness of the distribution of a series.

Kuznets Infrastructural Investment Cycle: one specification of the business cycle.

Labour Market: the market where labour supply (expressed by households) and labour demand (expressed by firms) meet.

Laffer Curve: a popular graphical representation of the relationship prevailing between the rates of taxation and the resulting levels of government revenue.

Law of Demand: a key principle in economics stating that the higher the price of a good, the lower the quantity demanded, other things being equal.

Law of Supply: a key principle in economics stating that the higher the price, the higher the quantity supplied.

Life Cycle Hypothesis: a theory of consumption advocated by the nobel prize winner Franco Modigliani, claiming in essence that consumption is a function of income over the whole life.

LM Curve: the geometric location of all combinations of interest rates and income that are compatible with an equilibrium in the money market.

Macroeconomics: a part of economics that deals with the large view and studies economy-wide phenomena such as, for instance, economic growth, business cycle analysis, inflation, unemployment, interest rates and many things more.

Microeconomics: a part of economics that takes the small view and focuses on questions like the decision-making of households and firms and the interaction in specific markets (such as, for instance, those for labour, money, goods and services, etc.).

Monetarist Economics: one school of economic thought that is closely linked to the work of the US-economist Milton Friedman.

Monetary Pillar: one of the two pillars that form part of the ECB's monetary policy strategy.

Monetary Targeting: one of the basic monetary policy strategies, basically aiming at the control of the ultimate objective (i.e. inflation) by use of pre-announced intermediate targets for the growth rates of a specific monetary aggregate.

Money: a good that provides three main functions, namely the function as a medium of exchange, as a store of value, and as a unit of account.

Money Illusion: a term describing the observation that households might erroneously focus on the level of nominal wages (instead of real wages), when deciding about the supply of labour.

Money multiplier: an economic concept that basically describes by how much an increase in the monetary base will be reflected in an increase in broader monetary aggregates.

Moral Hazard: an expression that basically describes the behaviour of an individual willing to take more risks because the costs will not be borne by the individual itself, but by others.

Multiplier: an economic concept that describes the fact that an increase in investment leads to a multiple increase in income.

Neo-Classical Economics: an economic school that, among others, has its roots in the work of William Jevons, Carl Menger and Leon Walras.

Neoclassical Theory of Investment: a coherent framework for investment explaining how much capital stock a firm is willing to hold at a particular point in time. The key variables explaining investment behaviour in this approach are the expected marginal product of capital and the (real) user cost of capital.

Net Investment: a measure that is commonly defined as gross investment minus capital depreciation.

Neutrality of Money: a concept claiming that changes in the money supply will, in the long run, lead to changes in nominal but not in real variables.

New Classical Economics: an economic school that is closely linked to the work of the US-economists Robert Lucas and Thomas Sargent.

New Keynesian Economics: an economic school that is closely linked to the work of Robert Gordon, Jordi Gali and Gregory Mankiw.

Nominal GDP: an economic measure that is calculated as the sum of the quantities of final goods produced times their current prices.

Nominal Wage: the wage expressed in monetary units (i.e. for instance in €).

Okuns Law: a rule of thumb that quantifies the relationship between (cyclical) unemployment and forgone GDP.

Opportunity Costs: a key concept in economics, which refers to the fact that every choice involves opportunity costs and the latter ones are usually expressed in terms of the amount of one good that has to be given up to acquire more of another good.

Optimal Currency Area (OCA): a concept that was pioneered by the Canadian economist and nobel-prize winner Robert Mundell.

Output Gap: the difference between the actual output of an economy and the respective value that could be achieved, when it is operating at full capacity.

Permanent Income Hypothesis: a theory of consumption advocated by the nobel prize winner Milton Friedman, claiming in essence that consumption decisions would not only be based on current, but also on expected future income.

Phillips Curve: a concept, originally describing the relationship between inflation and unemployment.

Portfolio Balance Approach: a model originally developed in the context of exchange rate economics. This kind of integrated approach, however, bears also useful insights for the theory of money demand.

Portfolio Selection Model: a money demand approach suggested by the US economist James Tobin. In essence, Tobin further extended Keynes' speculative demand for money and developed it into a fully-fledged portfolio selection theory.

P-Star Approach: a macroeconomic concept that links the so-called "price gap" to a so-called "velocity gap" (reflecting the liquidity overhang situation) and the so-called "output gap" (reflecting the business cycle situation).

Precautionary Demand for Money: one of the three motives for holding money, postulated by J.M. Keynes.

Price Level Targeting: one of the basic monetary policy strategies basically aiming at the developments of the price level relative to a publicly pre-announced price level target.

Quantity Theory: a key concept in economics that basically describes the link between money and prices.

Real GDP: an economic measure in which the effect of increasing prices has been eliminated and, thus, accounts exclusively for the rise in production.

Real Wage: the ratio between the nominal wage and the price level, thus basically expressing the purchasing power of money.

Relative Income Hypothesis: a theory of consumption advocated by James Duesenberry, stating in essence that consumption depends on the relative income position and, thus, on the social status of the individual (i.e. "to keep up with the Joneses").

Ricardian Equivalence: a key concept in economics, stating that – under the assumption of the rational expectations hypothesis – rising government deficits will not exert any influence on interest rates because households will foresee a higher tax burden in the future and, thus, start to save already today.

Sacrifice Ratio: the ratio of the forgone output to the decline in inflation caued by a restrictive monetary policy. It can be seen as a measure of the costs associated to a monetary tightening.

Scandinavian Model of Inflation: a macroeconomic approach that links the inflation rate in an economy to a term labelled as "imported inflation" (since the increase in prices for tradable goods is dictated by international competition), and a term labelled as "structural inflation" (which mirrors the relative differences in the productivity changes of the two sectors).

Scarcity: a key concept in economics, which refers to the fact that resources are limited, whereas wants and needs are unlimited.

Scatterplot: a graph that contains two series, in which the values of the second series are plotted against the values of the first series.

Seasonality: a pattern of cyclical variation occurring in a repetitive and predictable fashion. Such a behavior is not uncommon for many economic time series.

Skewness: a measure of data distribution that shows whether large deviations from the mean are more likely towards one side than towards the other.

Slope: the slope of a curve shows how a variable reacts to changes in another variable. In a chart with Y on the vertical and X on the horizontal axis, the slope of the curve is defined as the change in Y (or, alternatively, the "rise" in Y) which results from a one-unit change in X (or, alternatively, the "run" in X).

Speculative Demand for Money (or Asset Demand for Money): one of the three motives for holding money, postulated by J.M. Keynes.

Standard Deviation: a statistical tool to measure the variability or dispersion of a given data set.

Stock Variable: a quantity measured at a given point in time.

Structural Deficit: a deficit that materialises when the economy is in equilibrium (i.e. at the potential level of GDP).

Structural Unemployment: the kind of unemployment that refers to people that have either not acquired the skills needed in the labour market or live in the wrong area.

Substitute Goods: a term describing the relationship between two goods. In case, the goods are substitutes, an increase in the price of one good will lead to a decrease in the demand for this good and, at the same time, to an increase in demand for the other good.

Taylor Rule: a monetary policy rule first advocated by the US-economist John B. Taylor. In essence, the rule postulates a linear relationship between the short-term interest rate (the key policy instrument of the central bank) and some key macroeconomic determinants.

Time Inconsistency Problem: an economic phenomenon that basically refers to the observation that policy-makers always face an incentive to change their policies once they have announced it and markets have reacted accordingly.

Time Series Chart: a chart showing the time dimension on the horizontal axis and the variable under review on the vertical axis.

Tobin's Q: a key variable suggested by the US economist James Tobin as the main driving force of investment. The measure is defined as the ratio of the market value of the existing capital stock to the replacement cost of the capital stock.

Trade Balance: the difference between a country's exports and its imports. If the trade balance is positive (negative), a country is said to have a trade surplus (deficit), that is the country sells more (less) to other countries than it buys from them.

Transactions Demand for Money: one of the three motives for holding money, postulated by J.M. Keynes.

Two-Pillar Phillips Curve: a macroeconomic concept (first proposed by Gerlach and Svensson) that links the so-called "price gap" to a so-called "real money gap" (reflecting the liquidity overhang situation) and the so-called "output gap" (reflecting the business cycle situation).

Unconventional Monetary Policy: the monetary policy approach followed by many central banks in order to provide additional monetary easing, while being constrained by the zero lower bound (ZLB) for interest rates.

Unemployment: status, when people are without work and actively seeking for work.

Unemployment Rate: the ratio of the number of unemployed people to the total labour force (usually explained in terms of percentages).

Value Added Approach: one of the approaches of calculating GDP as the sum of the values added at all stages of the production process.

26 ANNEXES

26.1 STOCKS AND FLOWS

There are various types of data in economics and statistics and it is important to recognise the nature of these data when interpreting them. In this respect, a simple example often used in the literature is a bathtub that is filled with water. A certain rate of water is entering and leaving the bathtub at any minute in time (i.e. the inflow and the outflow). Besides, there is a certain volume of water in the bathtub (i.e. the stock of water). It is easy to imagine what happens to the volume of water (i.e. the stock), if the inflow remains steady and there is no outflow or, if the outflow is larger than the inflow and many things more.

In economics, stocks, such as for instance, the stock of money usually refer to a specific point in time, say, for example to the end of the quarter or the end of the year. Like in the previous example, stocks can accumulate or decumulate. By contrast, flows are measured over a specific interval in time (such, as for instance, over the next month or quarter). In economic practice, flows often have to be adjusted for reclassifications, foreign exchange variations and other kind of revaluations in order to get a coherent picture of the underlying transactions. As a rule, in the daily work, caution is needed, since stocks and flows can sometimes not directly be compared in a meaningful way.

2.6.2 SOME LARGE NUMBERS

Attached are some large numbers and the corresponding expressions often used in the financial sphere:

Ten	deca	10
Hundred	hecto	100
Thousand	kilo	1,000
Million	mega	1,000,000
Billion	giga	1,000,000,000
Trillion	tera	1,000,000,000,000
Quadrillion	peta	1,000,000,000,000,000
Quintillion	exa	1,000,000,000,000,000,000
Sextillion	zetta	1,000,000,000,000,000,000,000
Septillion	yotta	1,000,000,000,000,000,000,000,000

26.3 LEVELS AND GROWTH RATES

Many economic variables, such as for instance, inflation or money growth are generally expressed in terms of annual growth rates, which basically summarise today's information and the respective development one year ago in a single figure. The annual prespective is, however, just by international convention and not the only way of expressing developments in these data.

In principle, there are three ways of calculating the annual growth rates of a variable Y in percentages:[325]

$$\Delta Y = \left[\frac{Y - Y_{t-12}}{Y_{t-12}}\right] \cdot 100 \qquad \text{(A.26.3.1)}$$

$$\Delta Y = \left[\frac{Y - Y_{t-12}}{Y_t}\right] \cdot 100 \qquad \text{(A.26.3.2)}$$

$$\Delta Y = \left[\log(Y) - \log(Y_{t-12})\right] \cdot 100 = \left[y_t - y_{t-12}\right] \cdot 100 \qquad \text{(A.26.3.3)}$$

where small letters denote logarithms. In case of rather small values of change, the first two options are basically similar. In case of more substantial changes, the first alternative will yield larger values. Economists involved in empirical analysis often make use of the third alternative that can be seen as representing a good compromise.

26.4 SOME USEFUL GRAPHICAL MEASURES

In this annex a number of graphical concepts will be introduced, all of which represent helpful tools in today's economics.

A first very simple tool that can be deemed of help in data analysis are time series charts or, alternatively, time series graphs. By definition, such a chart shows the time dimension on the horizontal axis and the variable under review on the vertical axis. In economic analysis, these charts often turn out to be very useful as they help to get a first impression about magnitudes, trends, variability, cycles, outliers, periods, and many other issues.

The next tool is again of a graphical nature. The so-called "scatterplot" is a graph that contains two series, whereby the values of the second series are plotted against the values of the first series. Why could this be of help? Well, it is often not intuitively clear, what exactly the relationship between two time series is. For instance, how do inflation and money behave vis-à-vis each other? When you are confronted with such a question, scatterplots allow you to examine visually the relationship between the two variables and that is often quite telling.

Another very simple but nevertheless very helpful graphical device is a "histogram".[326] On the horizontal axis of this kind of chart, the variable of interest is divided into suitable intervals and the number of observations in that class is then indicated by the height of the corresponding bars.[327] Such a chart usually gives a good indication of the frequency of specific observations and, thereby, of the distribution of the underlying data.

A large number of economic time series also typically exhibit a pattern of cyclical variation widely known as seasonality. As the name implies, seasonality can thought of as occurring in a repetitive and predictable fashion. It is, for instance, a well-known fact in economics and statistics that retail sales and, in parallel, currency in circulation increase before and during the Christmas period and decline afterwards. Seasonality can often be detected easily by simple visual inspection and it can be removed by a number of statistical techniques. One quite popular approach for seasonal adjustment is the use of dummy variables.[328]

26.5 SOME USEFUL STATISTICAL MEASURES

In this section, a number of descriptive statistical concepts will be introduced, all of which can prove useful in complementing the graphical analysis. To begin with, the "mean" represents the average value of the series under investigation. It is obtained by simply adding up the series (Y) and afterwards dividing the result by the number of observations (N). Formally, the mean ($\bar{Y}$) can be calculated as follows:[329]

$$\bar{Y} = \frac{1}{N}\sum_{i=1}^{N} Y_i \qquad \text{(A.26.5.1)}$$

By contrast, the "median" is represented by the middle value (or the average of the two middle values) of the series, when the values are ordered according to size (i.e. from the smallest to the largest value). The median must be seen as a very popular measure in applied empirical work as it represents a robust measure of the centre of the distribution that is much less sensitive to outliers than for instance the mean.[330] In many cases, also the maximum and minimum values of the series under investigation give useful insights.

The "standard deviation" represents a rather simple tool to measure the variability or dispersion of a given data set. More specifically, a low standard deviation indicates that the data points tend to be very close to the mean, while a high standard deviation reveals that the data are more "spread out". Among other things, the standard deviation is of particular relevance in the area of finance, where the standard deviation of a rate of return is generally interpreted as a measure of risk. Formally, the standard deviation ($\hat{s}$) is calculated as follows:

$$\hat{s} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(Y_i - \bar{Y})^2} \qquad \text{(A.26.5.2)}$$

A related concept is the one of "skewness". The latter represents a measure of the data distribution that shows, whether large deviations from the mean are more likely towards one side than towards the other. In the case of a symmetrical distribution, deviations on either side of the mean are equally likely. As a consequence, the skewness of a symmetric distribution is zero. A positive skewness is equivalent to saying that the distribution has a long right tail and, therefore, large upward deviations are more likely than large downward ones. By contrast, a negative skewness means that the distribution has a long left tail and, thus, large downward deviations are more likely than large upward ones. Formally, the skewness (S) is calculated as follows:

$$S = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{Y_i - \bar{Y}}{\hat{s}}\right)^3 \qquad \text{(A.26.5.3)}$$

The concept of "kurtosis" is a suitable tool to measure the "peakedness" or flatness of the distribution of a series. It can be shown that the kurtosis of the normal distribution equals exactly a value of 3. If the kurtosis of the series under investigation exceeds the value of 3, the distribution is peaked (i.e. "leptokurtic") compared to the normal distribution. By contrast, if the kurtosis is less than the value of 3, the distribution is flat (i.e. "platykurtic") relative to the normal distribution.[331] Formally, the kurtosis (K) is calculated as follows:

$$K = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{Y_i - \bar{Y}}{\hat{s}}\right)^4 \qquad \text{(A.26.5.4)}$$

26.6 THE CORRELATION COEFFICIENT

In this annex, we have a closer look at the so-called "correlation coefficient" ("*CC*"), which basically represents a measure of the degree of association between two variables X and Y. It can be computed as follows:[332]

$$CC = \frac{\sum\left[(X_i - \bar{X})\cdot(Y_i - \bar{Y})\right]}{\sqrt{\sum(X_i - \bar{X})^2 \cdot \sum(Y_i - \bar{Y})^2}} \qquad \text{(A.26.6.1)}$$

Admittedly, the formula looks quite impressive at first glance. This notwithstanding, you should not be worried too much as, in practice, most software packages can calculate it very easily for you. What could be the possible use of this measure? For instance, it plays a role in modern portfolio analysis, as for reasons of diversification, you are supposed to aim at holding stocks in your portfolio that are negatively correlated with each other since in case one asset declines, the other one rises.

It is fair to say that there is no general agreement on the fact, when a correlation can be called "high" or "low". In practice, however, quite often values of the correlation coefficient that range (in absolute terms) between 0.1 to 0.3 are termed as a "small" correlation, values between 0.3 to 0.5 are seen as indicating a "medium" correlation and values between 0.5 to 1.0 are noted as a "high" correlation.[333] At the same time, it is worth taking note of some important properties of this measure: First, it is non-dimensional, since the numerator and the denominator are measured in the same unit of account. Second, it can be positive or negative, the sign depending on the term in the numerator. Third, it lies between the limits of -1 and +1. Fourth, it is symmetric in nature, that is the coefficient of correlation between X and Y is the same than the one between Y and X.[334] Fifth, if X and Y are statistically independent, the corresponding correlation coefficient is zero. If, however, the correlation coefficient between two variables is zero, it does not necessarily mean that the two variables are independent. Note that this measure will only reflect the degree to which variables are linearly related. For instance, two variables might be perfectly related in a non-linear way (e.g. $Y = X^2$) and still result in a low value for the correlation coefficient.

26.7 LINEAR REGRESSION

A concept that resembles the one of correlation in many ways, but differs in many other ways, is the one of "linear regression". Perhaps the most important difference between these two concepts relates to the fact that, in linear regression, it is assumed that the variable on the right-hand side influences the one on the left-hand side, but not vice versa (which, in a way, can be thought of as a kind of "causality"). In general terms, a regression equation looks as follows:

$$Y = \alpha + \beta \cdot X + \delta \cdot Z + \varepsilon \qquad \text{(A.26.7.1)}$$

A number of remarks are worth being made.[335] To begin with, the variable that is meant to be explained is the so-called "dependent variable" (here Y), whereas the variables that are used to explain the dependent variable are the "independent variables" (here X and Z).

For each independent variable, the estimation renders the estimated coefficient as well as the so-called "t-statistic". The t-statistic tells you, how confident you can be that the true coefficient is different from zero. A t-statistic above 2 indicates that one can be at least 95% sure, that the true coefficient is different from zero.

The estimated coefficients of course reflect the interrelationships among the variables over the sample period.[336] One of the "measures of fit" for such an equation is denoted by the so-called "R^2". In general terms, it can be stated that the closer this measure is to one, the better the regression line fits the data. By contrast, a lower value would indicate that a substantial amount of the movements in the dependent variable cannot be explained by movements in the independent variables.

27 LIST OF FIGURES AND BOXES

☑ List of Figures

☑ List of Boxes

28 REFERENCES

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ENDNOTES

1. The text partly builts on some work that the author has carried out for the European Central Bank many years ago, but mostly goes far beyond that coverage.
2. It is not possible to do justice to all details in economic thinking in just one short paragraph. See Issing (1994) for a more detailed perspective.
3. Although the expression "neoclassical synthesis" seems to have been coined much later, following the suggestions put forward in Samuelson (1967, chapter 19).
4. See Friedman and Schwarz (1963).
5. See, for instance, Mankiw (1987) und Gali (2015).
6. Similar considerations can be found in Chiang (1984, p. 38).
7. The term "ceteris paribus" derives from Latin. In literal translation, it means "all other things being equal or held constant".
8. See also the deliberations in Cassler (1992, p. 27).
9. See, in particular, Chiang (1984).
10. See Samuelson and Nordhaus (2005, pp. 66–70) for a more detailed description.
11. Using percentage changes has the effect that a change in the unit of measurement does not change the elasticity. So, independent of the fact whether prices are measured in euro or in cent, the price elasticity will stay the same.
12. Similar considerations can of course be applied to the elasticity of supply.
13. See Annex 26.1 for a more detailed overview on stocks and flows.
14. See Mishkin (2012, p. 19).
15. See also Hall and Taylor (1996, pp. 22 ff).
16. See also Burda and Wyplosz (2001, p. 22) for these issues.
17. See Schneider and Enste (2000).
18. See Nordhaus and Tobin (1972).
19. See also Browne (1995, pp. 562 ff).
20. Inventories changes are classified as investment because current inventories represent future sales.
21. See Annex 26.2 for a survey on large numbers.
22. We will return to this issue at a later stage.
23. See Duesenberry, J. (1949), Ando, A. and Modiglian; F. (1963), Modigliani, F. and Brumberg, R. (1954), and Friedman, M. (1957).
24. To keep things easy, however, we assume that the interest rate to be paid for a loan just equals the interest rate that is received when you invest the same amount in the market. By doing so, we circumvent for the moment the problems arising from different interest rates on own funds and external financing.
25. See, for instance, Burda and Wyplosz (2001, p. 231 ff).
26. Similar considerations can be found in a number of ECB publications. See, for instance, ECB (2011a, b, c) or Scheller (2004).
27. See ECB (2011b, pp. 18 ff).
28. At the time of writing this version (i.e. in mid-2017), there were nineteen governors of euro area NCBs.

29. See Treaty on the European Union, Treaty on the Functioning of the European Union and the Statute of the European System of Central Banks and of the European Central Bank, available on "www.europe.eu" and "www.ecb.europa.eu".
30. The first president of the ECB was Wim Duisenberg, the former president of De Nederlandsche Bank, the Dutch national bank, and former finance minister of the Netherlands. In November 2003, he was succeeded by Jean-Claude Trichet, the former president of the Banque de France. In November 2011, Mario Draghi, the former governor of Banca d'Italia, became the third president of the ECB.
31. See Marshall (1999), but also Issing (2008, p. 27).
32. See Irwin (2013, pp. 112 ff).
33. See Irwin (2013, pp. 300 ff).
34. This assumption must not necessarily hold as broader monetary aggregates typically also include endogenous components, such as time and savings deposits.
35. See, for instance, Hall and Taylor (1996, pp. 397 ff).
36. See Baumol (1952) and Tobin (1956).
37. In the words of Keynes (1936, p. 195): "Money held for each of the three purposes forms, nevertheless a single pool, which the holder is under no necessity to segregate into three water-tight compartments; for they need not be sharply divided even in his own mind, and the same sum can be held primarily for one purpose and secondarily for another". In practice, however, this partitioning is often illustrated by the example of separate segments of a wallet.
38. In the literature, the following considerations are often expressed in terms of the "LM function". It should be noted, however, that also the money market equilibrium that has been derived under the assumption of a given income, represents an LM function.
39. See Hicks (1937).
40. Against the background of our previous considerations regarding "Walras' Law", one could of course also argue that every point on the LM curve represents an equilibrium in the financial market.
41. It is fair to say, however, that Keynes himself apparently regarded such a situation as a rather theoretical case, since he wrote: "I know no example of it hitherto" (Keynes, 1936, p. 207). Modigliani interpreted Keynes absolute liquidity preference "as a curiosity and not the true hallmark of the Keynesian" (see Modigliani, 1944, p. 221). Against this background, the concept did not receive too much attention for decades, until Paul Krugman revived it (Krugman, 1998).
42. See Friedman and Meiselman (1963).
43. For a more detailed discussion, see, for instance, Gordon (1984, pp. 212 ff.) and the literature quoted there. Gordon explicitly stresses the difference between "notional" and "effective" labour demand.
44. See also ECB (2004).
45. The deliberations in these paragraphs follow quite closely the ones in Gerdesmeier (2011b, Box 4.2).
46. As we have seen in earlier chapters, economists often phrase a decline in money demand in terms of an increase in the velocity of money. The latter variable can be defined as the speed with which money is transferred between different money holders and thus determines how much money is required to serve a particular level of transactions. In fact these two phenomena must be regarded as two different sides of the same coin. If people want to hold less money, this means that – given a constant money supply – the available stock of money has to change hands more often and so circulates more. This is equivalent to a higher velocity of money.

47. This level is sometimes also called the "natural" level of GDP. This is due to the fact that the natural level of GDP is the level that prevails when employment is equal to its natural level.
48. See, for instance, Blanchard (1997, p. 29). By contrast, a process of a sustained decrease in the general level of prices is widely known as a process of deflation.
49. In the words of Milton Friedman: "Inflation is always and everywhere a monetary phenomenon".
50. See Keynes (1936, p. 96).
51. See Kuznets (1946).
52. See Friedman (1959) for details.
53. See Modigliani and Brumberg (1954) as well as Ando and Modigliani (1963).
54. In line with this, also stock market developments can be expected to have an impact on consumption.
55. However, the latter figure might have to be adjusted, in case of possible holdings of assets coming from sources other than work.
56. Both are, for the sake of simplicity, expressed in terms of years.
57. There are in fact two versions of the accelerator hypothesis existing in parallel in the literature. The first one links investment to actual production, while the second one links it to expected production.
58. See Jorgensson (1963, 1967) for details.
59. It goes without saying that deflation – or a general decline in the price level – increases the real value of debt.
60. See also the much more detailed discussion in Mankiw (2010, pp. 532 ff).
61. See Tobin (1969).
62. A number of observations are fine at this stage. Abstracting from inconsistencies, at any point in time, the cyclical deficit and the structural deficit add up to the actual deficit. Therefore, the difference between the actual deficit and the structural deficit is, by definition, the cyclical deficit. Vice versa, the structural deficit found at the potential level of GDP serves as a reference point for gauging the size of the cyclical deficit. At the same time, the presence of the concept of potential output in the determination of the structural deficit raises the issue of its quantification and the projection of the corresponding values for government expenditures and tax revenues.
63. The name "Laffer curve" stems from the fact that its graphical form was first sketched on a napkin during a meeting by the US-economist Arthur Laffer.
64. See Baumol (1952) and Tobin (1956).
65. The explanation follows very closely the respective deliberations in Gerdesmeier (2015).
66. Expressed in terms of the traditional IS-LM-diagram, this is equivalent to saying that the LM curve is upward-sloping, even in the absence of a speculative demand for money.
67. A theoretical exception could be the case, when the expected yields of money and bonds would be exactly identical.
68. See Tobin (1958) and Markowitz (1959).
69. In the literature, this statement is generally attributed to James Tobin, a famous Yale-economist. Being asked by journalists about a simple sentence summarising his ideas, he answered: "You know, don't put all your eggs in one basket". On the next day, this sentence could be found on the front pages of various newspapers. See, for instance, the Guardian, 5 March 2009.
70. See Friedman (1956) for details.
71. See also Gerdesmeier (2011a, pp. 47 ff).
72. See Frankel (1983) and Obstfeld (1982).

73. See, for instance, Goldfeld (1976).
74. See Goodhart (1975) for details.
75. See Issing (1997) for a more detailed explanation.
76. See De Santis, Favero and Roffia (2008).
77. See, for instance, Ueda (1990) for the case of Japan.
78. See, for instance, Coenen and Vega (2001), Calza, Gerdesmeier and Levy (2001), Gerlach and Svensson (2003), Bruggeman, Donati and Warne (2003), Brand and Cassola (2004), Greiber and Lemke (2005), Carstensen (2006), Dreger and Wolters (2006), De Santis, Favero and Roffia (2008) and Beyer (2009).
79. See von Landesberger (2007).
80. See, for instance, Moutot, Gerdesmeier, Lojschová and Von Landesberger (2007).
81. See Scheller (2004, in particular pp. 28 ff) for more details.
82. The expression was selected by the Governing Council of the ECB in 1998.
83. As we shall see in more detail below, however, once the convergence criteria have been fulfilled, an EU country can adopt the euro.
84. See Article 127 of the Treaty establishing the European Community.
85. See also Gerdesmeier (2011b, pp. 55 ff).
86. Both the Governing Council and the Executive Board are chaired by the President of the ECB.
87. All six members of the Executive Board are appointed by common accord of the Heads of State or Government of those countries that together form the euro area.
88. For a more detailed description, see James (2012, pp. 210 ff), but also Scheller (2004, pp. 15 ff).
89. The two main tasks of the EMI included the strengthening of central bank cooperation and monetary policy coordination and the contribution to the preparations required for the establishment of the ESCB, for the conduct of the single monetary policy and for the creation of a single currency in the third stage. See Scheller (2004).
90. For details, see ECB (2011b). Compared with some of its individual member countries, the euro area is a large and much more closed economy.
91. Sources: ECB, Eurostat, national data and ECB calculations as well as BIS, IMF, OECD, Reuters and national sources. Population in millions, GDP in percent of world GDP in PPP, GDP per capita in € thousands, unemployment in percent of the labour force, gross debt, exports, imports and current account balance as percent of GDP.
92. See Mundell (1961) for details.
93. See Tavlas (1993) for an in-depth discussion of the "new" theory of optimum currency area.
94. See Fleming (1971).
95. See McKinnon (1963).
96. See Kenen (1969).
97. See Friedman (1953).
98. See Tavlas (1993, pp. 666 ff) and the detailed literature review therein.
99. See Molle (2001, pp. 372–373). For a view from the US, see the interesting summary by Jonung and Drea (2009).
100. These criteria were laid down in the Maastricht Treaty and were signed by the members of the European Union on 7 February 1992.
101. As will be shown in later chapters, this criterion has not always been applied in a very strict manner.

102. See ECB Press Release (2014a). The benchmark values for inflation and long-term interest rates were calculated on the basis of the unweighted arithmetic average of the rates of HICP inflation over the last 12 months in Latvia (0.1%), Portugal (0.3%) and Ireland (0.3%).
103. See, for instance, De Grauwe (2000).
104. See Pasinetti (1998).
105. Losses in income and wealth would be the inevitable consequence.
106. In case, financial markets hold a suspicion of similar exit solutions also for other (weak) countries, the latter might face a real danger of sudden capital outflows.
107. See ECB (2015b) for details.
108. See Bordo and Jonung (1999) for details.
109. See Stiglitz (2016, pp. 7 ff and pp. 272 ff).
110. See Stiglitz (2016, p. 295).
111. See Drudi, Durré and Mongelli (2012).
112. See European Commission (2015), Annex 1 for details.
113. See the seminal contributions of Mitchell (1913), Burns and Mitchell (1946) and the discussion in Koopmans (1947).
114. See, for instance, Haberler (1937) for an early systematic overview.
115. See Blanchard (1997, pp. 18 ff), but also Samuelson and Nordhaus (2005, pp. 468 ff).
116. It is worth noting that using the term "business cycles" can be a rather misleading concept as it somehow implies the notion of "regularity", which, however, is clearly not the case in reality.
117. See Samuelson (1939).
118. See Annex 26.3 for a brief overview on levels and growth rates.
119. See Annex 26.4 for a discussion of various graphical concepts.
120. See Bombach (1985) for details.
121. Although there seem to have been early predecessors in the Netherlands.
122. Some of these cycles have first been identified in Schumpeter (1911).
123. See also the more detailed discussion in Burda and Wyplosz (2001, pp. 339–353).
124. To start with, it is useful to classify the different explanations into two categories, namely exogenous and endogenous sources of the cycle. As the name suggests, exogenous theories assign business cycle fluctuations to events that happen outside the economic system, such as, for instance, wars, discoveries, scientific breakthroughs and technological innovations, but sometimes also to sunspots, or the weather. By contrast, endogenous theories primarily regard mechanisms within the economic system as a source of the generation of business cycles.
125. See Samuelson (1939) for details.
126. See Burda and Wyplosz (2001).
127. As will be shown in later chapters in more detail, stock markets are indeed able to act in a very forward-looking manner and to process available and relevant information at very high speed. Against this background, they have often proven able to anticpate economc downturns before the latter materialise. This notwithstanding, stock markets have also sometimes issued "false signals" (i.e. situations that did not translate into recessions). Therefore, as a rule, caution is warranted when interpreting the reactions of stock markets.
128. See Friedman and Kuttner (1998).
129. See Hodrick and Prescott (1997) for details.

130. Expressed in other words: The larger the lambda-parameter, the smoother the sigma of the original time series.
131. See Brand, Reimers and Seitz (2005) and von Landesberger (2007).
132. See Blanchard (1997, p. 26 ff).
133. See Blanchard (1997, p. 27).
134. To be more precise: in essence, there are more unemployed workers than job openings due to the breakdown of the economy.
135. The success of the HARTZ reforms seems to be even more remarkable, as in the past, such reforms have often been avoided when they promised to bear fruit only over lionger horizons but not over the short term, owing to political economy considerations.
136. In fact, some economists even hold the view that frictional unemployment should be seen as a kind of transaction cost of trying to find a new job.
137. See also the deliberations in Gerdesmeier (2011b, p. 26 ff).
138. See Dornbush, Fischer and Starz (2004, p. 39).
139. See Gerdesmeier (2011a, p. 78). It is assumed that the amount in the base year equals 100. The table then shows the remaining purchasing power after the indicated number of years for a given inflation rate.
140. See ECB (1999a and 2003) for details.
141. However, given its role as a key user, the Eurosystem has also been closely involved in this work. See also ECB (2011b) and the much more detailed considerations in Camba-Mendez (2003).
142. See Pollard (2003, p. 20).
143. See also ECB (2011b, pp. 65–66). Traditionally, food prices are divided into processed and unprocessed foods. This separation is due to the fact that prices for the latter are influenced by factors such as weather conditions and seasonal patterns, while such factors have less of an impact on processed food prices.
144. See Weber (2007) for a more detailed decription of these issues.
145. The concept of core inflation as a measure of inflation that excludes food and energy prices was – to our best knowledge – first introduced in Gordon (1975).
146. Parts of this section draw heavily on Gerdesmeier (2015, Chapter 5.5).
147. These problems have been well documented in the well-known "Boskin report". See Boskin et al. (1996, 1998), who conclude that – in case of the United States – the CPI overstated inflation by about 1.1 percentage points per year in 1996 and about 1.3 percentage points prior to 1996.
148. See Cagan (1956) for details.
149. See also Gerdesmeier (2011b, pp. 31 ff).
150. See Frenkel (1977) for details.
151. See Hanke (2008, 2009).
152. See also the description in Gerdesmeier (2015, chapter 2). For a more detailed overview on some descriptive statistical measures, see Annex 26.5.
153. See, for instance, the considerations outlined in Bleymüller et al. (1983, pp. 15 ff).
154. See also Gujarati (2003, pp. 148 ff).
155. See also Pill und Rautanen (2006).

156. It is worth noting, however, that the definition of the exact boundaries of the decomposition remains in some sense arbitrary: Moreover, the decomposition also constitutes an accounting exercise as the sum of the various frequencies must necessarily add up to the headline series.
157. See Hamilton (1989).
158. The regimes would differ, for instance, in their respective means and variances.
159. See Krolzig (1997).
160. It goes without saying that the filtered value corresponds to the smoothed value when the entire sample is used.
161. See Amisano and Fagan (2013) and Amisano, Colavecchio and Fagan (2014) for a more elaborated version of an MS-model.
162. The opposite definition is also frequently used in the academic literature.
163. See, for instance, van Marrewijk (2004, p. 24).
164. For a theoretical model of an exit from a monetary union, see Cooper (2012).
165. It is normally expressed in index form.
166. See Mishkin (2003, p. 512).
167. See Mishkin (2003, p. 513).
168. Some economists even argue that the ideas underlying purchasing power parity have a history dating back at least to scholars at the University of Salamanca in the 15th and 16th century, see Officer (1982).
169. This description draws from Claassen (1980, pp. 424 ff) and Pillbeam (2005, pp. 138 ff).
170. The time index t is omitted for the sake of simplicity.
171. See Balassa (1964), Samuelson (1964) as well as Isard (1977).
172. See Mussa (1979).
173. See Officer (1982).
174. Such a transformation can be done on the basis of the assumption of the purchasing power parity for tradable goods. See also Pillbeam (1998, pp. 140 ff).
175. For the following considerations, see also Dornbush (1976).
176. This would imply that there is no difference in the "perceived riskiness" of one asset relative to the other.
177. Another way of saying the same thing is that the investor does not care about the underlying risks.
178. See Article 140(1) of the Treaty establishing the European Community.
179. Exceptions to this rule are only possible if all ERM II stakeholders agree.
180. See Fisher (1911). It is worth mentioning, however, that some authors seem to have found such kind of relationship already in earlier writings. See, for instance, Volckart (1997) for a study on the work of Copernicus.
181. See Friedman (1956) for details.
182. See Phillips (1958) and ECB (2014d) for some empirical results for the euro area.
183. See Samuelson and Solow (1960).
184. Milton Friedman and Edmund Phelps received the Nobel Prize in Economics in 1976 and 2006, respectively.
185. See Friedman (1968) and Phelps (1967, 1968).
186. In the words of Friedman: "But people, who are forming anticipations are not fools – at least some of them are not. They are not going to persist in being wrong. And more generally they are not going to base their anticipations solely on the past history of prices". See Friedman (1976, p. 231).

187. Friedman explicitly referred to the so-called "adaptive expectations" when deriving his results.
188. Again Friedman: "The only way unemployment can be kept below the natural rate is by an ever-accelerating inflation, which always keeps current inflation ahead of anticipated inflation". See Friedman (1976, p. 227).
189. It is worth noting that some economists prefer to substitute the notion of the "natural rate of unemployment" with the concept of a "non-accelerating inflation rate of unemployment" ("NAIRU"). The logic of the latter expression is caused by the observation that an actual unemployment rate below the natural rate will often lead to an acceleration of inflation, while with unemployment above the natural rate, inflation generally decelerates. With the actual rate equal to the natural rate, inflation is stable, neither accelerating nor decelerating.
190. See Balassa (1964), Samuelson (1964) as well as Isard (1977), but also the illustrative expositon in Claassen (1980) and Pillbeam (2005).
191. See Aukrust (1970) and Edgren, Faxen and Odhner (1969).
192. See Hallman, Porter and Small (1989, 1991).
193. See Tödter and Reimers (1994) for a concrete application for the case of Germany.
194. See, for instance, Hoeller and Poret (1991). It is fair to say, however that a number of economists have criticized the P-Star approach for a lack of microfoundations.
195. See Gerlach and Svensson (2003) and Gerlach (2004).
196. See Claassen (1980, pp. 298 ff).
197. It goes without saying that the influence of earlier periods (with a corresponding decay in weights) can also be taken into account.
198. See Muth (1961), but also Lucas (1972).
199. Implicitly, this assumes the existence of a normal distribution and, thus, abstracts from the existence of regime shifts or structural breaks.
200. In this respect, some authors have criticized that it is not entirely clear what the term ”rational” implies if different approaches about the underlying macroeconomic dynamics exist. See Frydman and Phelps (1983) for this argument.
201. Against this background, it is obvious that rational expectations also embody a systematic learning effect.
202. In the words of Keynes: "Even apart from the instability due to speculation, there is the instability due to the characteristic of human nature that a large proportion of our positive activities depend on spontaneous optimism rather than mathematical expectations, whether moral or hedonistic or economic. Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as the result of animal spirits – a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities". See Keynes (1936, pp. 161–162).
203. See, for instance, Akerlof and Shiller (2009),
204. See Dreger at al. (2016).
205. Seen from that perspective, several issues then boil down to a closer understanding of the behaviour of time series at different frequencies. In the older literature, mostly the so-called "Fourier analysis" was used to study the cyclical nature of a time-series in the frequency domain. This, however, had the major disadvantage that, under the Fourier transformation, the time information of a time series got (at least partly) lost. Moreover, the classical techniques can only be used in case time series are

stationary. Unfortunately, most macroeconomic time series are noisy, complex and typically strongly non-stationary. As a consequence, more recently, some authors have made use of the so-called "Wavelet analysis", which performs the estimation of the spectral characteristics of a time-series as a function of time, as an alternative to the Fourier transformation.

206. See, for instance, Baxter and King (1999) as well as Christiano and Fitzgerald (2003).
207. See Andersson (2011).
208. It is also worth noting that all frequency components apart from the long-run relationship are by definition stationary. Morover, in order to take account of possible simultaneity issues, we proceed by making use of the DOLS-methodology proposed by Saikkonen (1991) instead of the traditional OLS-estimates.
209. The expression "long-run" should – in this context – be understood as "lower frequency".
210. The literature usually attributes this statement to Sir John Hicks.For a more detailed discussion of alternative monetary concepts, see Degens (2013).
211. It is easy to show that in case of just two goods, there is only one relative price, while for three goods, there are just three relative prices. In the case of ten goods, however, there are already 45 relative prices, and with 100 goods the number of relative prices amounts to 4950.
212. See also the deliberations in Gerdesmeier (2011b, pp. 17 ff).
213. See Davies (1994) for a much more detailed overview on the history of money.
214. Moreover, it was always possible to melt them in order to produce jewellery.
215. See ECB (1999b) for details.
216. See, for instance, Mishkin (1995) for a more detailed overview.
217. See, for instance, Mahadeva and Sinclair (2001), who explore the econometric link between official interest rates and interest rates on loans and deposits in a number of countries.
218. See Mishkin (1995) for further details.
219. See also the very didactical publications on the website of the Bank of Canada (1996, 2010 and 2012).
220. See Modigliani (1971).
221. See Brainard and Tobin (1968).
222. See Stiglitz and Weiss (1981).
223. See Akerlof (1970).
224. For some early studies on the credit channel, see Bernanke and Gertler (1995), Cecchetti (1995) and Hubbard (1995).
225. It is worth noting in this respect that, in the euro area, inflation expectations have been well anchored slightly below 2 per cent since about 1998.
226. See Borio and Zhu (2008) as well as Adrian and Shin (2009).
227. Overall, this channel might amplify the influence of interest rates on investment behavior, which is referred to as the "financial accelerator effect".
228. See Friedman (1961).
229. See Peersman and Smets (2003).
230. To our best knowledge, this argument was first explicitly mentioned by Friedman. See Friedman (1961).
231. See Bank of Canada (2010).
232. A much more detailed and didactical exposition of the monetarist and non-monetarist debate on policy activism can be found in Gordon (1984, pp. 387–396).

233. See, for instance, Nordhaus (1975).
234. See Friedman (1960).
235. An alternative rule has been developed and proposed by McCallum. See McCallum (1984, 1987, 1988, 1999 and 2000) for details.
236. See Kydland and Prescott (1977).
237. See Rogoff (1985). A "conservative central banker" is a central banker who places a greater weight on the loss from inflation than the government does.
238. See Walsh (1995).
239. See Annex 26.6 for a more detailed overview on the concept of the correlation coefficient.
240. See Friedman, B. (1991) for a more detailed description of the issue.
241. The concept of using so-called "information variables" for monetary policy was first introduced in the literature by Kareken, Muench and Wallace (1973) and Friedman (1975).
242. See also Mishkin (2003, p. 458 ff). Or, alternatively, in the more colourful words of Fisher: "Monetary policy is a bit like duck-hunting. If you want to bag a mallard, you don't aim where the bird is at present, you aim ahead of its flight pattern". See Fisher, R.W. (2014, p. 3).
243. See Issing (1996, p. 24), translation by the author.
244. See Mishkin (2003, pp. 508 ff).
245. One example of such a successful speculator was George Soros, "the man who broke the Bank of England". See Mallaby (2010, especially Chapter 7) for a detailed description of this episode.
246. The expression "pragmatic monetarism" is often used to describe the monetary targeting of the Deutsche Bundesbank.
247. As Gerald Bouey, the then Governor of the Bank of Canada once put it: "We did not abandon monetary aggregates, they abandoned us".
248. See Mishkin and Sevastano (2001).
249. The figure is selected on purpose as most central banks woud regard a small amount of annual inflation is (say up to about 2% per year) actually acceptable for an economy
250. See Gaspar, Smets and Vestin (2007).
251. The following deliberations regard the expressions "nominal GDP targeting" and "nominal income targeting" as synonymous.
252. See Clark (1994) for more details.
253. See Bernanke and Mishkin (1997) for a more detailed discussion.
254. A more detailed assessment of how the Eurosystem's Committee structure and the related expertise have provided input into the decision-making, can be found in Jung, Mongelli and Moutot (2010).
255. See ECB (2011b, pp. 62 ff).
256. See ECB (2003, pp. 87 ff).
257. According to Angeloni et al., it was "felt that the announcement of a definition of price stability in the form of a target range with precise maximum and minimum levels, would easily lead to the interpretation that any possible price development outside the range would automatically entail a policy response. (…) It was, however, deemed necessary to state a precise figure for the ceiling of price increases compatible with price stability". See Angeloni et al. (1999, p. 14).
258. See Issing (2005, in particular, pp. 2 ff).
259. For a more detailed description of VAR models, see Sims (1980).

260. Given the fact that VAR systems attempt to mirror the historical behaviour of the data, a contractionary monetary policy "shock" is then defined as a positive deviation of the interest rate from the average reaction function of the central bank over the sample period. See also Gerdesmeier and Roffia (2009) for an application for euro area data and the literature quoted therein
261. The underlying economic reason why the impulse response analysis (of the effects of monetary policy) is carried out in terms of the impact of an "unsystematic shock" to short-term interest rates lies in the fact that this approach addresses the so-called "identification problem". More precisely, if monetary policy changes because of a shock to output or prices (as emphasised, for instance, in the literature on "reaction functions" of central banks), it is often not possible to separate the impact of monetary policy on other variables from the impact of the initial shock. By definition, only the unsystematic part of monetary policy is identified separately from developments in other variables and, thus, allows the transmission mechanism itself to be properly traced out.
262. From a more technical perspective, the reason for introducing the trend variable is the problem of "spurious correlation". This expression basically describes the fact that economic time series often tend to move in the same direction, reflecting an upward or downward trend. Therefore, a simple regression of the variables might not necessarily reflect the "true" relationship, but might instead simply reflect this common trend. There are various ways to cope with this difficulty. One way consists of the introduction of a linear time trend into the model. Another way would be to explicitly "de-trend" the variables and run the regression on the de-trended variables. See Granger and Newbold (1974) for a more detailed discussion of these isues.
263. This is of course not the only way to construct confidence intervals. In many other cases, the 95% confidence interval is selected.
264. In the terminology used at the beginning of the book, the original shock is "exogenous", whereas the subsequent movements in the selected variables are then endogenous (i.e. caused by the reactions of the variables in the system and the lagged values of the interest rate).
265. It goes without saying that, as a rule, the sum of all assets has to equal the sum of all liabilities.
266. It is worth emphasising at this point that in modern financial economies, the process of money creation does not rely anymore on the physical production of paper currency or metal coins. For a modern central bank, the decision to become more expansive is fully sufficient. If this decision is then set into force, for instance by means of open market operations, the central bank basically "automatically" credits the accounts that commercial banks hold at the central bank. Commercial banks are then in a position to use these accounts for withdrawing banknotes and coins from the central bank at any time if needed.
267. How can the central bank influence the monetary base? As we have seen in earlier chapters, from a purely economic perspective, the money supply is composed of currency in circulation and various deposits held with the banks. For instance, the monetary base was composed of currency in circulation and reserves. Hence, a central bank that wants to change the money supply has in principle two options. It can, first, vary the amount of notes and coins in circulation and it can, second, influence the amount of reserves held with the central bank. The first option, namely varying the amount of currency in circulation, is in principle very easy to implement since the central bank is the sole supplier of banknotes and, in principle, also coins, although the right to coin mint is in many countries with the government. But in many cases, the central banks buy the coins from the government at face value to keep the process under control. The second approach, namely varying the minimum reserve

ratio is more complicated, since an increase in the minimum reserve ratio leads to higher reserves and, thus, to an increase in the monetary base. In other words, the impact effect goes in the wrong direction. Moreover, as a matter of fact, banks are not very fond of holding minimum reserves since this can prove costly when the money can be lent out more profitably to customers.

268. See Poole (1970).
269. See Taylor (1993a, 1993b).
270. See Woodford (1999).
271. More detailed information regarding the derivation of this type of rule starting from a simple Taylor rule can be found in Peersman and Smets (1998) and Gerdesmeier and Roffia (2004).
272. See Goodfriend (1991).
273. See Woodford (1999) for the argument of a "traditional" interest rate smoothing behaviour by central banks in their conduct of monetary policy, Orphanides (1998) for the data uncertainty argument and Rudebush (2002) for the misspecification argument. Moreover, smoothing interest rates might also be consistent with the behaviour of the central bank being subject to a learning process or might result from the fear that ex abrupto changes in interest rates might be regarded as being too disruptive to the economy.
274. See, for instance, Favero (2001).
275. See Peersman and Smets (1999), Gerlach and Schnabel (1999), Clausen and Hayo (2002), Gerdesmeier and Roffia (2005) and Ullrich (2003).
276. See Bindseil (2004) for a more detailed overview.
277. See Kozicki (2011, pp. 15 ff) and Santor and Suchanek (2013, pp. 3 ff).
278. See also Manganelli (2012, p. 2) for more details on this simultaneity issue.
279. See Churm et al. (2012) for some evidence for the United Kingdom.
280. For instance, Weale and Wieladek (2014, p. 35) suggest that asset purchases have a statistically significant effect on real GDP with a purchase of one percent of GDP leading to a 0.36% (0.18%) rise in real GDP and an 0.38% (0.03%) rise in CPI for the United States (United Kingdom). More precisely, Joyce, Tong and Woods (2011) estimate for the Bank of England's QE program to yield a peak effect of $1^{1/2}$ to 2 per cent for real output and between $^{3/4}$ and $1^{1/2}$ per cent for inflation.
281. See Kozicki, Santor and Suchanek (2011).
282. A recent and notable exception is the paper by Gornemannn, Kuester and Nakajima (2016).
283. See also Santor and Suchanek (2013, p. 10).
284. Similar considerations can be found in Gerdesmeier (2015, pp. 173 ff).
285. See ECB (2011b, pp. 126 ff). More particularly, the bundle of measures included (i) an extension of the maturity of liquidity provision (an extension of the maturity of the ECB's longer-term refinancing operations to twelve months and supplementary refinancing operations with maturities of three and six months; (ii) fixed rate full allotment (unlimited access to central bank liquidity at the main refinancing rate (subject to adequate collateral); (iii) currency swap agreements (the temporary provision of liquidity in foreign currencies, most notably in US dollars, at various maturities); (iv) collateral requirements (the extension of the list of eligible collateral accepted in Eurosystem refinancing operations, in essence allowing banks to use a larger range and proportion of their assets to obtain central bank liquidity); and, finally, the covered bond purchase programme (the purchase of euro-denominated covered bonds issued in the euro area aiming at the revival of the dried-up segment of the important financial segment of the covered bonds market).

286. See ECB (2011b, p. 128).
287. See Manganelli (2012, p. 5).
288. See Blinder, A. (2006, pp. 9 ff).
289. See Praet (2012).
290. It is also worth noting that a key feature of the design of the three-year LTRO consisted in the fact that the interest rate on the three-year operations was indexed to the ECB's main policy rate, i.e. the rate on the main refinancing operations. Thus, if the ECB were to increase this rate, the costs for the remaining period of the three-year LTROs would also rise.
291. See Claeys (2014, p. 2).
292. See Draghi, M. (2012).
293. See ECB (2012, p. 1).
294. See ECB (2012, p. 4).
295. As regards the concrete arrangement, in order to qualify for the new Outright Monetary Transactions (OMT) program, countries would need to be participating in either a full or precautionary EFSF/ESM programme and accept the implied conditionality. IMF involvement would be sought in this context. Failure to fulfil the conditions established in the programme would lead the ECB to cease purchases. Purchases were announced to concentrate on bonds with a maturity from one to three years and would be fully sterilised. In the legal documentation establishing the OMT, the ECB explicitly renounced any claim to seniority of its sovereign debt holdings under the programme.
296. On 18 July 2013, the ECB further altered its collateral framework. In particular, three changes were announced, namely: (i) the ECB accepted a broader range of ABS as collateral, (ii) the ECB reduced haircuts on higher-rated sovereign bonds, while raising haircuts on lower-rated sovereign debt, and (iii) the Governing Council harmonised collateral rules applying to additional credit claims (ACCs). See ECB (2013c) for details.
297. See Claeys (2014, p. 3).
298. See ECB (2013b, p. 1).
299. Another change in communication worth noting is the fact that, on 3 July 2014, the ECB announced that it would adjust the schedule of policy meetings to a six-week cycle from the beginning of 2015 onwards and that it would publish regular accounts in between meetings. See ECB (2014c) for details.
300. In fact, this sentence was used on several occasions by the former President Trichet, especially during the press conferences. See, for instance, ECB (2009).
301. See Praet (2017) for a more detailed overview.
302. To our best knowledge, the only other central banks that ever implemented negative interest rates were the Swedish Riksbank and Danmarks Nationalbank and, more recently, the Swiss National Bank and the Bank of Japan.
303. The amount of monthly (net) purchases in the context of the ECB's APP has occasionally been subject to changes. From March 2015 until March 2016, the aggregate pace of the ECB's APP monthly net purchases was € 60 billion. With effect from 1 April 2016, the volume of monthly purchases was raised from € 60 billion to € 80 billion. On 1 April 2017, the volume was reduced back to € 60 billion. In October 2017, the ECB's Governing Council decided that net purchases would be reduced from the current monthly pace of € 60 billion to a new monthly pace of € 30 billion from January 2018 unitl the end of September 2018.

304. More precisely, in March 2015, the Eurosystem started to purchase euro-denominated investment-grade securities issued by euro area governments and agencies and European institutions in the secondary market.
305. It is worth mentioning a few details of the ECB's corporate sector purchase programme (CSPP) as announced on 21 April 2016. The purchases started in June and were carried out by six national central banks only (namely by the Banque Nationale de Belgique, the Deutsche Bundesbank, the Banco de España, the Banque de France, the Banca d'Italia, and Suomen Pankki). While each NCB remained responsible for purchases from issuers in a particular part of the euro area, the purchases were coordinated by the ECB and a full risk-sharing across the Eurosystem applied. The basis for determining the eligibility of corporate sector securities (to be purchased under the CSPP) was the ECB's collateral framework. Purchases were undertaken in the primary as well as in the secondary markets, with an issuer limit of 70% and a maturity between 6 months and 30 years. The ECB purchased only bonds from non-banks, but bonds issued by insurance companies were also included. See ECB (2016b) for details.
306. See Altavilla, Giannone and Lenza (2014).
307. See Eser and Schwaab (2016).
308. See Darracq and De Santis (2015).
309. See Boeckx, Dossche and Peersman (2014) as well as Gambacorta, Hoffmann and Peersman (2014). It goes without saying that, by construction, these estimates exclude ECB policies that rather manifest themselves in shifts within the balance sheet.
310. See Draghi (2015, p. 4).
311. Basically, the majority of these studies perform estimations using an instrumental variable (IV) method, the most commonly adopted being the Generalised Method of Moments (GMM). The choice of an IV method is due to the potential inconsistency and bias in the OLS estimators, especially with a lagged dependent variable. This so-called problem of "simultaneity" can be tested and it has been shown that it actually exists. The consequences in terms of biased and, therefore, misleading coefficients can be shown to be sometimes quite huge, thus asking for the use of other most appropriate estimation techniques outlined above. See, for instance, Gerdesmeier and Roffia (2004).
312. It goes without saying that parameter estimates might also well depend on the sample period considered.
313. See Orphanides (2001, 2003, 2004) for details.
314. This stands in relatively stark contrast to (quarterly) changes of around 300 basis points and more in central bank rates for some Latin American countries and some transition countries. See Mahadeva and Sinclair (2001) for details.
315. In essence, there are concrete rules regarding the international statistical standards for compiling such statistical statements, as outlined in the Balance of Payments Manual published by the IMF.
316. As a rule, an inflow of foreign currency is marked as a positive entry (e.g. exports sold overseas), whereas an outflow of foreign currency is counted as a negative entry (e.g. import of goods and services).
317. See Jarchow and Rühmann (1984) for more details.
318. See the website of the IMF for a more detailed overview.
319. See, in particular, Jarchow and Rühmann (1984, pp. 30 ff).
320. The following deliberations represent a set of theories used in economics to explain economic growth. In the literature, they are also often called "growth accounting". See Solow (1956, 1957), Kaldor (1961), Hall and Taylor (1997) and Samuelson and Nordhaus (2005, pp. 570 ff).

321. This chapter follows closely the very intuitive illustrations of the key issues outlined in Gordon (1984, pp. 571ff) and Blanchard (1997, pp. 446 ff.).
322. Note that – as in earlier chapters – small letters denote logarithms.
323. For the following deliberations, see Gordon (2000) and Issing (2004).
324. We are not entirely sure, who has been the first author to call it like that but we think, it could have been Abramowitz (1956).
325. See, for instance, Quantitative Micro Software (1987, p. 9.6).
326. See Bleymüller, Gehlert and Gülicher (1983, pp. 9 ff).
327. See Gujarati (2003, p. 147).
328. For more details, see for instance Johnston and DiNardo (1997, pp. 134–135).
329. See, for instance, Quantitative Micro Software (1997, pp. 164 ff).
330. See, for instance, the considerations outlined in Bleymüller et al. (1983, pp. 15 ff).
331. See also Gujarati (2003, pp. 148ff).
332. In the empirical literature, the correlation coefficient is usually denoted with the letter r. In this book, however, we abstain from the usual notation in order to avoid a potential confusion with the real interest rate.
333. See Brigham and Houston (2004, p. 184).
334. See Studenmund (1992, pp. 51 ff).
335. See Blanchard (1997, pp. 69 ff) for this brief description.
336. In statistics, the so-called "degrees of freedom" are defined as the number of observations minus the number of parameters. For instance, if there are 120 observations and four coefficients, the number of degrees of freedom is 120 minus 4=116. Economists tend to think that at least as many observations are needed as parameters to be estimated and preferably much more. Put another way, the degrees of freedom must be positive and the larger the better.