A Guided Tour through Euro Area Economics

Basics – Methods – Applications

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A Guided Tour through Euro Area Economics: Basics – Methods – Applications
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Contents

For Simone, Rhea and Lennart
(D.G.)

1 Introduction and motivation

This book is meant to represent a companion publication to the earlier and more basic book entitled "Fundamentals of monetary policy in the euro area" insofar as it covers topics that are more of a macroeconomic nature. Given the strong empirical focus that macroeconomics has witnessed over the last decades, the book aims at supplementing the basic concepts with a number of real-world examples conducted with adequate econometric tools.

Part I is meant 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 takes some selected issues 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 price indices and inflation, measures of real economic activity and unemployment.

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 the related areas they focus on in their analysis. 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 make decisions regarding the goods and services they can buy and the ones they must forgo. For instance, in order to buy a nice T–Shirt, you must give up on a visit to the cinema. Expressed in economic terms, one could say that economic subjects face the problem of how to best allocate resources and economics focuses on why these decisions are made and how they are best 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". Every choice involves opportunity costs and the latter ones usually measure 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 cycle analysis, 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 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 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 becomes 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 facing 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 a first attempt to summarise the main differences in a systematic way.[1]

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) und Jean-Baptiste Say (1767–1832). While many economists would probably subscribe to the view that there is not such as 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 increase of the wealth of a nation through the emergence of new technologies and productivity increases, but also 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" which is genrally associated with the work of William Jevons (1835–1882), Carl Menger (1840–1921) and Leon Walras (1834–1910) 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 its focus on 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"). 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 long-run macroeconomic development or short-run macroeconomic stability, Keynesian economists generally advocate 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.[2] Advocates of monetarism generally held the view that variations in money supply have 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 prefer rather a targeting of the growth rate of money supply (for instance by means of the so-called "Friedman rule"), which they regard 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. When it became clearer over time, 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 in 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).

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 1 October 2014, euro area residents could roughly obtain $ 1.26 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 accumulation of public sector deficits run up in 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 the 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, of Monetarism and, last but not least, of new classical 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, 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?
- 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 supply and demand and the effects of disequilibria as well as on the implications caused by shifts in supply and demand. Finally, we outline the basic concepts of the slope and the elasticity.

3.2 Models

In analysing real-world phenomena, economists often make use of a sound dose of common sense. This notwithstanding, when trying to explain the underlying reasons for 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 concern 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 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 set-up, 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 expenditures to behave as an exogenous variable, since their 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" can be distinguished.

The verbal analysis is rather popular in economics with the only disadvantage consisting of the fact, that in the case of rather 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:[3]

(3.3.1) $Q^D = a - b \cdot P$ Demand equation

(3.3.2) $Q^S = -c + d \cdot P$ Supply equation

(3.3.3) $Q^D = Q^S$ Equilibrium condition

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 determines the equilibrium value for the price and the quantity (i.e. Q_0, P_0). It then follows:

(3.3.4) $Q^D = Q^S$

(3.3.5) $a - b \cdot P = -c + d \cdot P$

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

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

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

(3.3.8) $Q^D = a - b \cdot P$

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

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

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

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

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 "identities" and "equilibrium conditions".

Behavioural equations are of crucial importance in economics. They 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:

(3.3.13) $$C = C(Y)$$

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".[4] 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:

(3.3.14) $$Y = Y(N, K)$$

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 labor and capital.

Institutional equations in essence describe the behaviour of institutions in the economic process. Typically, some economic decision-makers 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:

(3.3.15) $$G = \bar{G} \quad \text{and} \quad M^S = \bar{M}^S$$

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:

(3.3.16) $$Y = C + S$$

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. Quite to the contrary, 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.

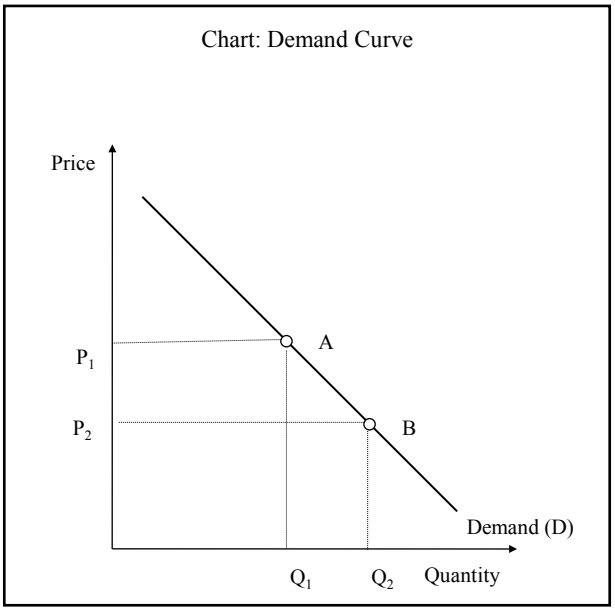
Finally, equilibrium conditions are key features of macroeconomics. An equilibrium situation is a situation in which there is no pressure for change since economic subjects have no incentive to alter their behaviour. Therefore, an equilibrium often shows a certain degree of "stickiness". For instance,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

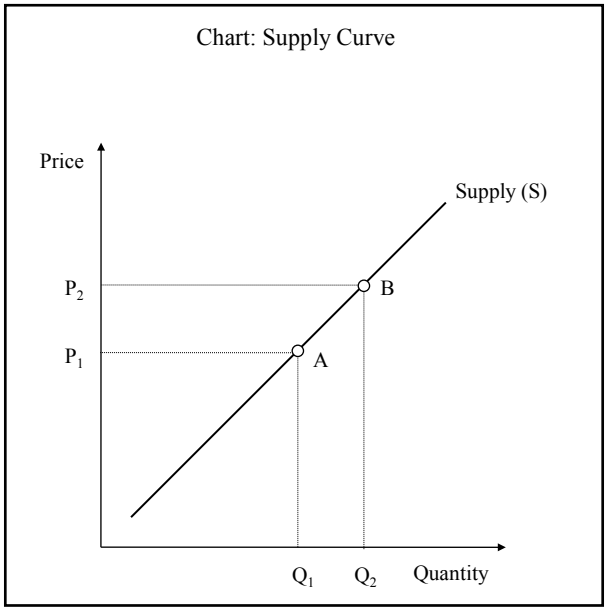
(3.3.17) $Supply = Demand$

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 a "dynamic" model. 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 the consumption of something else, they will avoid buying the more expensive good. This logic can be graphically illustrated by means of the demand curve below.

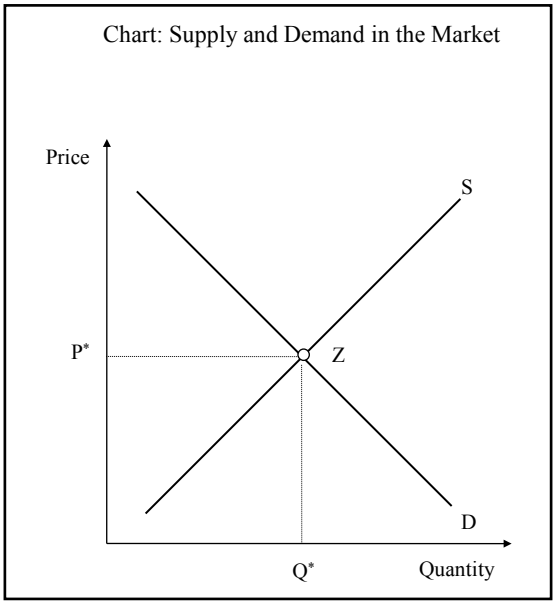




Points A and B represent two alternative combinations of price (P) and quantity (Q) demanded. It is easy to see that the higher the price of a good, the less quantity will be demanded. Combining the two points then yields the so-called "demand curve".

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.

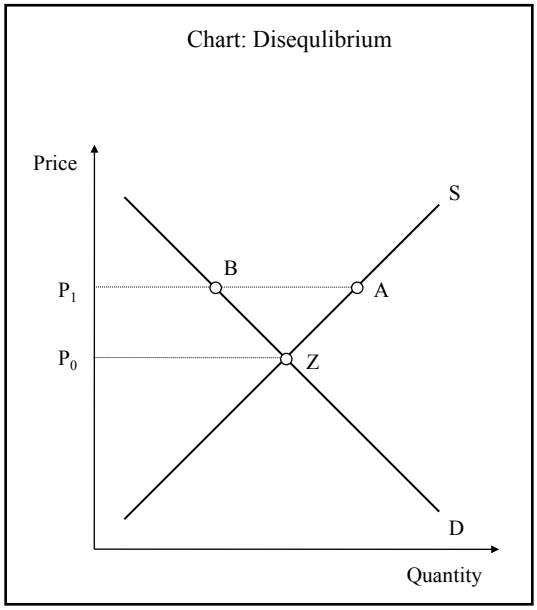
In the chart showing the supply curve, points A and B represent two combinations of price (P) and quantity (Q) supplied. It is easy to see that the higher the price of a good, the more quantity will be supplied. Combining the two points then yields the so-called "supply curve".



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 above 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

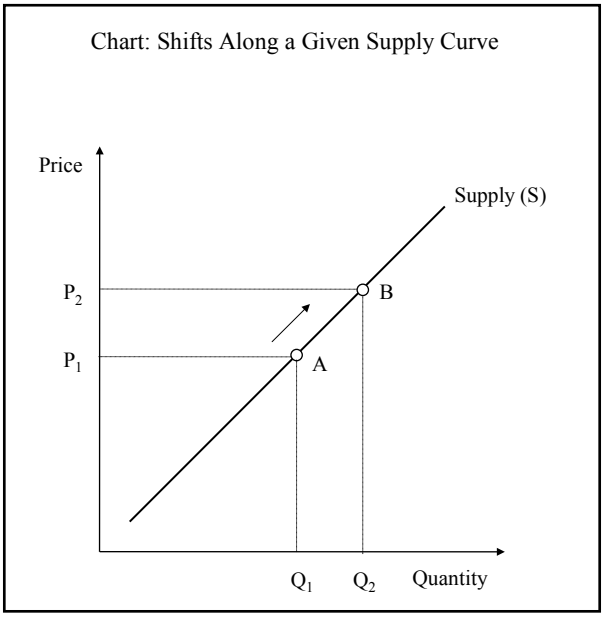
What happens in case of a disequilibrium? Assume, for instance, that for some reason, the market price increases and is set at a too high level (compared to equilibrium). In this case, changes along the supply and demand curves materialise. More specifically, demand will decrease along the demand curve,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



The chart above 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.

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 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. The supply and demand model allows to identify the effects of exogenous factors on prices and quantities. In order to derive the new equilíbrium, 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 the moment, a new 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.

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 following table summarises a variety of shifts in demand and supply and their implications for the equilibrium price and the equilibrium quantity.

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	decreases
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

3.5 Complementary and Substitute Goods

For some of the following considerations, the exact form of the relationship among goods might 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 raises the demand for this good but also for the complementary good. Examples are bread and butter or CD's and CD-players.[5]

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, alternatvely, the "run" in X). More formally, this can be expressed as follows:

(3.6.1) $$Slope = \frac{\Delta Y}{\Delta X}$$

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.[6]

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 thus requires to know how much the quantity demanded changes when the price changes. In numerical terms, we can calculate the precise number of price elasticity according to the following formula:[7]

(3.6.2) *Price elasticity of demand* =

$$\varepsilon_D = \frac{percentage\,change\,in\,quantity\;demanded}{percentage\,change\,in\,price}$$

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:[8]

(3.6.3) $$\varepsilon_D = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}}$$

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 use the average price. Then the exact formula will be:

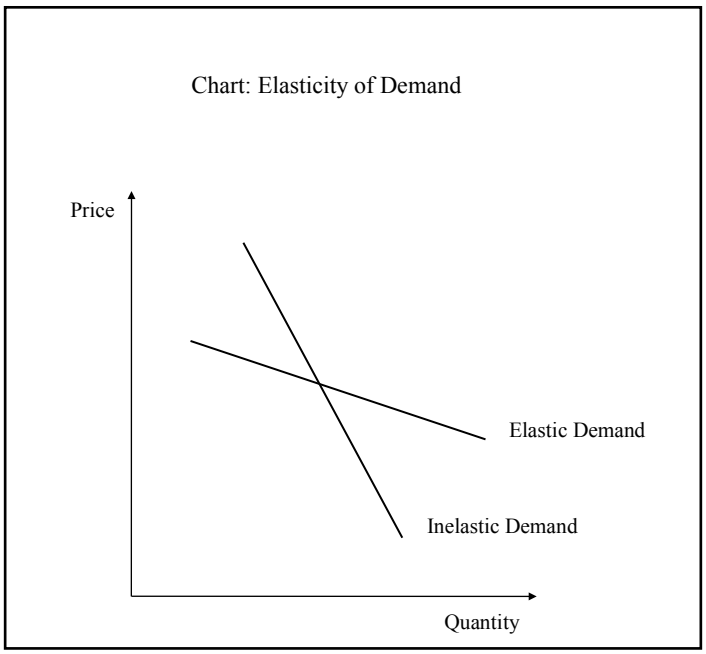
$$\varepsilon_D = \frac{\frac{\Delta Q}{(Q_1+Q_2)/2}}{\frac{\Delta P}{(P_1+P_2)/2}} \tag{3.6.4}$$

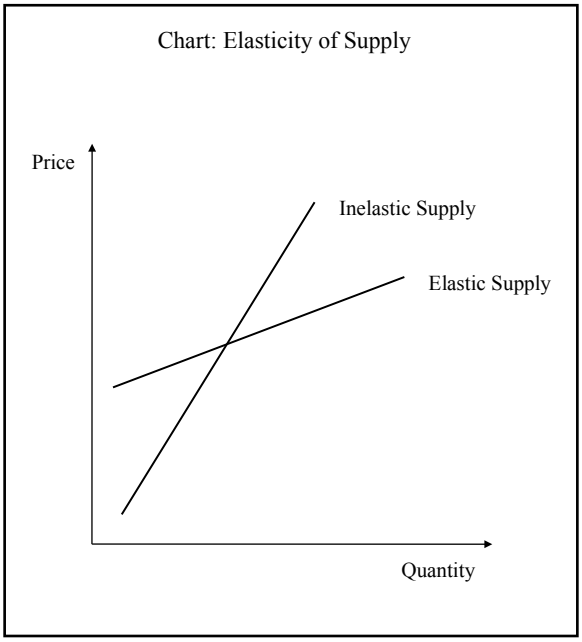
where P_1 and Q_1 represent the original price and quantity and P_2 and Q_2 stand for the new price and quantity. Finally, given the fact that in case of a "normal" downward-sloping demand curve, the elasticity will always be negative, most practitioners tend to drop the minus sign from all the numbers, 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 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 because the opportunity cost of buying the product will become too high.

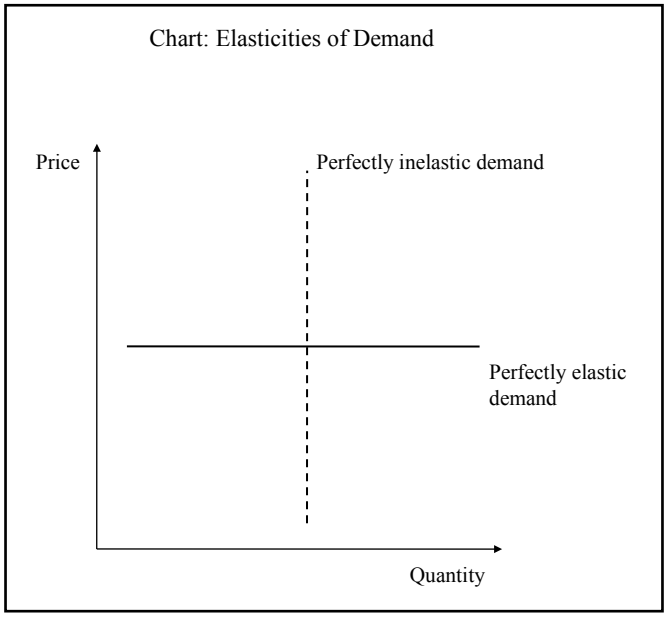
How can the elasticity be illustrated in graphical terms? As has been shown in previous sections, the demand curve has a negative slope, and if a large decrease in the quantity demanded is accompanied by a small increase in price, the demand curve must be rather flat or more horizontal. This flatter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





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 1. 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 responds not 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 in the horizontal demand curve in the chart.



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.

☑ 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.

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 "dynamic" model. 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 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. 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 concepts are the concepts 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 the meaning of complementarity and substitutability between goods?
- 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?
- 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?

4 National Income Accounting

4.1 Learning Objectives

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. 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, this is generally labeled 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:

(4.2.1) Total production = total expenditure = total income

In the literature, this equation is often called the "fundamental identity of national income accounting".[9] 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 (€).[10] 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. Real GDP (Y^r) equals the ratio of nominal GDP (Y) and the price level (P).

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

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 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 economc 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.[11]

☑ 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.[12] For some southern and eastern European countries, the respective figures are between 20% and 30%.

Source: Schneider and Enste (2000).

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 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 necessitates the use of an appropriate equlibrium exchange rate in order to convert GDP measures.

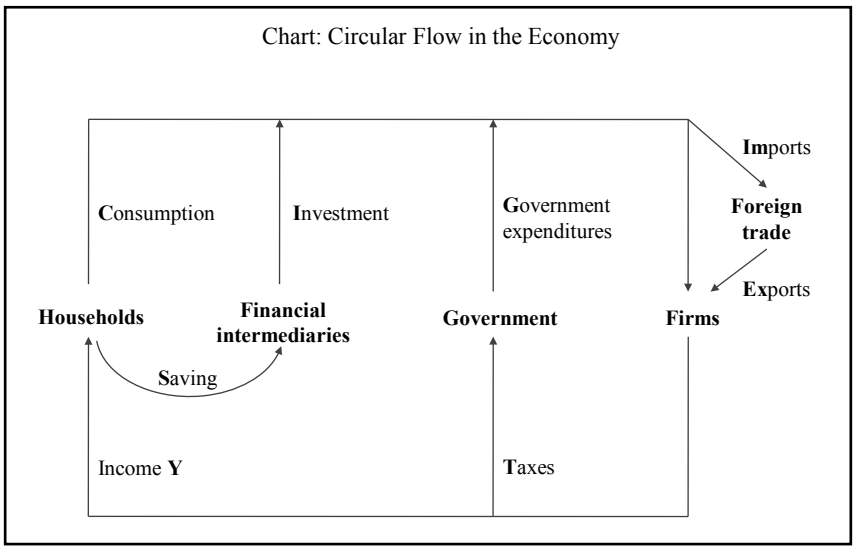
Because of these caveats, other measures of welfare such as, for instance, the "Index of Sustainable Economic Welfare" have been proposed. These concepts are, however, beyond the scope of this introductory textbook. At the same time and notwithstanding these shortcomings, GDP will – at least for the 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 becomes consumption expenditures, while savings are used by financial intermediaries to finance investment expenditures.



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 expenditures approach" to calculating GDP.

The sum of all expenditure categories 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.

(4.5.1) $$Y = C + I$$

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

(4.5.2) $$Y = C + I + G$$

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

(4.5.3) $$Y = C + I + G + EX - IM$$

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.

☑ 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, which comes first? 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 economist Jean Baptiste Say (1767-1832). The opposite view has been advocated by the famous 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".

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 measure of people's welfare. There are, however, serious limitations 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 expenditures approach, factor payments approach, nominal GDP, real GDP, circular flow analysis, consumption, investment, government expenditures, 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 a closer look at the consumption function. We then 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 the 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 expenditures and EX and IM stand for exports and imports, respectively.

Consumption expenditures or, alternatively, consumption constitute 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.[13]

Investment refers to business expenditures 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.[14] 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. 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 constitutes to the remaining major component of GDP. Net exports refer to the difference between exports and imports.

☑ 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 2014, private consumption expenditures were around €5651.1 billion, government expenditures were around €2127.7 billion, gross investment was around €1970.9 billion and inventories were around €-19.7 billion. At the same time, exports and imports were around €4494.4 billion and 4120.8 billion, respectively. Expressed in percentages, the relative share of private consumption expenditures to total GDP was around 56.0%, compared to 21.1% for government expenditures, 19.5% for gross investment (-0.2% for inventories) and 3.7% for the contribution of exports and imports.

Source: ECB data.

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.

For didactical reasons, it is 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 then proceed by further analysing the determinants of private consumption before turning in more detail towards investment behavior.

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), the income should be seen as the dominant determinant of consumption. Assuming the constancy of the other factors mentioned above (that is "ceteris paribus"), this leads to the following consumption function:

(5.3.1) $C = C(Y)$

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:

(5.3.2) $S = S(Y)$

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.

☑ Consumption and Savings – 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 savings (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 an analogous 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)).

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:

(5.3.3) $C = C(Y)$ with $dC/dY > 0$

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:

(5.3.4) $c = C/Y$ = average propensity to consume

(5.3.5) $s = S/Y$ = average propensity to save

(5.3.6) $c' = dC/dY$ = marginal propensity to consume

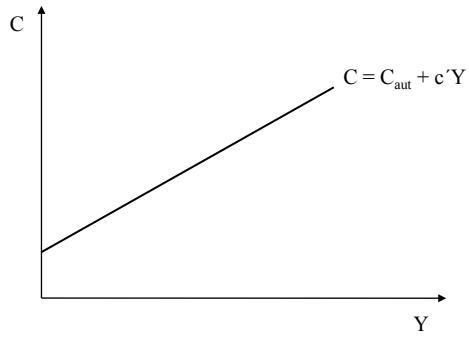
(5.3.7) $s' = dS/dY$ = marginal propensity to save

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:

(5.3.8) $C = C_{aut} + c' \cdot Y$ with $C_{aut} > 0$

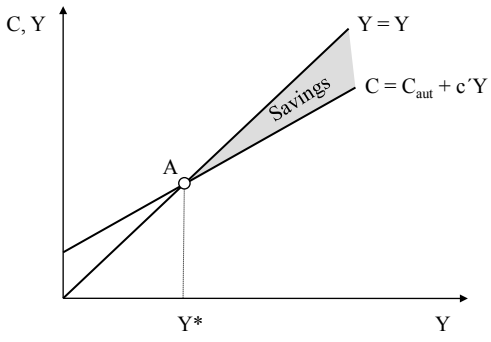
Expressed in graphical terms, this would lead to the following result:

Chart: Consumption Function with Autonomous Consumption



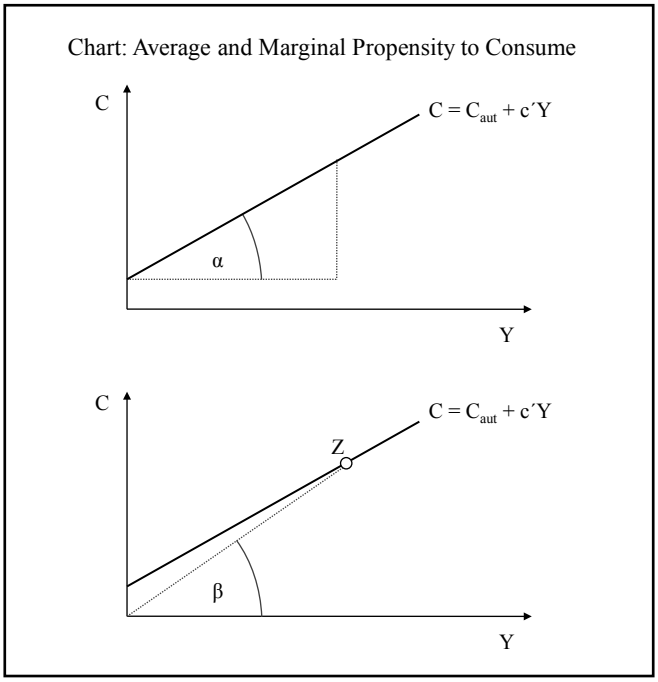
It is then rather straightforward to extend this chart in order to account for additional considerations. In fact, when incorporating – in addition to the consumption function – the "income line" into the chart, the latter would take the shape of a 45-degree line. In every point along this line, the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

Chart: Consumption Function and 45 Degree Line



It is then easy to show 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.

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.



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

(5.3.9) $Y = C + S$

Taking the (partial) derivative for Y then yields:

(5.3.10) $dY/dY = dC/dY + dS/dY$

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

(5.3.11) $1 = c' + s'$

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

(5.3.12) $Y = C + S$ and thus

(5.3.13) $Y/Y = C/Y + S/Y$

(5.3.14) $1 = c + s$

The 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 desribing the behavior 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-laborer".
- 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.[15]

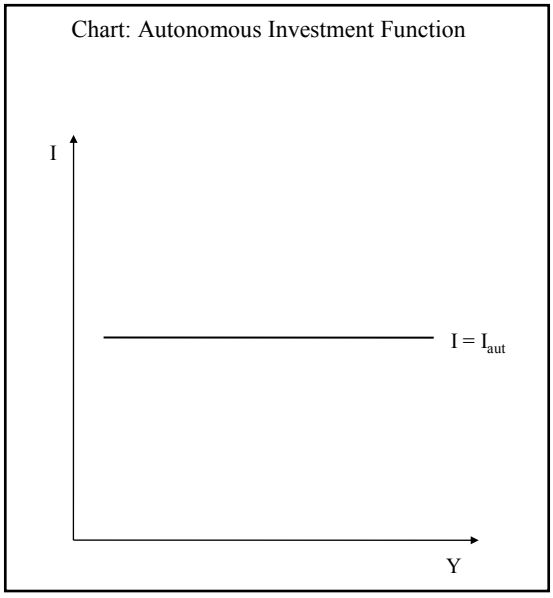
5.4 The Investment Function

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:

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

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 parallel to the income axis, i.e. 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:

(5.4.2) $I = I(i)$ with $dI/di < 0$

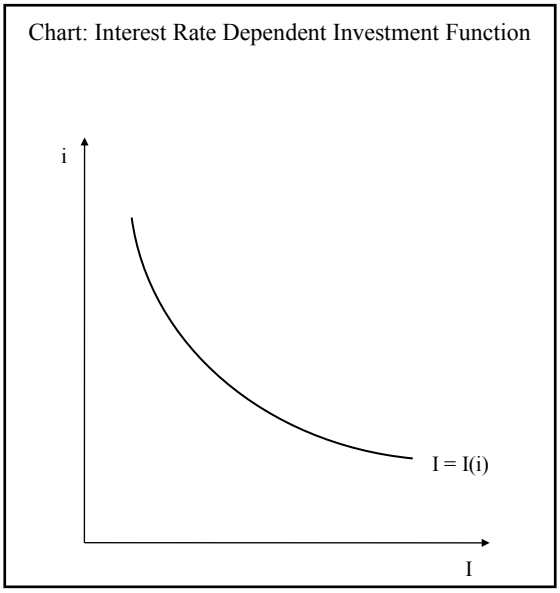
What could be the reasoning behind this? Let us illustrate the basic ideas by means of a simple example. Starting from the assumption that an investment is only realised when it yields a positive return in the end, our considerations focus on three key elements for the decision-making, namely, first the expected return of the investment, second the costs of the investment and third, the market interest rate. More precisely, we assume that the purchase of a machine would cost €5000. The expected life time of the machine would be four years and the expected returns would be €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.[16]



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:

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

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

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

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:

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

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 easy to see that the following relationship would hold:

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

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

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

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

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

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

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

Assuming an interest rate of 10%, this gives:

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

(5.4.11) $$G_0 \approx 1545 + 1405 + 1277 + 1161 \approx 5388$$

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:

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

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

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 (i.e. r > i).

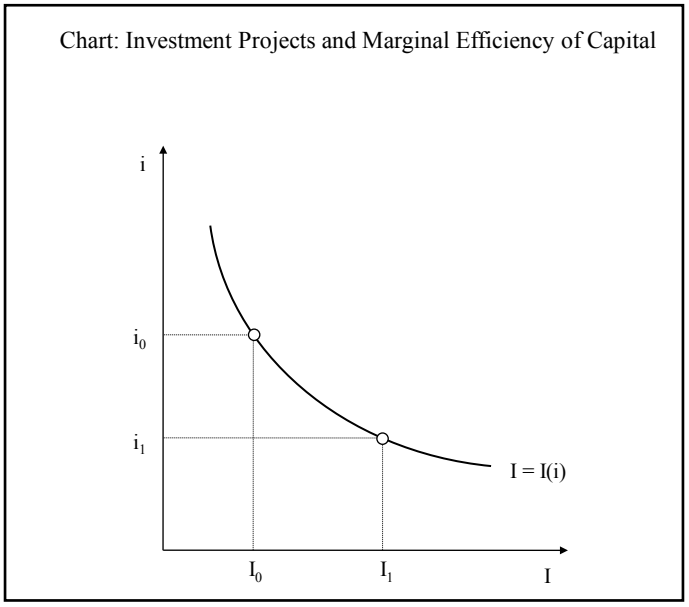
Both methods then allow for the conclusion that an investment is all the more profitable, the lower the market interest rate in an economy. Following Keynes, investment will take place as long as:

(5.4.14) $r \geq i$

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 will rise and, ceteris paribus, the lower the marginal return of the investment will be. For this reason, the marginal efficiency of capital remains different from the market interest rate but it will 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 at least equal to the market interest rate get realised. It then follows:

(5.4.15) $I = I(i)$ with $dI/di < 0$

The aforementioned relationships can be easily illustrated in a chart in which the investment projects are ordered according to their marginal efficiency of capital. Then, the following curve results:



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.

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 $(I_1\text{-}I_0)$ 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:

(5.4.16) $$I = f(\Delta Q)$$

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 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 are a typical Keynesian consumption function and an autonomous investment function, In short:

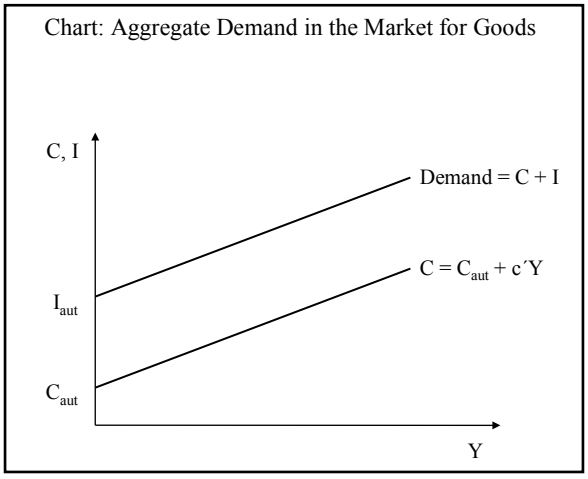
(5.5.1) $$C = C_{aut} + c' \cdot Y$$

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

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:

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

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 (S = Y) allows us to express the equilibrium between aggregate supply and aggregate demand as follows:

(5.5.4) $Supply = Y$

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

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

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

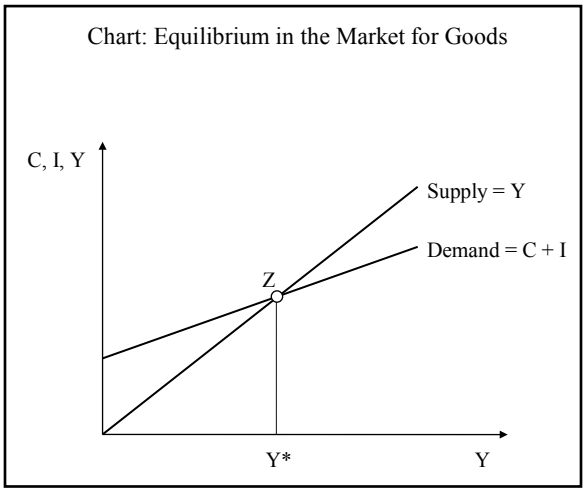
If equilibrium values are marked with an asterisk, it follows:

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

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. It then follows:

Chart: Equilibrium in the Market for Goods



The point Z can be characterised by the equivalence of supply and demand in the market for goods. 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:

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

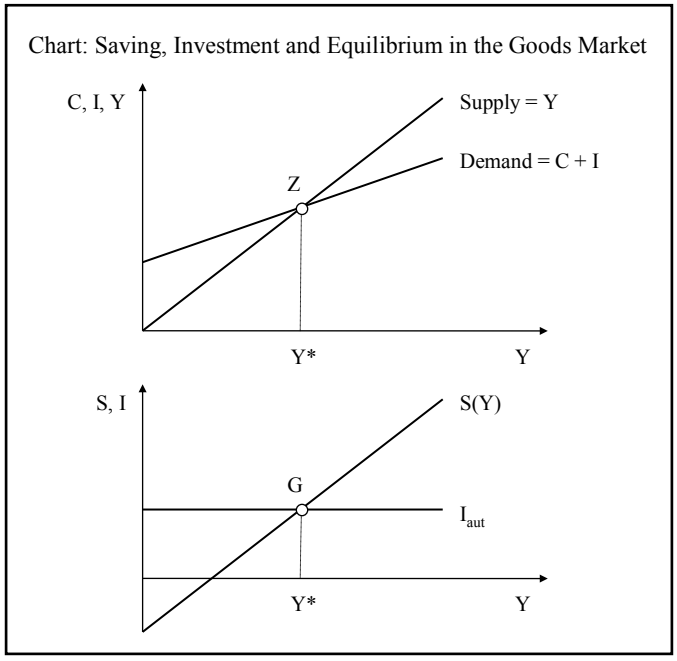
(5.5.10) $Y = C + S$ and, therefore,

(5.5.11) $I = S$

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:

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

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



The upper chart does not necessitate 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 charts 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.

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:

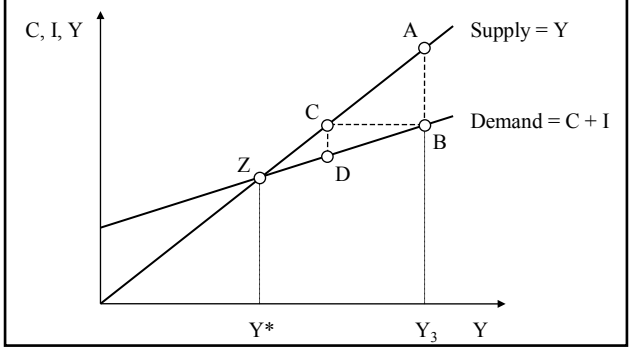
Supply = Demand	$Y = Y^*$	$S = I$	Equilibrium
Supply < Demand	$Y < Y^*$	$S < I$	Lack of supply
Supply > Demand	$Y > Y^*$	$S > I$	Lack of demand

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. In the latter case, 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. In the same vein, savings exceeds investment. Quite obviously, the expectations of the firms have been disappointed.

Chart: 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* has 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.

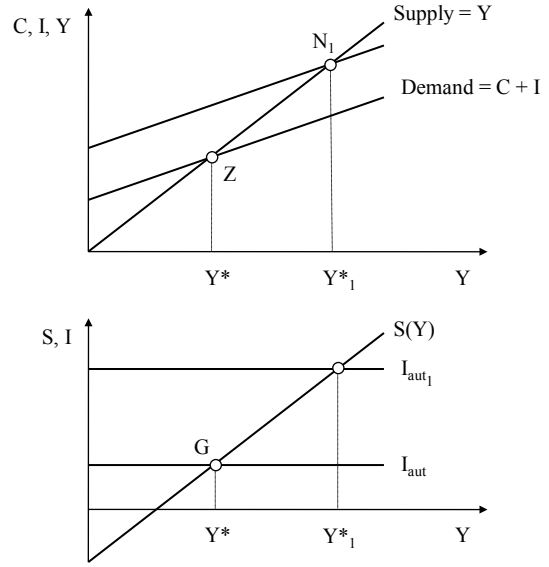
The process that leads to the restoration of equilibrium income materialises in discrete steps with individual steps getting smaller and smaller. In case of a disequilibrium, system-immanent forces start to work thus leading to a restoration of the equilibrium. The forces at work are accompanied by changes 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.

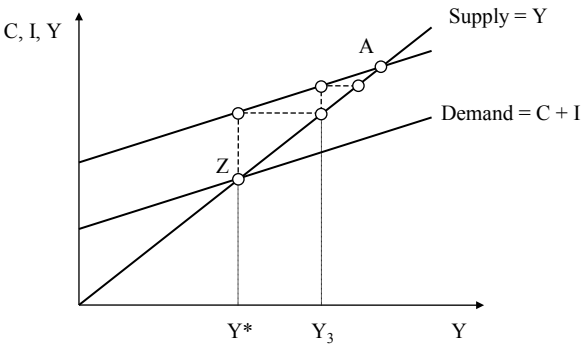
Following our previous considerations, income can be raised by an increase in aggregate demand, i.e. an increase in autonomous consumption (C_{aut}), an increase in the marginal propensity to consume (c') or an increase in autonomous investment (I_{aut}). And, should, for one reason or another, the private sector not be in a position to take action, the government would need to take an active role in this respect. 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 $I_{aut1} > I_{aut}$).

Chart: 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. More precisely, it follows:

Chart: The Multiplier Process



Starting from the original equilibrium, the adjustment process then leads to a new equilibrium. It is worth noting that 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.

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:

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

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

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

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

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

(5.6.4) $$dY / dI_{aut} = 1/(1 - c') = 1/s'$$

Since the marginal propensity to consume is larger than zero but smaller than one, this expression 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:

(5.7.1) $$G = G_{aut} = \bar{G}$$

This leads to an extended version of the demand function:

(5.7.2) $$Demand = C + I_{aut} + G_{aut}$$

And in equilibrium, this yields:

(5.7.3) $$Y = C + I_{aut} + G_{aut}$$

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

Differencing the equation then leads to the following expression:

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

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

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

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 lump-sum tax from every household. Against this background, households can only spend the so-called "disposable income" (Y_D), which is defined as follows:

(5.7.7) $$Y_D = Y - T$$

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

(5.7.8) $$Demand = C + I$$
(5.7.9) $$Demand = C_{aut} + I_{aut} + c' \cdot Y_D$$
(5.7.10) $$Demand = C_{aut} + I_{aut} + c' \cdot (Y - T)$$

Solving for the equilibrium then yields:

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

And differencing yields:

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

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 is 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 expenditures.

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 "balanced budget"). What are the implications for income? The equation for demand then reads as follows:

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

In equilibrium, it follows:

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

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

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

(5.7.16) $$dY = c' \cdot dY - c' \cdot dT + dG$$

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

(5.7.17) $$dY = c' \cdot dY - c' \cdot dG + dG$$

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

(5.7.19) $$\frac{dY}{dG} = \frac{1 - c'}{1 - c'} = 1$$ or, equivalently,

(5.7.20) $$dY = 1 \cdot dG$$

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:

(5.8.1) $I = I(i)$

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:

(5.8.2) $Supply = Demand$

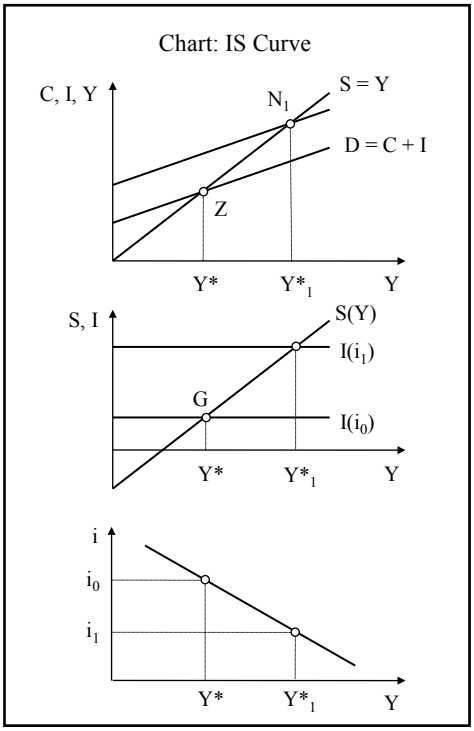
(5.8.3) $Y = C + I = C(Y) + I(i)$

(5.8.4) $S(Y) = I(i)$

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?

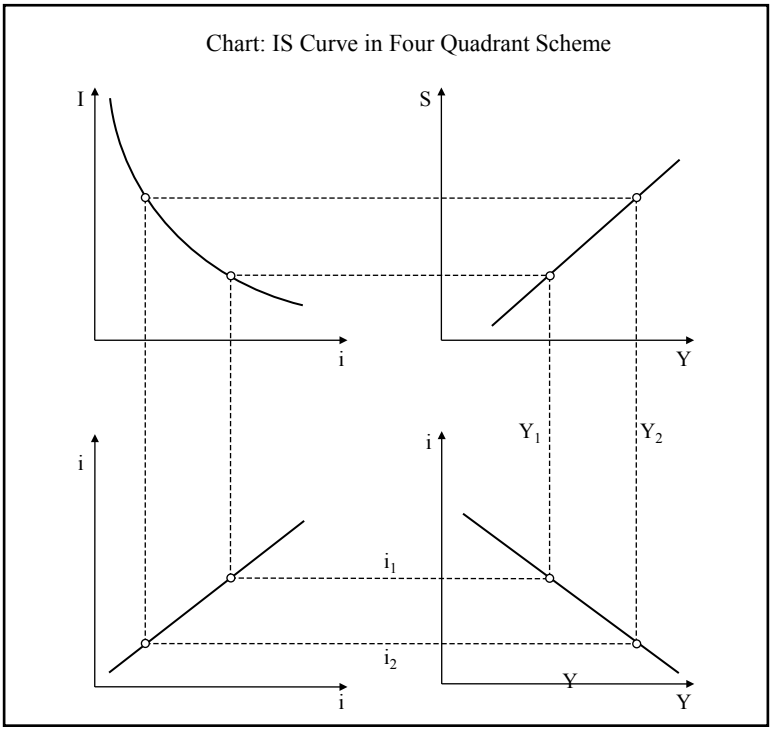
In line with the previous considerations, a high income leads to high savings. Following equation (5.8.4), this assumes a high investment which, following our earlier considerations, presumes a low interest rate and vice versa. It should be noted, however, that also the reverse causality applies: A high interest rate leads to low investment which, following the "ex-definitione equivalence" of savings and investment, necessitates a low income. It follows that, 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 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.

In the literature, however, a derivation based on four quadrants has become quite popular.[17] 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.

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 (see Box below):

(5.8.5) $$\tan \alpha = di / dY = s' / i'$$

☑ 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. $dS = s' \cdot dY$

Solving for the slope of IS then yields:

v. $$\tan \alpha = \frac{di}{dY} = \frac{dI / i'}{dS / s'} = \frac{dI \cdot s'}{dS \cdot i'} = \frac{s'}{i'}$$

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.

As a consequence, the IS curve gets steeper if the marginal propensity to save increases and the interest rate sensitivity of investment decreases (i.e. a flattening of the investment function). By contrast, a rather low marginal propensity to save and/or a high interest rate sensitivity of investment (i.e. a rather steep investment function) 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.

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. In sum: 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:

(5.9.1) $$S + T + IM = I + G + EX$$

Rearranging terms, it follows that:

(5.9.2) $$(EX - IM) + (G - T) = (S - I)$$

This implies that the trade balance (X-Z) plus the fiscal deficit (G-T) must by definition equal the excess of savings over investment. Expressed in other words: in case twin deficits exist, they must be paid for by an excess of savings over investment. This implies that savings have to be used to pay for the deficits and, thus, fewer funds are available for investment.

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 investment functions shift. Changes in the slope of the IS curve occur, if 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 could a graphical illustration of Keynes "fundamental psychological law" look like?
- 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?

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 take a look at 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 – we will consider 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 that following "Walras' Law" (developed by the famous French economist Leon Walras, 1834–1910), 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 an 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

On 1 January 1999 the European Central Bank (ECB) assumed responsibility for monetary policy in the euro area – the second largest economic area in the world after the United States.[18] 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 and 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.

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.

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.[19] 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.[20] 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. 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.[21]

☑ 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.[22]

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 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 2015). 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.

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.[23] It then follows:

(6.4.1) $$M = M_{aut} = \bar{M}$$

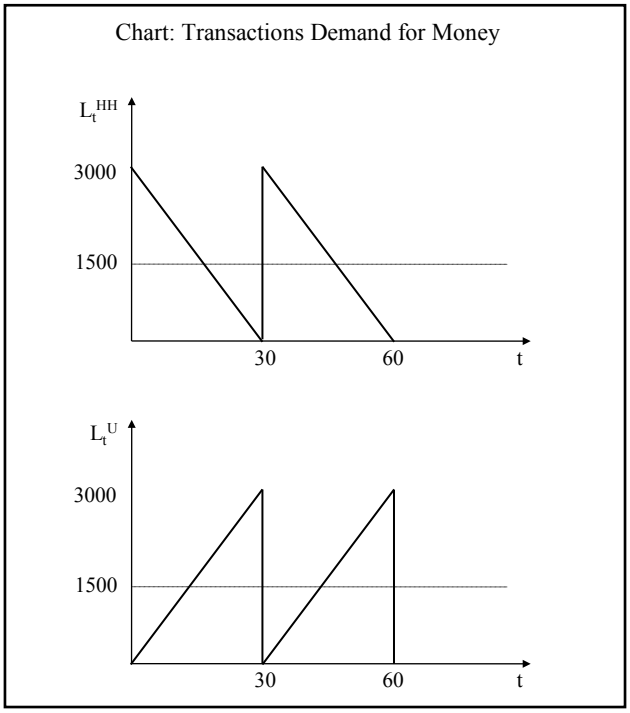
While this assumes that other factors, as, for instance, interest rates, do not play a role for money supply, it should be noted that the influence of interest rates can be easily incorporated into the following deliberations, without changing the results too much.

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".[24] 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 the 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 follows:

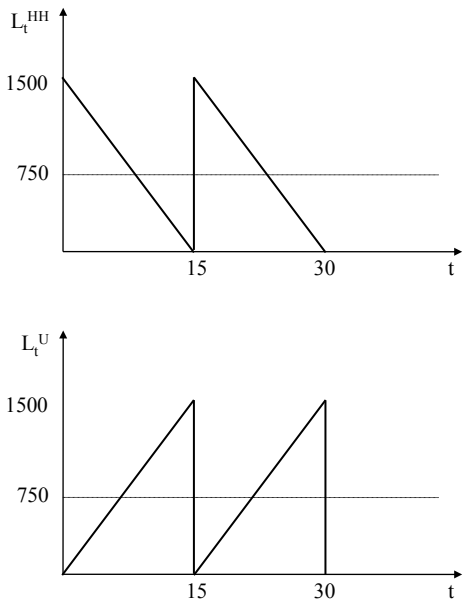


Quite obviously, money has the function of "synchronising" between the various monetary in- and outflows. Moreover, it is easy to see that the average cash holdings of households over the month are €1500 and the same also holds for the firms. When taking an annual perspective, the average cash holdings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

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.

Chart: Transactions Demand for Money

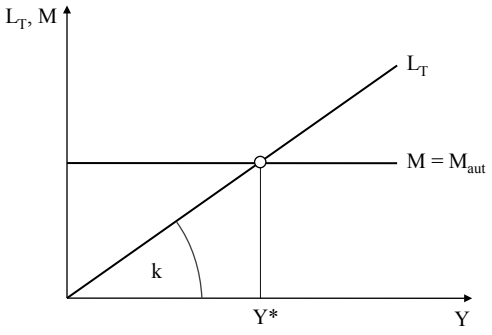


What do these figures tell us? Well, in the first case, the (aggregate) money holdings of households and firms together were exactly $k = (1500+1500)/12 \cdot 3000 = 3000/36000 = 1/12 \approx 0.08$. In the second case, households and firms each hold on average €750. As a matter of fact, it follows that 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 in an economy. More formally, it follows:

(6.5.1) $$L_T = L_T(Y) = k \cdot Y$$

In a graphical illustration, it would follow:

Chart: 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. If we separate nominal income further into real income and the price level, it follows:

(6.5.2) $$L_T = k \cdot P \cdot Y^r$$

where P stands for the price level, Y^r for real income and $P \cdot Y^r$ denotes nominal income. The equilibrium in the money market is then given by the intersection of the two lines which then, in turn, determines equilibrium income. Determinants of the transactions demand for money are then 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:

(6.5.3) $$L_T = k \cdot Y$$

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

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, also expresses in essence 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 mentioning that – as will be shown in later chapters – this relatively simple model has been extended in various respects in the literature, but the key messages still hold.

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, leading to the fact 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).[25]

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 for precautionary purposes is needed to deal with unforeseen monetary in- and outflows. 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. It is worth noting that some studies have found the transactions demand for money also to depend on (short-term) interest rates; we will, however, for reasons of simplicity neglect this fact for the time being.[26]

The speculative demand for money is of decisive importance to capture 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 and, thereby especially on money and bonds. More specifically, bonds are modelled as "consols" i.e. perpetual bonds with an infinite maturity. In addition, economic subjects are subject to an imperfect foresight and, thus, have to form expectations regarding the future developments of bond prices, in order to make profits.

To be able 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 positive utility, 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. In Keynes' framework, an individual keeps its wealth either in form of cash or in bonds. What in essence matters for the investment decision are 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, at the same time, their degree of liquidity is considerably lower.

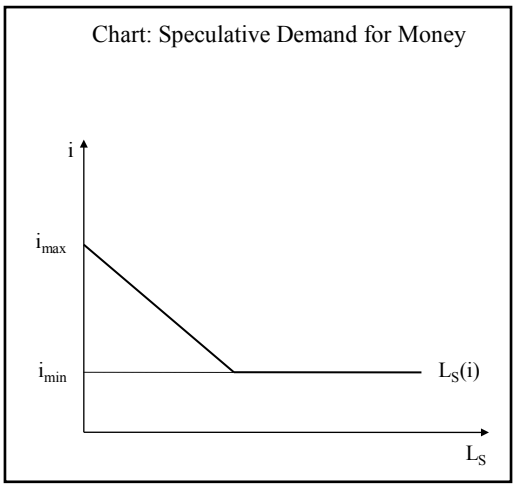
Following Keynes, a further distinction is of relevance. At the micro level, a Keynesian individual is an "all or nothing"-individual meaning that it will just hold one asset. Therefore, the portfolio of a Keynesian individual contains just one asset, either only money or only bonds. At the macro level, however, heterogeneous expectations do exist and, therefore, contrary to the micro level, a mixed portfolio is possible. A variable, that is of crucial importance for the structure of wealth of economic individuals is the interest rate. This 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:

(6.5.5) Return of a bond = Nominal interest rate / Bond price

If the interest rate is low or bond prices are high, economic subjects will prefer to hold money. Contrary to that, 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:

(6.5.6) $L_S = L_S(i)$

In graphical terms, the aforementioned relationships can be illustrated as follows:

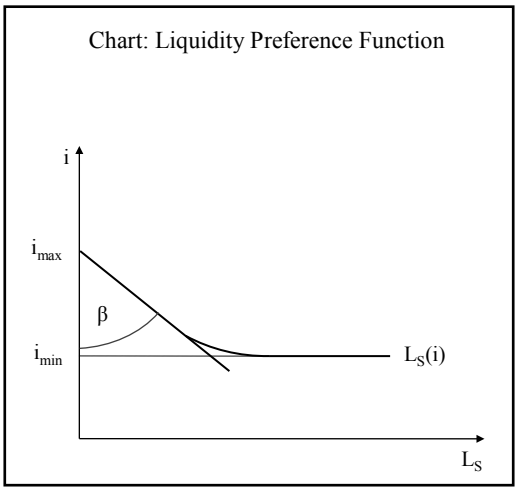


This function has been labelled as the "speculative demand for money" as it basically explains the demand for speculation purposes. There is basically two alternative ways of explaining the behaviour of this function, namely via the interest rate or via bond prices.

If the focus is on the interest rate, it can be argued that a low interest rate corresponds to low opportunity costs of holding money. Therefore, there is no problem related to the "luxury" of holding cash, consequently, all wealth is held in the form of cash. In the chart above, this situation is typically found in the lower right segment. Contrary to that, a high interest rate will lead to high opportunity costs of holding money and, thus, lead to holdings of bonds. This is represented by the upper left segment.

The same results can be shown if the focus is on bond prices or, more precisely, on expected bond prices. High levels of the interest rate are accompanied by low bond prices and vice versa. Given a prevailing level of low bond prices, an increase in bond prices might be expected which, in turn, leads to bond purchases and a low level of holdings of money for speculation purposes. By contrast, low interest rates are equivalent to high bond prices. Then, a decrease in bond prices might be expected which, in turn, leads to higher cash holdings rather than bond purchases. Therefore, the speculative demand for money is rather high.

The exact characteristics of the resulting curve can be derived as follows. Visual inspection shows that there is a vertical segment ("classical segment") and a horizontal segment ("Keynesian segment"). 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 will rise and 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}). Fearing the losses related to foreseen 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, however, 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 above.

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

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.

6.6 Equilibrium in the Money Market

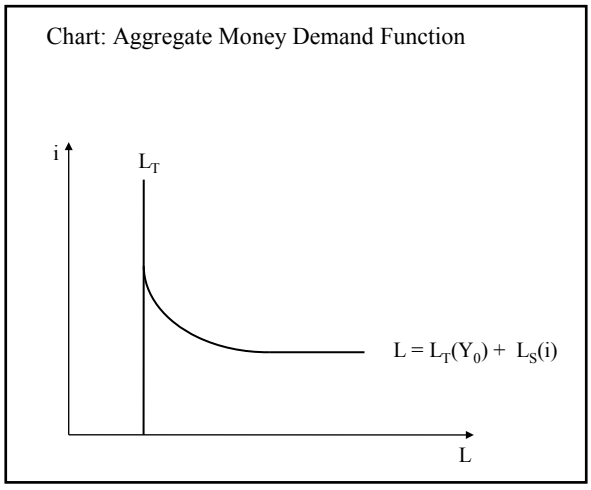
In this section, the two modules i.e. the transactions demand for money and the speculative demand for money will be combined together. As a starting point, it can be shown that:

(6.6.1) $L = L_T + L_S$

(6.6.2) $L = L_T(Y) + L_S(i)$

(6.6.3) $L = k \cdot Y + l' \cdot i$

As a consequence, the aggregate demand for money depends on the level of income and the interest rate. The following charts depict 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.



In the next step, the interest rate-dependent liquidity preference function is added via horizontal addition to the above derived curve. Given the fact, that the relationship with the interest rate is negative, the following aggregate money demand function results: 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:

(6.6.4) $M = L$

(6.6.5) $M = L_T + L_S$

(6.6.6) $M = k \cdot Y + l' \cdot i$

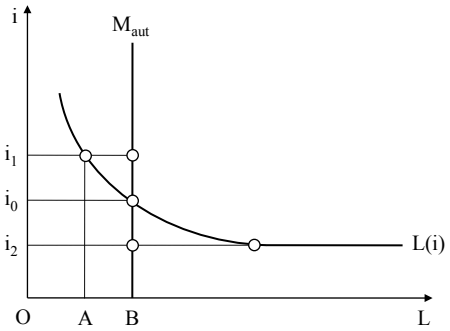
with $M = M_{aut}$. Since obviously aggregate money demand consists of transactions demand for money and speculative demand for money, which in turn, depend on the level of income and the interest rate, it is necessary to have specific combinations of income and the interest rate that will ensure equilibrium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

6.7 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.

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.

Chart: Equilibrium in the Money Market Assuming a Constant Income



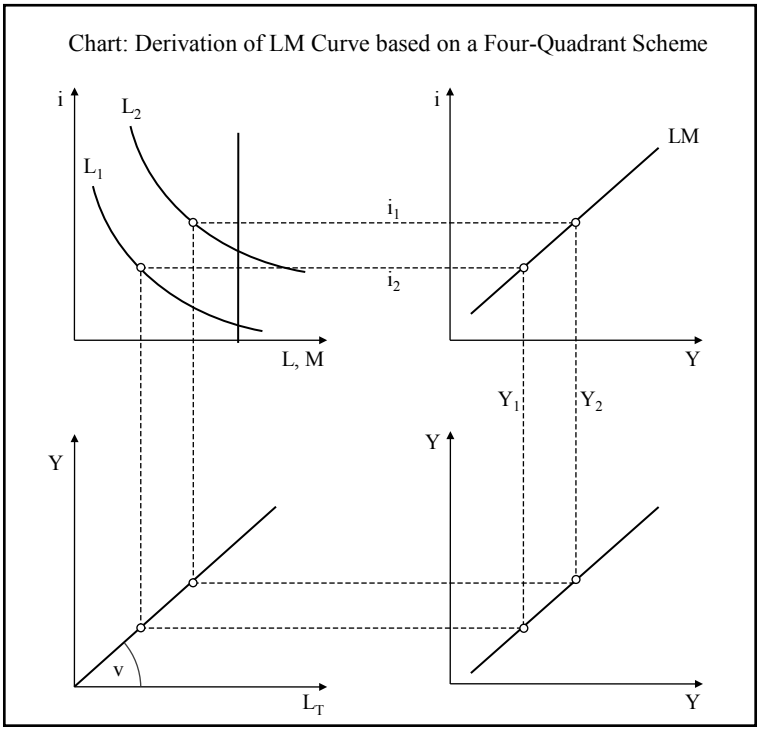
At the interest rate level i_1, quite obviously a disequilibrium exists, since – in horizontal terms – the level of money supply exceeds the level of money demand ($M > L$). Expressed in other words: the actual cash holdings are higher than the desired cash holdings. Therefore, economic subjects will 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 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.

6.8 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.[27] 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.



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:

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

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

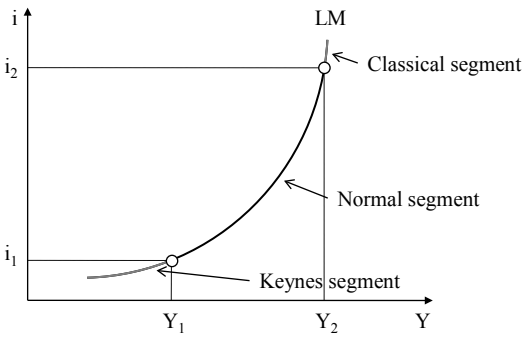
(6.8.2) $$\frac{\delta Y}{\delta L_T} = \frac{1}{k} = V$$

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 depicted 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_2 / Y_2).

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:

Chart: 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.

In the vertical or "classical" area, 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.

☑ Slope of the LM Curve

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

i. $\tan\beta = \frac{di}{dY} > 0$

This can be shown as follows. We have seen that

ii. $\tan\beta = \frac{dL_S}{di} = l' < 0$ 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 $k \cdot dY = -l' \cdot di$

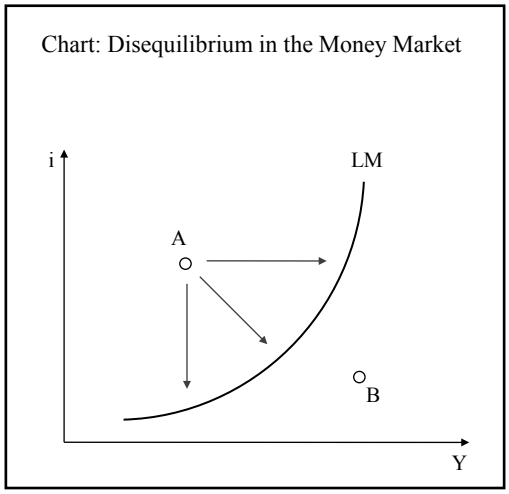
It then follows

v. $\frac{di}{dY} = \tan\beta = \frac{k}{-l'}$

This 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.

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 the 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 in 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.

6.9 Summary

- On 1 January 1999 the European Central Bank (ECB) assumed responsibility for monetary policy in the euro area – the second largest economic area in the world after the United States. 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: 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 model, 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 is the difference between the Eurosystem and the European Central Bank?
- 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 does it look like?
- 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

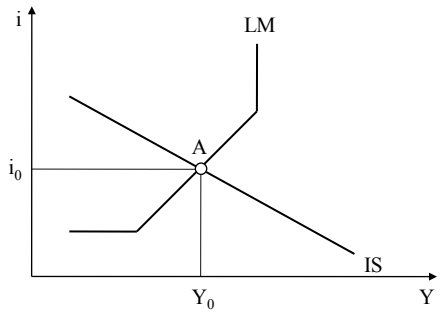
7.1 Learning Objectives

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 their consequences. Finally, we perform some comparative-static analysis in the IS-LM-model.

7.2 Equilibrium in the Goods and the Money Market

After having derived the individual equilibria in the market for goods and the financial market, we want to combine the previous results and use this to discuss the conditions for a simultaneous equilibrium in both markets.[28] 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.[29] Is there a point in which both markets are simultaneously in equilibrium? Obviously, this is exactly the case, where the IS curve and the LM curve intersect. In our graphical illustration, it follows:

Chart: Simultaneous Equilibrium in the Goods and Money Market



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.

☑ 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 curve intersect. How can this result be derived in algebraic terms? Recall that

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. To make sure 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 curve together. 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 not of the 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. $Y - c' \cdot Y + (b \cdot k / l') \cdot Y = C_{aut} + (b / l') \cdot M$

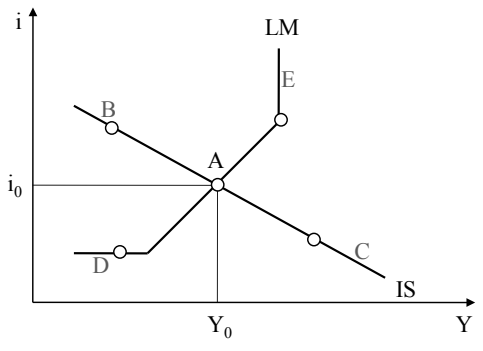
vi. $Y^* = Y = \frac{C_{aut} + (b / l') \cdot M}{(1 - c' + (b \cdot k / l'))}$

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.

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.

Chart: Disequilibria in the IS/LM Model

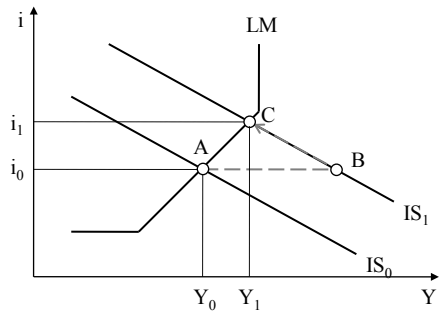


An equilibrium only occurs in point A. In B, the market for goods is in equilibrium, but the demand for money is lower than the supply of money. In C, the market for goods is in equilibrium but the demand for money balances exceeds the supply of money. In D, the money market is in equilibrium but the 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. 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 deccumulation 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. This would lead to a rightward shift of the IS curve, from IS_0 to IS_1. In graphical illustration, it follows:

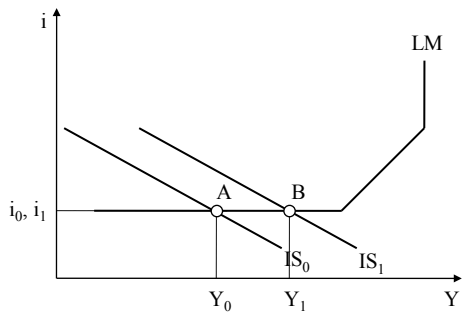
Chart: Increase in Investment in the IS/LM Model



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.

Now suppose that the initial impact would not stem from a rise in investment but from a rise in government expenditures. 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 expenditures at least partly "crowd out" private investment. The existence and magnitude of "crowding out" effects has led to some major controversies among macroeconomists.

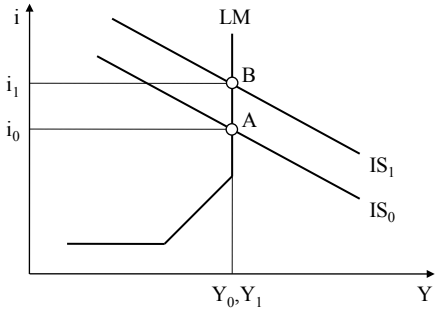
Chart: Shift of the IS curve in the "Keynesian Segment"



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.

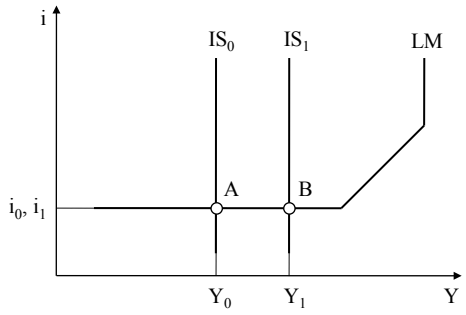
By contrast, in the "classical segment" area, income remains unchanged and only the interest rate increases. In other words: the multiplier effect is equal to zero. Why is that? Quite obviously, in that area, people tend to hold only transactions demand for money and are not at all willing to hold any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

Chart: Shift of the IS curve in the "Classic Segment"



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.

Chart: 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 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.

Chart: Increase of Money Supply in the Normal Segment

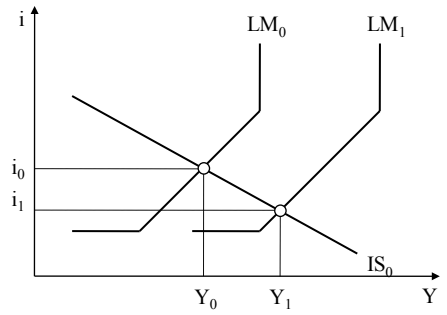
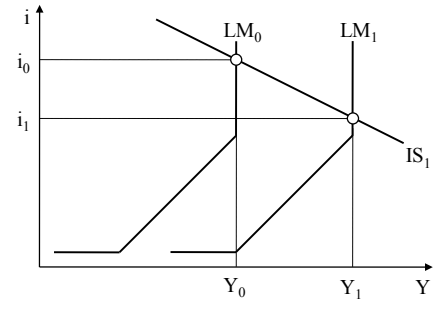


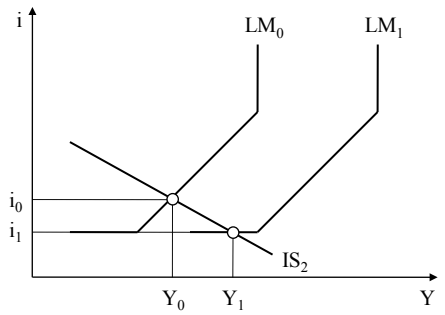
Chart: Increase of Money Supply in the "Classic Segment"



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 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 are 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.[30]

Chart: Increase of Money Supply in the "Keynesian Segment"



7.5 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 deccumulation materialises 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.
- 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 expenditures at least partly "crowd 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 area.
- 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 are 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 a "investment trap"?
- Suppose, the economy finds itself in a "liquidity trap". Is monetary policy still effective? Is fiscal policy still effective?

8 The Labor Market

8.1 Learning Objectives

We start with some basic considerations on the labor market. Subsequently, we analyse the classical labor market and the way, disequilibria are dealt with. We then derive the Keynesian view of the labor 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 labor. The latter market can be characterised by the interplay of labor supply and labor demand. In order to avoid confusion, however, it should be noted that labor supply denotes the supply of labor expressed by households, whereas the demand for labor stands for the demand for labor expressed by firms. For didactical reasons, we will first present the classical view and, subsequently, the Keynesian view in detail.

8.3 The Labor Market – the Classical View

When asking for the determinants of labor 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 labor supply. In this respect, however, a crucial aspect refers to the distinction between the nominal wage level and the real wage level. 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.

☑ 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.

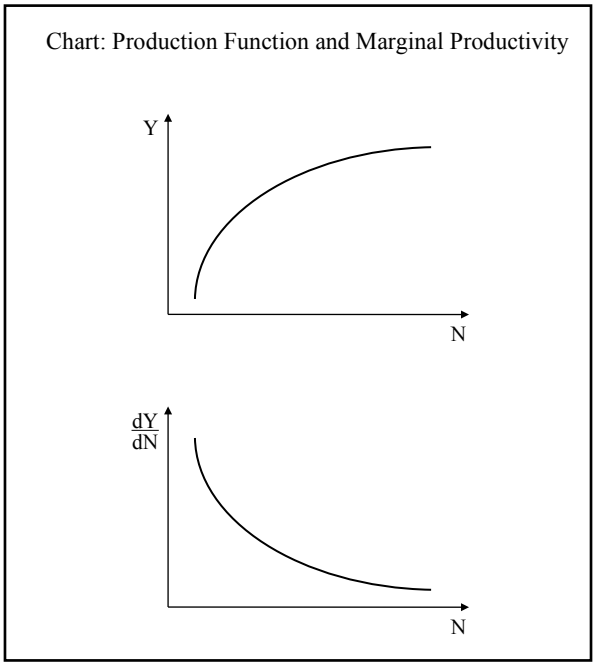
The classical doctrine is based on the belief that labor supply (N^S) depends positively on the real wage. This can be illustrated as follows:

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

$$dN^S / dW^r > 0 \tag{8.3.2}$$

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, labor supply can be illustrated as an upward-sloping curve.

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



In terms of the latter, an increase in labor input that is accompanied by a constant input in capital implies an increase in production. A further increase in the input of labor 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 labor.

How would that 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:

(8.3.3) $$G = P \cdot Y - W \cdot N$$

In a 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:

(8.3.4) $$dG/dN = P \cdot dY/dN - W = 0$$ and, thus

(8.3.5) $$P \cdot dY/dN = W$$

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 labor (that is the price times the marginal product of labor). Re-arranging the equation helps to express the aforementioned relationship in terms of the real wage:

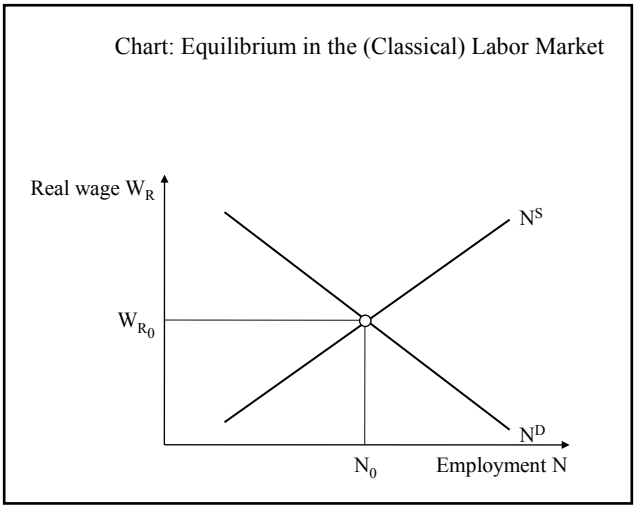
(8.3.6) $$dY / dN = W / P = W^r$$

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 labor since wages basically represent a cost factor. Taken together, it follows that

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

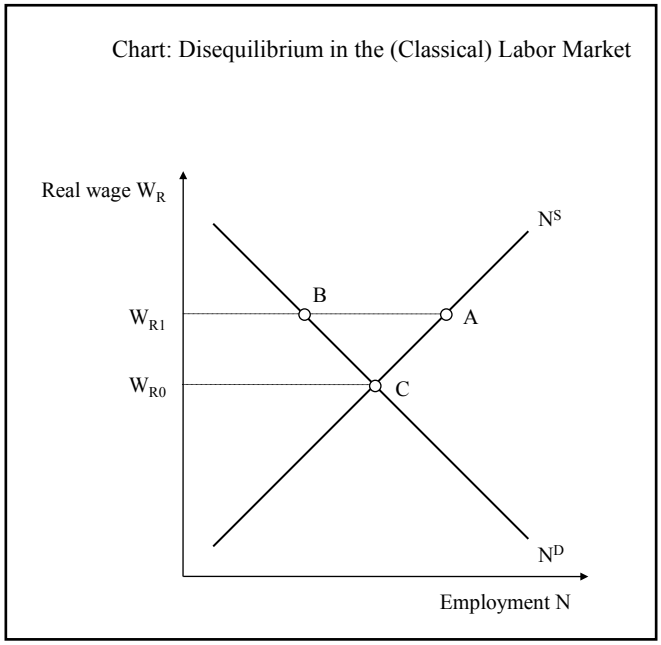
(8.3.8) $$d N^D / d W^r < 0$$

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



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 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 labor? If real wages are too high, an excess supply of labor 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 labor supply in the amount of A exists but only a demand for labor 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 labor market is subject to competitive pressures. These pressures emerge from the fact, that the input factor "labor" can be characterised by homogeneity and mobility as well a full flexibility of wages.



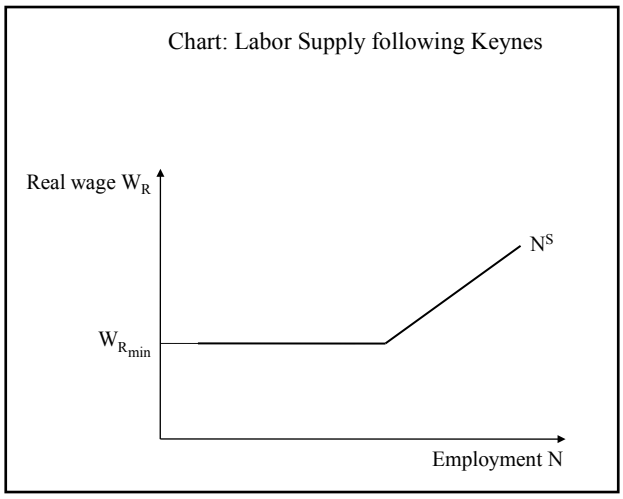
In line with this, some of the unemployed workers signal their willingness to work for lower wages. At the same time, a lower level of real wages will provide an incentive for firms to demand more labor. As a consequence, shifts along the curves will materialise until the equilibrium is reached again.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

8.4 The Labor Market – the Keynesian View

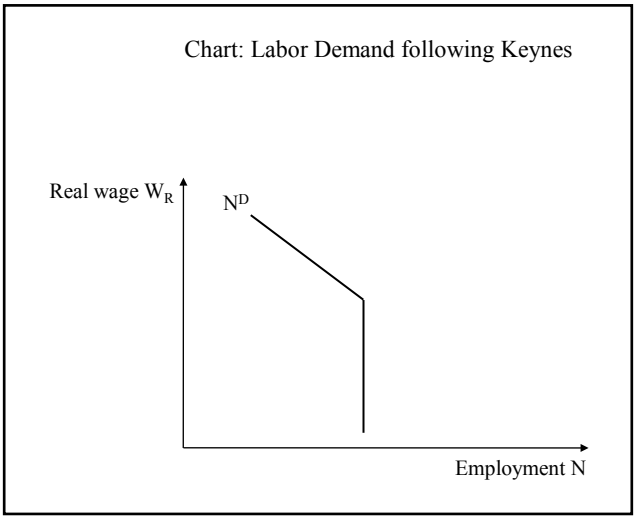
In line with the proponents of the classical theory, Keynes held the view that the supply of labor by households depends on the wage level. Furthermore, he supported the idea that the real wage constitutes the relevant variable for such a decision. Should households erroneously focus on the level of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

But Keynes added a further concept 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 labor market (i.e. the existence and relative power of trade-unions) 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 labor anymore. This observation bears important implications for the shape of the labor supply function. Indeed, as a consequence, a so-called "kinked" labor supply curve results.



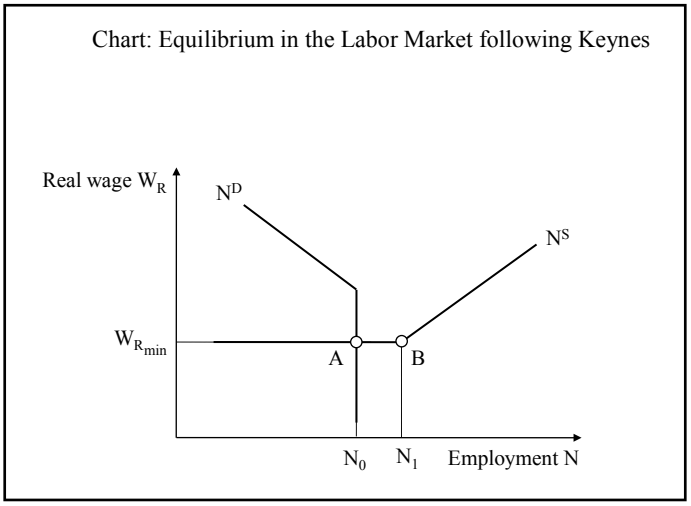
Similar considerations can be applied for labor demand. Again, Keynes generally accepted the microeconomic relationship stating that there is an inverse relationship between the demand for labor and real wages. But, in addition to that, he claimed that the demand for labor also depends on the level of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

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



As in the case of labor 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 labor. This is a direct consequence of the fact that there is no demand for the additional output.[31]

If the supply and the demand for labor are illustrated in a diagram, the Keynesian equilibrium in the market for labor results. Both curves intersect in point A, which then determines the equilibrium with an equilibrium employment and an equilibrium real wage. It is easy to see, however, that in this point labor supply is higher than labor demand, as expressed by the horizontal distance AB, which then leads to unemployment (to the amount of AB). Given the fact that labor demand restricts labor 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 labor market.

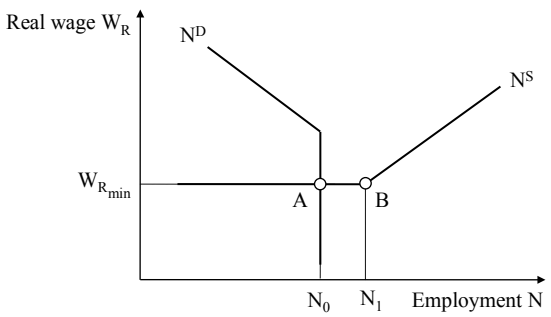


At the same time, it is easy to see that in point B, the full employment equilibrium advocated in the classical paradigm would result. This begs immediately the following question: how can the labor demand curve be shifted to the right? Now, given the fact that the demand for labor depends on aggregate 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 labor demand curve to the right and thus increase employment.

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 "purchasing power theory of wages". In line with these considerations, 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 keep in mind that, according to the classical view, the labor market represents a competitive market and wages are flexible in both directions. Labor is also seen as a rather homogeneous good and the mobility of labor can be assumed. Against this background, the wage mechanism ensures that a full employment equilibrium exists.

Chart: Classic full employment equilibrium in the labor market and the Keynesian view



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

8.5 Summary

- The classical view regards the supply of labor by households as a positive function of the real wage, while the demand for labor expressed by firms is a declining function of the real wage, given that wages are regarded as a cost factor.
- The equilibrium in the labor market is then – following the classic view – consistent with full employment. This is due to the fact that – via 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. Following 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 labor anymore. As a consequence, a so-called "kinked" labor supply curve results.
- With respect to the demand for labor, Keynes accepted the basic microeconomic relationship but claimed that the demand for labor also depends on the level of aggregate demand in the market for goods. This emerges from the fact that, following Keynes, demand determines supply and thus employment. Employment in the economy thus 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 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 emerge out of different assumptions in both paradigms.

📖 Key Concepts

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

☑ Questions for Review

- How can a labor supply curve be derived? Which are the factors that play a role in its determination?
- How can a labor 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 labor market be illustrated in graphical terms? Now suppose, the wage is above its equilibrium value. What are the consequences for the labor market? Which mechanisms can be expected to lead the labor market back to equilibrium?
- Which modifications have to be done to the labor supply curve following the Keynesian view? Which modifications have to be done to the labor demand curve following the Keynesian view?
- How would Keynesian economists explain the situation of a non-market-clearing in the labor 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 the money market in the previous chapters, we are now in the 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

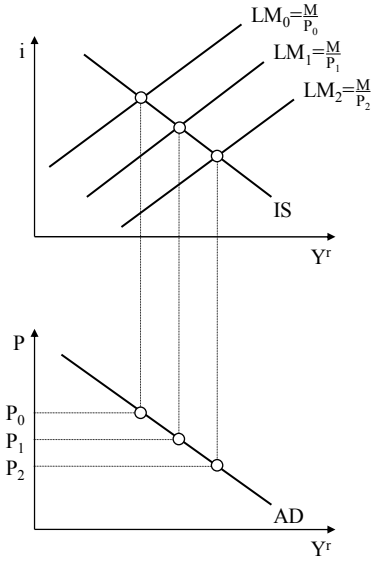
As in previous chapters, we want to derive the aggregate demand curve in a graphical representation. The starting point is the well-known IS-LM-model outlined in previous chapters.

What would be the effects of changes in the price level in 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 laid down 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^r) 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 financial 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.

Chart: Aggregate Demand

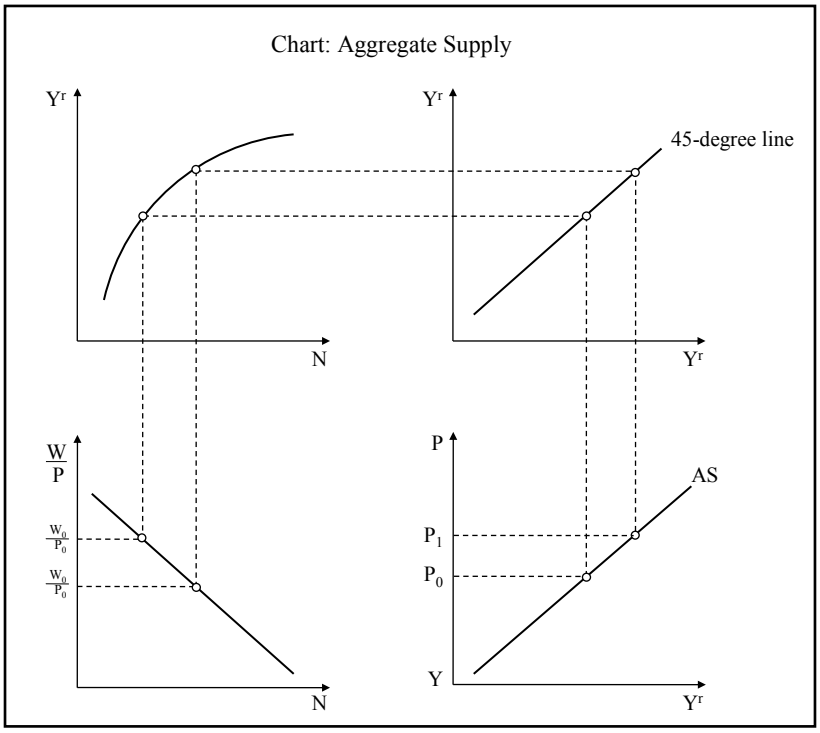


Since the AD curve represents a general equilibrium situation, the location of the curve depends on all factors, that either shift the IS or the LM curve. These are a change in the nominal money supply (M) as well as changes in the autonomous components of the demand for goods, such as consumption (C), 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 a general scheme relying on four quadrants.

In the lower left chart, the demand for labor 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 labor 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^r) increases if the input of labor 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 labor, and following the production function, the corresponding level of output results.



What does the aggregate supply curve exactly show? In essence, it shows for various price levels the corresponding measures of real output Y^r 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 labor 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.

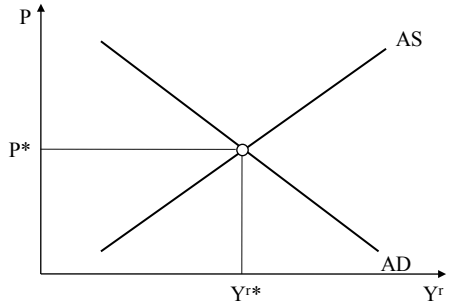
The exact position of AS clearly depends on the position of the demand for labor and also the marginal productivity of labor in the sense that steep curves for labor demand and the marginal productivity will inevitably be reflected in a steep AS curve. Other inputs such as capital, technology and many 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 labor and the money market.[32]

What happens if the economy faces a disequilibrium? Suppose, the economy faces a price level which is higher than the equilibrium level. 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.

Chart: Aggregate Demand and Short-Run Aggregate Supply



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 – an increase in government expenditures, a decrease in taxes, an increase in real wealth (e.g. higher stock and land prices) which in turn leads to higher private consumption and investment expenditures.

At the same time, private consumption and investment may also be driven by expectations, an aspect that has been 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.[33] 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 it allows for more production at the same cost.

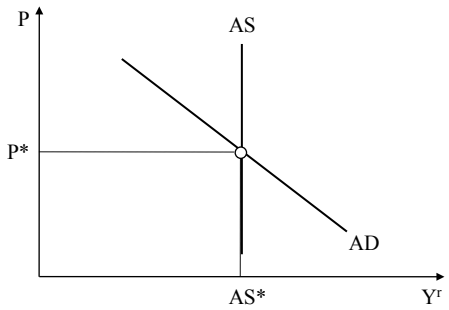
This analysis already shows that changes in the general price level can be brought about by shifts in the supply as well as in the demand curve or in both. A decline in aggregate supply (i.e. a leftward shift of AS) is for instance ceteris paribus accompanied by a short-term decrease in real output and 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 labor. 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.

Chart: Aggregate Demand and Long-Run Aggregate Supply



The intersection of the AS curve with the horizontal level (i.e. AS^*) is what economists call the "potential level of output".[34] 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 the crucial role for the general price level an economy is experiencing in the long run. If the aggregate supply curve is vertical, then changes in aggregate demand affect prices but not real output in the long run. If, for instance, money supply were to 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.

Now recall that inflation was defined as a "sustained increase in the general level of prices".[35] 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.[36]

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 labor 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", 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. 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?
- 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?
- Which are the factors driving price increases? Is there a difference between the short run and the long run?

Part II

10 The European Union and the European Monetary Union

10.1 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 vis–a-vis the United States; Japna and China. In the next step, we outline the essence of the convergence criteria and the status quo of nominal and real convergence in European integration.

10.2 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 also through intergovernmental negotiated decisions by the member states.[37]

☑ 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 766 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.

10.3 The European Central Bank

The 19 national central banks (NCBs) in the euro area and the ECB together form the so-called "Eurosystem".[38] 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.[39] The basic tasks of the Eurosystem are to:[40]

- 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.

☑ 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.

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.

The highest-ranking decision-making body of the ECB is the "Governing Council".[41] It consists of the six members of the Executive Board and the Governors of the NCBs of the euro area.[42] 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.[43] 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.

10.4 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 is not new. 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 (EMU) in three concerted and sequential steps.[44]

The first stage, which basically consisted of a liberalisation of all capital transactions, was launched on 1 July 1990. The second stage of EMU started on 1 January 1994 and was mainly characterised by the establishment of the European Monetary Institute (EMI).[45] 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 (ECB).

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.

☑ 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.
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.
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.

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

10.5 Key Characteristics of the Euro Area Economy

This section makes an attempt to put the main economic and financial elements of the euro area economy into an international perspective.[46] Measured in terms of population and abstracting from China, the euro area – with almost 340 million people – is one of the largest economies in the world. 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 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.

Variable	Euro Area	United States	Japan	China
Population	339.4	319.2	127.1	1360.7
GDP	12.2	16.1	4.4	16.3
GDP per capita	29.8	42.1	28.2	9.2
Value added by economic activity				
Agriculture, fishing, forestry	1.6	1.2	1.2	10.0
Industry (including construction)	24.5	18.4	24.5	43.9
Services (including non-market services)	73.8	80.4	74.3	46.1
Unemployment rate	11.6	6.2	3.6	4.1
Labor partipation rate	72.3	72.7	75.5	n.a.
Employment rate	63.8	68.1	72.8	n.a.
General government surplus (+) or deficit (-)	-2.4	-5.6	-8.5	-1.1
Gross Debt	92.0	96.0	222.0	41.1
Exports of goods and services	26.3	13.5	18.7	24.8
Imports of goods and secrveices	23.2	16.4	21.5	22.3
Current account balance	2.0	-2.2	0.5	1.9

Table: Key Characteristics of Euro Area
Source: ECB data, data refer to the year 2013.[47]

10.6 Convergence Criteria

As already mentioned, the criteria that a member state of the European Union must fulfil in order to join the European 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:[48]

- 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.[49]
- 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 on the basis of 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.[50]

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

This notwithstanding, the convergence criteria have been criticized intensively for various reasons.[51] First, they are completely backward-looking by nature. Second, the reference values for public deficit and public debt are widely seen as arbitrary.[52] 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 labor. 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.

10.7 Nominal and Real Convergence

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

In the table below 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 line with the results of large parts of the literature.[53]

Country	Inflation[1)]	Long-term bond yields[1)]	Unemploy-ment[2)]	GDP per capita[3)]
Belgium	0.5	1.71	8.5	32.5
Germany	0.8	1.16	5.0	34.0
Estonia	0.5	(n.a.)	7.4	19.9
Ireland	0.3	2.37	11.3	36.1
Greece	-1.4	6.93	26.5	19.6
Spain	-0.2	2.72	24.5	25.5
France	0.6	1.67	10.3	29.4
Italy	0.2	2.89	12.7	26.5
Cyprus	-0.3	6.00	16.1	23.4
Latvia	0.7	2.51	10.8	17.6
Lithuania	0.2	2.79	10.7	20.1
Luxembourg	0.7	1.34	6.0	74.3
Malta	0.8	2.61	5.9	23.2
Netherlands	0.3	1.45	7.4	36.0
Austria	1.5	1.49	5.6	34.9
Portugal	-0.2	3.75	14.1	21.4
Slovenia	0.4	3.27	9.7	22.6
Slovakia	-0.1	2.07	13.2	20.8
Finland	1.2	1.45	8.7	30.2
Euro area	0.4	2.28	11.6	32.7

Table: Nominal and Real Convergence in the Euro Area
Source: Eurostat data, year 2014, differences due to rounding, [1)] in percentages, [2)] in percent of the labor force. [3)] in PPP thds.

10.8 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 notr constitute an optimal' currency area, were mentioned.[54] These shortcomings have become even more obvious in the course of the financial crisis.

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:[55]

- 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.

10.9 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.

📖 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 suplus, unit labour costs.

☑ Questions for Review

- What is the essence of the European Union?
- What is behind the concept of the European 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 unemployment and general government debt?

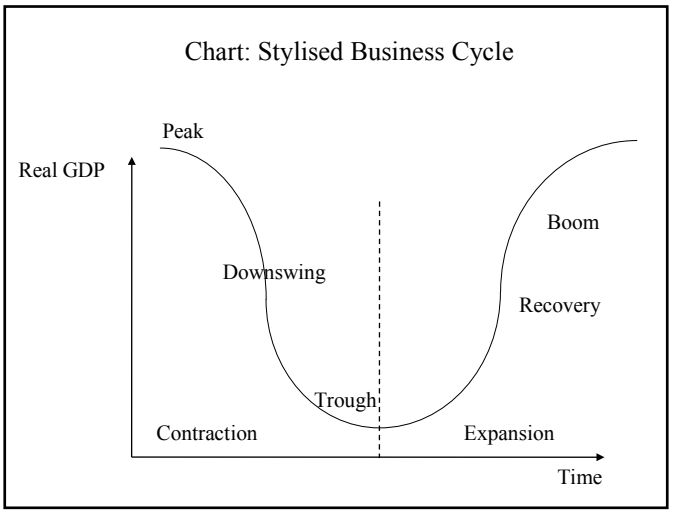
11 Business Cycle Fluctuations

11.1 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.

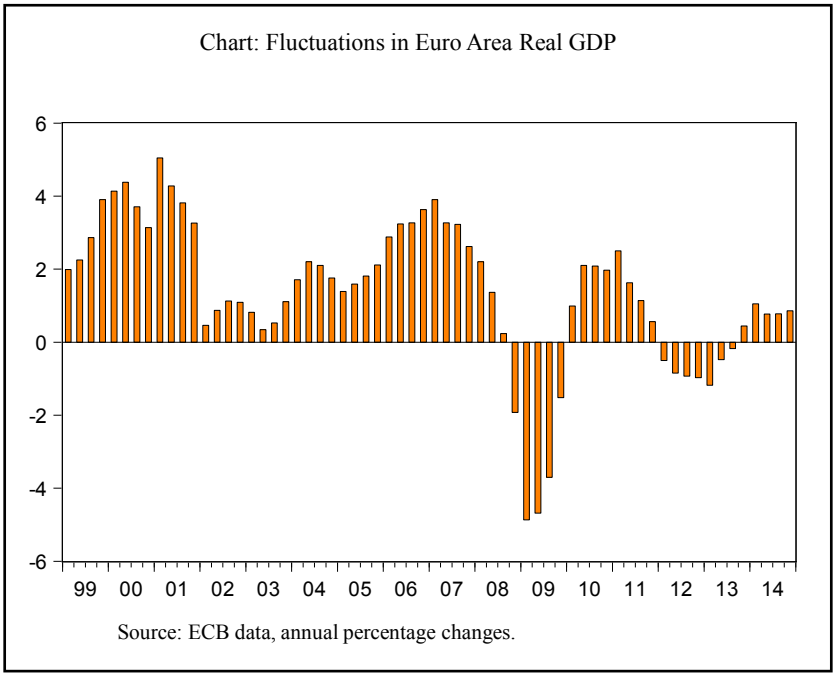
11.2 Fluctuations in Real GDP

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". Understanding the causes of business cycle fluctuations has attracted interest ever since in the economic profession.



As already mentioned, the expressions "business cycle" or "business fluctuations" refer to the ups and downs in economic activity.[56] 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 quite common to measure business cycle fluctuations in terms of the growth rates of the real gross domestic product over time.[57] 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".[58] 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.



For the following considerations, the term Y^r_t will denote real GDP in the year *t*. Similarly ΔY^r_t will refer to the growth rate of real GDP in the year *t*, that is:

$$\Delta Y^r_t = \left(\frac{Y^r_t - Y^r_{t-1}}{Y^r_{t-1}} \right) \cdot 100 \qquad (11.2.1)$$

Quite often, periods of positive GDP growth are 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 word 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.

11.3 Various Types of Cycles

Economic research has identified a variety of different cycles that have been named after their discoverers or proposers.[59] 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.[60] 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:

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 Telecommunications (1971).

Over the years, macroeconomists have engaged in heated debates about the sources of business cycles.[61] 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 innovationse).[62] 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 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. 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. 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.

11.4 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.

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 procyclical 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.[63]

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.[64] 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- and low-grade bonds). Both measures have been quite useful in predicting downturns in the economy.[65]

11.5 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.[66] 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:

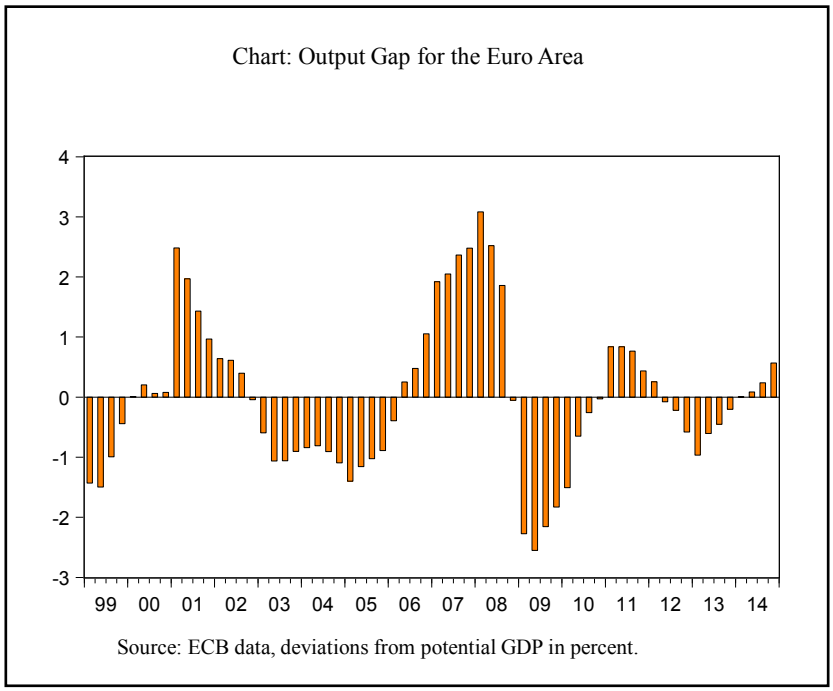
i. $$\sum_{t=1}^{T}(y_t - y_t^*)^2 + \lambda \sum_{t=2}^{T-1}\left[(y_{t+1}^* - y_t^*) - (y_t^* - y_{t-1}^*)\right]^2$$

This expression basically consists of two terms, whereby the first comnponent 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.[67] In practice, the concrete value for λ is often selected as 100 for annual data, 1600 for quarterly and 14400 for monthly data.

Source: Junius et al. (2002, p. 180).

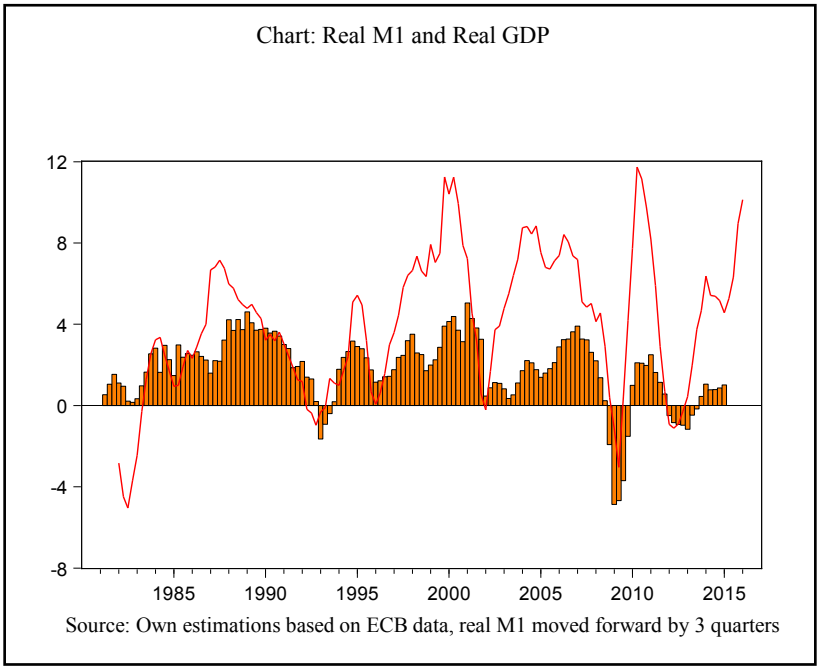
11.6 A First Look at the Data

When applying this method to euro area data, evidence for a business cycle consisting of three upswings and three downswings (with 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.



11.7 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.[68] This is illustrated in the chart below.



11.8 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 some 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) M1 has reliable forecasting properties for (real) GDP growth 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?

12 Unemployment

12.1 Learning Objectives

In this chapter, we outline the essence of unemployment. We first identify some key features of unemployment. We then have a look at different types of unemployment. Finally, we have a look at the euro area evidence.

12.2 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 labor force (LF), which is defined as the sum of those employed (N) and those unemployed (U):[69]

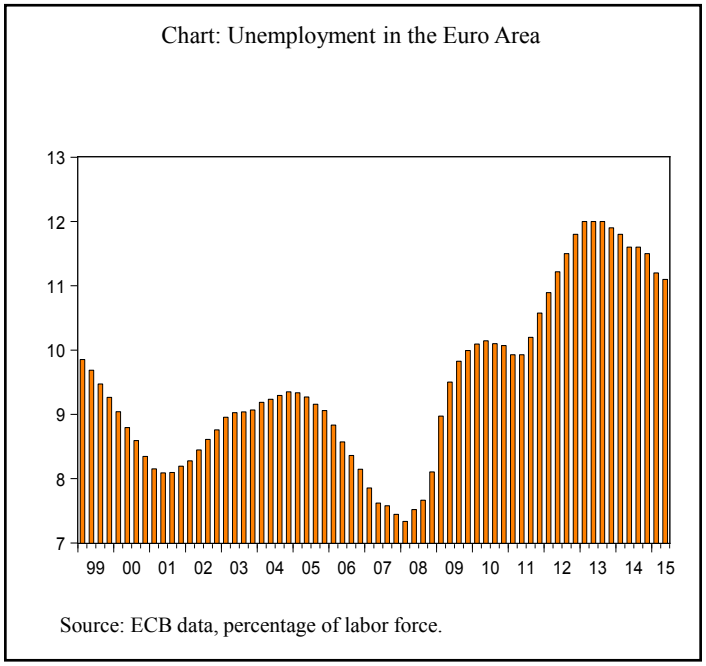
$$LF = N + U \tag{12.2.1}$$

In the next step, the unemployment rate (u) is then defined as the ratio of the number of unemployed people (U) to the total labor force (LF) and it is generally explained in terms of percentages:

$$u = \left(\frac{U}{LF} \right) \cdot 100 \tag{12.2.2}$$

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 labor 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 agree that there are 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.[70]



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 mid-2015, 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.

12.3 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.[71]

By contrast, structural unemployment refers to people that have either not acquired the skills needed in the labor 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 conomy is booming. 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. Taken together, this explains why the unemployment does not equal zero in the case of full employment. There will always be some people who are structurally or frictionally unemployed.[72]

☑ Okun's Law

The relationshp 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:

i. $$\frac{Y_t^r - Y_{t-1}^r}{Y_{t-1}^r} = \frac{\Delta Y_t^r}{Y_{t-1}^r} \approx 2.5(U - U^*)$$

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 faat that the calculations are based on the difference between U and U*, Okun's Law clearly gives a measure of the forgone output due to cyclical unemployment.

Source: Okun (1962).

12.4 Summary

- The unemployment rate is defined as the ratio of the number of unemployed people to the total labor force and generally explained in terms of percentages.
- Most macroeconomists would agree that there are 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.
- 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 primary categories of unemployment, namely structural, frictional, and cyclical unemployment.

🕮 Key Concepts

Unemployment, Okun's Law, structural unemployment, frictional unemployment, cyclical unemployment.

☑ Questions for Review

- How can the unemployment rate be defined?
- What do you know about Okun's Law?
- Which types of unemployment do you know?

13 Prices and Inflation

13.1 Learning Objectives

We start with some basic considerations 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.

13.2 Goods and Baskets

Let us illustrate some basic considerations by means of a simple numerical example.[73] 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 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:

$$P_t = \frac{330}{300} = 1.1 \tag{13.2.1}$$

Frequently, 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 as in the base year, they will have to pay 10 percent more.

On a more fundamental basis, such a price index tries to provide a 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.

13.3 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-1} represents the price level last year and P_t represents the actual price level, then the inflation rate over the past year can be written as:

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} = \frac{\Delta P}{P_{t-1}} \tag{13.3.1}$$

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:

(13.3.2) $$\pi = (110 - 100)/100 = 10/100 = 0.10 = 10\%$$

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 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:

(13.3.3) $$P_t = P_{t-1} + (\pi_t \cdot P_{t-1}) = P_{t-1} \cdot (1 + \pi_t)$$

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.[74]

13.4 Effects of Inflation

The table below gives a quantitative impression of the impact of inflation on the purchasing power of money.[75] Among other things, it shows the effects that even relatively benign inflation rates have, if they persist over longer time horizons. 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.

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%
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

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 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 ongoing changes. 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 hard, 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.

13.5 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 these 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 early reliable early warning signals well ahead of future inflationary pressures.

The CPI and the GDP deflator differ in various respeects. 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.

13.6 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%".[76] In light of the facts that prices are affected over short- to medium-term horizons by a variety of factors being beyond the control of the monetary authority and 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.[77]

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 harmonized indexes 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.[78]

Overall index	100.0
Goods prices	57.2
Unprocessed food	7.5
Processed food	12.3
Non-energy industrial goods	26.7
Energy	10.8
Services	42.8
Housing services	10.5
Transport	7.3
Comunication	3.1
Recreation and personal services	14.7
Miscellaneous	7.2

Table: Weights of main euro area HICP components
Source: Eurostat, as of February 2015.

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 2015, 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.[79] Based on the consumer expenditure weights applicable for 2015, goods account for around 57% and services account for around 43% of the HICP.

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 treatment in a general price measurement.[80]

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.

13.7 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".[81] 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 and international commodity prices. 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), 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.

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

Table: Country Weights for Euro Area HICP
Source: ECB data.

13.8 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.

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 preceived 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.

13.9 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.[82] It is intuitively obvious that such a phenomenon places a heavy burden on the economy and is, 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.[83]

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[84]), 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.[85]

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
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
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 hyperinflations
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, therefore, leading in sum to a further widening of the deficit.

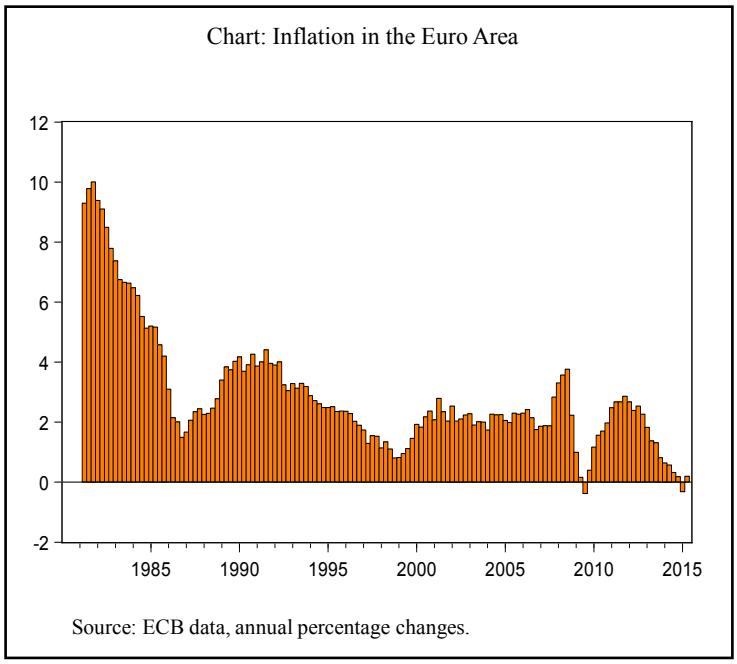
In any way, economies suffering from hyperinflation over several years tend to, ultimately, fall into chaos. Although in most cases, attempts to establish price and/or interest rate controls were enforced, there is no documented evidence that such measures would have been sufficient successful to bring an end to such an episode of hyperinflation to an end. 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 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 were to be reformed. In many cases, also the currency was, at least temporarily, pegged to a foreign currency in an attempt to anchor inflationary expectations.

13.10 Sacrifice Ratios

If inflation is becoming too much of a concern, central banks will eventually have to take the reins on price developments. As we will see in later chapters in more detail, in such a case, however, it might happen that the related restrictive monetary policy action slows down the growth rate of real output to a substantial extent. The ratio of the lost production to the decline in inflation is usually termed as the "sacrifice ratio" of monetary policy and it can be seen as a measure of the costs associated to a monetary tightening. Sacrifice ratios have been calculated by a number of international organisations for a variety of countries.

13.11 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.[86] 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 1.84% with a maximum value of 3.77% and a minimum value of -0.38% over the sample starting in 1999.

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.[87] The median of euro area inflation was around 2.02% and, therefore, slightly above 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 0.87%, 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.[88]

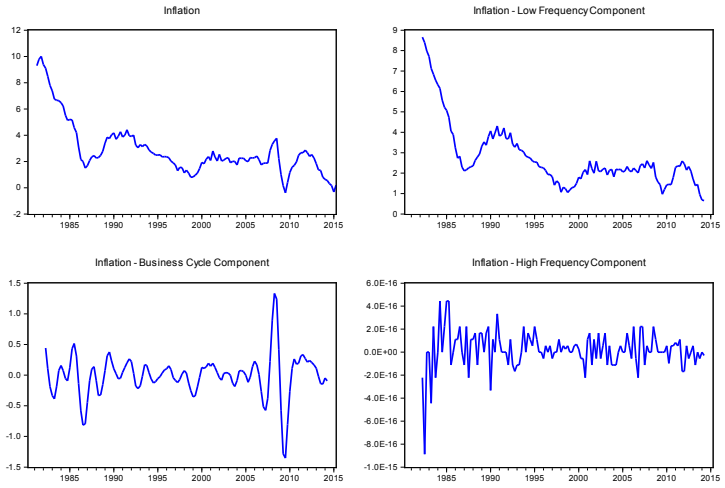
The skewness and kurtosis of euro area inflation were -0.61 and 3.23 respectively and, therefore, euro area inflation can be regarded as being, first, more peaked than the normal distribution. Second, the negative skewness means that the tails of the probability density function do not balance out. In 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 chapters.

13.12 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.[89]

Chart: 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).[90] 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.

13.13 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.[91] 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.[92] In other words, it is assumed that the economy is subject to 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 with 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.

MS-models offer some additional attractive features. On the one hand, the so-called "transition probabilities" can be quantified. There are basically two versions of this application. In a first version, the aforementioned transition probabilities are regarded time-invariant (hence the name "fixed transition probabilities model").

☑ 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. $Y_t = \alpha_{0,1} + \alpha_{1,1} Y_{t-1} + \ldots + \alpha_{p,1} Y_{t-p} + \varepsilon_{t,1}$ if $S_t = 1$

ii. $Y_t = \alpha_{0,2} + \alpha_{1,2} Y_{t-1} + \ldots + \alpha_{p,2} Y_{t-p} + \varepsilon_{t,2}$ 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 $p_{11} + p_{12} = p_{22} + p_{21} = 1$ applies. The distribution of Δp (with a given state of i) is described by the 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.[93]

Source: Hamilton (1989).

The drawback of this version is that it implies that the expected durations of inflationary and non-inflationary periods are forced to be constant over time. This does not seem to be a very realistic assumption since, quite intuitively, the expected duration of an inflationary period is generally thought to vary with a number of variables, such as, for instance, the underlying strength of the economy but also monetary pressures. An alternative is the use of time-varying transition probabilities, which constitute a more realistic feature, but area also computationally more burdensome.[94]

At the same time, the procedure supplies, in addition to estimations of the parameter vector θ, also a quantification of the so-called "regime probabilities" depending on the amount of information considered in each case. In case, the entire amount of information is taken into account, the expression $\Pr(S_t = i \mid I_t)$ describes the conditional probability of being at point t in regime 1 and this ex-post perspective is often referred to as the "smoothed probability" of the MS-model.

If, on the other hand, the focus is only on the amount of information available up to the actual period t, then the expression $\Pr(S_t = i | I_t$ describes the conditional probability for state i, in real time and the latter is generally dubbed as the so-called "filtered probability"). It goes without saying that the filtered value corresponds to the smoothed value when use is made of the entire sample. There is indeed good reason to argue 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 this 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 2015.2. 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:[95]

Variable	Coefficient	Prob.
Low-inflation regime		
Constant	2.26	0.01
High-inflation regime		
Constant	7.33	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 7.33%) comprising mainly the period from the early 1980s to the end of 1998 and a low inflation period (with a mean of 2.26%), 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 (constant) transition probabilities can be shown to be as follows:

	Regime 1	Regime 2.
Regime 1	0.90	0.17
Regime 2	0.01	0.99

Source: own estimations.

Note that a considerable amount of state dependence in the transition probabilities can be detected with a relatively higher probability of remaining in the current regime (0.90 for the low-inflation state and 0.99 for the high-inflation state.

13.14 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 market basket in the base period is taken.
- 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 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.

- 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 be seen as being of help 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, from an economic point of view, extremely destructive.
- The ratio of the forgone output to the decline in inflation is usually termed as the "sacrifice ratio" of monetary policy and it can be seen as a measure of the costs associated to a monetary tightening.
- When applying a frequency decomposition to the euro area HICP, 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.
- When applying Markov-Switching techniques, "high-inflationary phases" and "low-inflationary phases" can be distingusiehd 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, sacrifice ratio, 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 could various descriptive statistical measures tell us about the history of the euro area inflation rate? Can individual regimes be distinguished?
- What does the abbreviation"HICP" stand for?
- Which measurement problems have to be mentioned?
- What is behind the concept of a "sacrifice ratio"?

14 Growth Theory

14.1 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.[96] Finally we have a look at the growth figures in the euro area and set them into an international context.

14.2 Some Basic Considerations

Economic growth is generally referred to as 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^r) 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:[97]

(14.2.1) $$Y^r = A \cdot K^b \cdot N^{1-b}$$

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.

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^r with G_{Y^r} 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:

(14.2.2) $$G_{YR} = G_A + b \cdot G_K + (1-b) \cdot G_N$$

☑ Levels and Growth Rates

In this box, we want to show that if $Z = X \cdot Y$ then $G_Z = G_X + G_Y$ holds.[98] Why is that? Let ΔZ be the increase in Z when X increases by ΔX and Y increases 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) $$1 + G_Z = (1 + G_X) \cdot (1 + G_Y)$$

The latter term can for small values of G_X and G_Y be simplified to:

(v) $$G_Z = G_X + G_Y$$

Source: Blanchard (1997), p. A10.

Seen in this way, the growth rate of real GDP (G_{Y^r}) equals the growth rate of autonomous growth (G_A) plus a weighted average of the growth of capital (G_K) and labour (G_N) with the respective weights b and 1 – b.

We can further extend our deliberations and express growth of real GDP per person. The 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 (G_N) from the growth rate of real GDP (G_{Y^r}). It then follows:

(14.2.3) $$G_{YR} - G_N = G_A + b \cdot G_K + (1-b) \cdot G_N - G_N$$

(14.2.4) $$G_{YR} - G_N = G_A + b \cdot G_K + G_N - b \cdot G_N - G_N$$

(14.2.5) $$G_{YR} - G_N = G_A + b \cdot (G_K - G_N)$$

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.

14.3 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:

(14.3.1) $$S = I$$

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

(14.3.2) $$I = I_{net} + D$$

In addition, replacement costs can be assumed to be a fixed fraction (the "depreciation rate" (d) of the capital stock (K):

(14.3.3) $$D = d \cdot K$$

Finally, net investment is equal to the change in the capital stock from one period to the next (ΔK).

(14.3.4) $$I_{net} = \Delta K$$

These individual key elements can be combined if we substitute all equations into equation (14.3.1). It then follows:

(14.3.5) $$S = \Delta K + d \cdot K$$

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:

(14.3.6) $$\frac{S}{K} = \frac{\Delta K}{K} + d$$

Next, we multiply the left-hand side of the equation by the term Y^r / Y^r:

(14.3.7) $$\frac{S \cdot YR}{K \cdot YR} = \frac{\Delta K}{K} + d$$

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 $s = S / Y^r$). Following our earlier convention, we denote the percentage change in the capital stock ($\Delta K / K$) by G_K:

(14.3.8) $$s \cdot \frac{YR}{K} = G_K + d$$

Next we solve this expression for G_K:

(14.3.9) $$G_K = s \cdot \frac{YR}{K} - d$$

Finally, we subtract G_N from both sides of the equation:

(14.3.10) $$G_K - G_N = s \cdot \frac{YR}{K} - d - G_N$$

We are interested in the growth of capital per person ($G_K - G_N$) because it is one of the two main determinants of real GDP per person. And the equation above states that ($G_K - G_N$) in turn depends on the average savings rate (s), the output to capital ratio (Y^r / K), the depreciation rate (d), and the population growth rate (G_N). We can also interpret our findings in an alternative way saying that the total available amount for savings relative to the capital stock (that is, $s \cdot (Y^r / K)$) can be used for three purposes – replacing old capital (d), equipping new workers with capital (G_N), or allowing the capital stock to grow faster than the growth in labor input ($G_K - G_N$).

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^r/K, d, and G_N) and one of which (s) can be affected by policy actions. The Y^r/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 (G_N) depends on birth and death rates. 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 discussion 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.

A policymaker willing to stimulate available savings and, thereby, growth in capital per person ($G_K - G_N$) 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.

☑ The New Economy from a Growth Perspective

During the four years 1995–99, U. S. 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 have declared this happy state as the "New Economy".[99] 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).

14.4 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 autonomous factor (G_A), and how can it be influenced? Recall from earlier sections that the following relationship holds:

$$G_{YR} - G_N = G_A + b \cdot (G_K - G_N) \tag{14.4.1}$$

A logical approach could be to estimate the magnitude of the main elements G_{Y^r}, G_N, G_K, and b. Then the final element G_A can be calculated as the residual. 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".[100]

Against this background, A is often interpreted as representing the impetus of the technology available, such as, for instance, inventions, improvements in the production process and management techniques. Hence G_A 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 labor) used and, therefore, is equivalent to a faster growth in output per unit of input, it is in the literature often summarised under the expression "total factor productivity". In principle, total factor productivity can be measured by:

$$G_A = G_{YR} - b \cdot G_K - (1 - b) \cdot G_N \tag{14.4.2}$$

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 G_A (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.

14.5 A First Look at the Data

How much was 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 period from the first quarter of 1980 to the second quarter of 2015, we regress the (log of) real GDP on a linear time trend. This yields:

$$Log(Y^r) = 15.4 + 0.005 \cdot Trend \tag{14.5.1}$$

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 better.

14.6 Summary

- Sustained divergences between 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, inventions, improvements in the production process and management techniques. Hence G_A 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?

15 Multiple Choice Test

Which of the following topics form part of macroeconomic analysis…?

- ❑ the analysis of household's behaviour
- ❑ the analysis of business cycle fluctuations
- ❑ the analysis of the monopolist's price-setting behaviour
- ❑ the analysis of unemployment

Classical economics is rooted in the work of…?

- ❑ David Ricardo
- ❑ Milton Friedman
- ❑ John Maynard Keynes
- ❑ Adam Smith

Some key macroeconomic variables are…?

- ❑ the rate of inflation
- ❑ the rate of unemployment
- ❑ the trade balance
- ❑ the exchange rate

Which of the following equations are part of the mathematical analysis…?

- ❑ behavioural equations
- ❑ primary equations
- ❑ secondary equations
- ❑ identities

An increase in the supply for a good leads to…?

- ❑ an increase in the price
- ❑ a decrease in the price
- ❑ an increase in the quantity
- ❑ a decrease in the quantity

A high elasticity of demand is reflected in…?

- ❑ a vertical demand curve
- ❑ a horizontal demand curve
- ❑ a steep demand curve
- ❑ a flat demand curve

The framework of national accounting embodies…?

- ❑ the expenditure approach
- ❑ the income approach
- ❑ the stock-and-flow approach
- ❑ the value added approach

In a closed economy with government, aggregate demand equals…?

- ❑ consumption minus investment
- ❑ consumption plus taxes plus savings
- ❑ consumption plus investment plus government expenditures
- ❑ consumption plus investment plus net exports

The "permanent income hypothesis" has been advocated by…?

- ❑ James Duesenberry
- ❑ Milton Friedman
- ❑ John Maynard Keynes
- ❑ Alberto Ando and Franco Modigliani

The investment multiplier…?

- ❑ always takes a positive value
- ❑ equals the value of one
- ❑ is always larger than one
- ❑ is usually negative

The "Haavelmo theorem" holds that…?

- ❑ a balanced budget has zero effect
- ❑ a balanced budget has a negative effect
- ❑ a balanced budget has a positive effect
- ❑ a balanced budget increases prices

Along the IS curve…?

- ❑ the market for investment is in equilibrium
- ❑ the market for goods is in equilibrium
- ❑ investment equals savings
- ❑ consumption equals taxes

The ECB's Governing Council…?

- ❑ currently comprises 25 members
- ❑ is chaired by the President of the ECB
- ❑ includes the ECB's Executive Board members
- ❑ votes according to a pre-defined rotation scheme

Along the LM curve…?

- ❑ the money market is in equilibrium
- ❑ the market for goods is in equilibrium
- ❑ transactions demand equals precautionary demand
- ❑ speculative demand equals income

Following J.M. Keynes, money demand consists of…?

- ❑ a transactions demand for money
- ❑ a precautionary demand for money
- ❑ a speculative demand for money
- ❑ an asset demand for money

The LM curve…?

- ❑ always has a negative slope
- ❑ normally has a positive slope
- ❑ can have a horizontal segment
- ❑ can have a vertical segment

The IS-LM model…?

- ❑ shows an equilibrium in the goods market
- ❑ shows an equilibrium in the money market
- ❑ shows an equilibrium in the labor market
- ❑ shows a simultaneous equilibrium in the money and the goods market

A shift of the IS curve to the right in the classical segment…?

- ❑ leads to an increase in prices
- ❑ leads to an increase in income
- ❑ leads to an increase in the interest rate
- ❑ leads to an increase in real wages

Following the classical view…?

- ❑ labor supply depends positively on real wages
- ❑ labor demand depends negatively on real wages
- ❑ diesequilibria cannot persist in the long run
- ❑ the invisible hand does not work

According to J.M. Keynes…?

- ❑ labor supply depends on real wages
- ❑ real wages are subject to downward rigidities
- ❑ labor demand depends on the level of aggregate demand
- ❑ adjustments in real wages will automatically clear the market

The aggregate demand curve…?

- ❑ has a negative slope
- ❑ mirrors the impact of the IS and the LM curve
- ❑ mirrors the impact of the labor market
- ❑ makes use of the production function

In the long run…?

- ❑ the aggregate demand curve is vertical
- ❑ the aggregate supply curve is vertical
- ❑ the aggregate demand curve has a negative slope
- ❑ the aggregate supply curve has a zero slope

The name "Europe" derives from…?

- ❑ one of the six continents
- ❑ a Greek princess
- ❑ a Phoenician princess
- ❑ a Greek island

How many countries are currently members of the euro area?

- ❑ 15
- ❑ 19
- ❑ 27
- ❑ 50

Which of the following countries form the "Baltic countries"?

- ❑ Latvia
- ❑ Estonia
- ❑ Russia
- ❑ Norway
- ❑ Lithuania

Which of the following persons are currently members of the ECB's Executive Board?

- ❑ Gertrude Tumpel-Gugerell
- ❑ Peter Praet
- ❑ Jürgen Stark
- ❑ Axel Weber
- ❑ Sirkka Hämäläinen

Among the business cycles mentioned in the literature are…?

- ❑ the Kitchin cycle
- ❑ the Juglar cycle
- ❑ the Kuznets cycle
- ❑ the Kondratieff cycle

Business cycle indicators are often categorized according to…?

- ❑ their direction
- ❑ their timing
- ❑ their availability
- ❑ their slope

According to empirical evidence, real M1…?

- ❑ is a lagging indicator for activity
- ❑ is a leading indicator for activity
- ❑ behaves in a procyclical way
- ❑ behaves in a countercyclical way

The types of unemployment mentioned in the literature are…?

- ❑ cyclical unemployment
- ❑ frictional unemployment
- ❑ structural unemployment
- ❑ shadow unemployment

Inflation is generally defined as…?

- ❑ a continued rise in the price index
- ❑ a continued decline in the price index
- ❑ a negative but increasing decline in the price index
- ❑ a positive bur decreasing increase in the price index

The three main price indices in the economy are…?

- ❑ the producer price index
- ❑ the interest price index
- ❑ the consumer price index
- ❑ the GDP deflator

The expression "core inflation" refers to…?

- ❑ the part of inflation caused by fundamental factors
- ❑ the part of inflation caused by energy prices
- ❑ the part of inflation caused by energy prices
- ❑ the part of inflation caused by non-fundamental factors

16 List of Symbols and Abbreviataions

AD	=	*Aggregate Demand*
AS	=	*Aggregate Supply*
C	=	*Consumption*
€	=	*Euro*
FV	=	*Future value*
I	=	*Investment*
i	=	*Nominal interest rate*
IM	=	*Imports*
i_{ST}	=	*Short-term interest rate*
i_{LT}	=	*Long-term interest rate*
M	=	*Money*
n	=	*Number of years*
P	=	*Price level*
PV	=	*Present value*
π^e	=	*Expected inflation rate*
r	=	*Real interest rate*
R	=	*Return*
RE	=	*Reserves*
δ	=	*Standard deviation of a distribution*
δ^2	=	*Variance of a distribution*
S	=	*Spot exchange rate*
V	=	*Velocity of money*
X	=	*Exports*
Y	=	*Nominal GDP*
Y^r	=	*Real GDP*
Y_D	=	*Disposable Income*
*	=	*Equilibrium value*
^{A}	=	*Foreign variable*

17 Glossary

Arbitrage: the simultaneous purchase and sale of a financial asset in order to exploit price differences and to realise a (risk-free) profit.

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.

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.

Convergence criteria: the criteria that a member state of the European Union must fulfil in order to join the European Monetary Union and, therefore, the Eurozone.

Correlation coefficient: a measure of the degree of association between two variables.

Currency area: a geographic area, in which the same currency holds.

Cyclical unemployment: unemployment caused by recession.

ECB: European Central Bank, the monetary authority of the euro area.

EMI: European Monetary Institute.

EMU: European Economic and Monetary Union.

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.

Eurosystem: the central banking system that consists of the 18 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.

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.

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.

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: unemployment that occurs when people are changing jobs.

General Council: one of the decision-making bodies of the European Central Bank.

Governing Council: one of the decision-making bodies of the European Central Bank.

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.

Inflation: a sustained increase in the general price level.

Interest rate: the price charged to a borrower for the loan of a certain amount of money.

Kurtosis: a statistical tool to measure the "peakedness" or flatness of the distribution of a series.

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.).

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.

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.

Okuns Law: a rule of thumb that shows the connection between unemployment and GDP by giving a measure of the lost output due to cyclical unemployment.

Optimal currency area (OCA): a concept that was pioneered by the Canadian economist and nobel-prize winner Robert Mundell.

Quantity theory: a key concept in economics that basically describes the link between money and prices.

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.

Standard deviation: a statistical tool to measure the variability or dispersion of a given data set.

Structural unemployment: unemployment tht exists because of lack of skills or being in the wrong location.

Time series chart: a chart showing the time dimension on the horizontal axis and the variable under review on the vertical axis.

Unemployment: status, when people are without work and actively seeking for work.

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Endnotes

1. 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.
2. See Friedman and Schwarz (1963).
3. Similar considerations can be found in Chiang (1984), p. 38.
4. The term "ceteris paribus" derives from Latin. In literal translation, it means "all other things being equal or held constant".
5. See also the deliberations in Cassler (1992), p. 27.
6. See, in particular, Chiang (1984).
7. See Samuelson and Nordhaus (2005, pp. 66–70) for a more detailed description.
8. 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.
9. See Mishkin (2012, p. 19):
10. See also Hall and Taylor (1996), p. 22 ff.
11. See also Burda and Wyplosz (2001, p. 22) for these issues.
12. See Schneider and Enste (2000).
13. See also Browne (1995, pp. 562 ff).
14. Inventories changes are classified as investment because current inventories represent future sales.

15. See Duesenberry, J. (1949); Ando, A. and Modiglian; F. (1963); Modigliani, F. and Brumberg, R. (1954) and Friedman, M. (1957).
16. 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.
17. See, for instance, Burda and Wyplosz (2001), p. 231 ff.
18. Similar considerations can be found in a number of ECB publications. See, for instance, ECB (2011a,b,c) or Scheller (2004).
19. See ECB (2011b), pp. 18 ff.
20. In 2015, there were nineteen governors of euro area NCBs.
21. 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.
22. 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.europea.eu and www.ecb.europa.eu.
23. This assumption must not necessarily hold as broader monetary aggregates typically also include endogenous components such as time and savings deposits.
24. See, for instance, Hall and Taylor (1996), pp. 397 ff.
25. 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.
26. See Baumol (1952) and Tobin (1956).
27. 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.
28. See Hicks (1937).
29. And, therefore, also for an equilibrium in the financial market.
30. We can also derive these effects more formally, but want to abstain here from such a procedure.
31. 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" labor demand.
32. See also ECB (2004).
33. 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 – that the available stock of money has to change hands more often and so circulates more. This is equivalent to a higher velocity of money.

34. 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.
35. 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.
36. In the words of Milton Friedman: "Inflation is always and everywhere a monetary phenomenon".
37. See Scheller (2004, in particular, pp. 28ff) for more details.
38. The expression was selected by the Governing Council of the ECB in 1998.
39. As mentioned before, however, once the convergence criteria have been fulfilled, an EU country can adopt the euro.
40. See Article 127 of the Treaty establishing the European Community.
41. See also Gerdesmeier (2011b, pp. 55ff).
42. Both the Governing Council and the Executive Board are chaired by the President of the ECB.
43. 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.
44. For a more detailed description, see James (2012, pp. 210ff), but also Scheller (2004, pp. 15ff).
45. 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).
46. For details, see ECB (2011b). Compared with some of its individual member countries, the euro area is a large and much more closed economy.
47. Sources: For the euro area: ECB, Eurostat, national data and ECB calculations; for the United States, Japan and China: BIS, IMF, OECD, Reuters and national sources. *) 2013 figures 1) in millions 2) %-share of world GDP in PPP 3) in EUR thsds. 4) percent of total 5) % share of the labor force 6) % 7) % 8) % of GDP 9) % of GDP 10) % of GDP 11) % of GDP 12) % of GDP.
48. These criteria were laid down in the Maastricht Treaty, and were signed by the members of the European Union on 7 February 1992.
49. As will be shown in later chapters, this criterion has not always been applied in a very strict manner.
50. 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%).
51. See, for instance, De Grauwe (2000).
52. See Pasinetti (1998).
53. See ECB (2015).
54. See Bordo and Jonung (1999) for details.
55. See European Commission (2015), Annex 1 for details.
56. See Blanchard (1997), p. 18 ff. but also Samuelson and Nordhaus (2005), pp. 468 ff.
57. 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.
58. See Samuelson (1939).
59. See Bombach (1985) for details.
60. Although there seem to have been early predecessors in the Netherlands.
61. See also the more detailed discussion in Burda and Wyplosz (2001), pp. 339–353.

62. 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.
63. See Burda and Wyplosz (2001).
64. Many economists claim that every postwar downturn in the U.S. economy has been anticipated by the stock market. The problem is that there have been also several downturns in the stock market that didn't turn into recessions – so-called "false signals". A classic example is the October 1987 crash, which was followed by several years of continued growth. It is, therefore, often argued that "the stock market has predicted twelve of the last eight recessions".
65. See Friedman and Kuttner (1998).
66. See Hodrick and Prescott (1997) for details.
67. Expressed in other words: The larger the lambda-parameter, the smoother the sigma of the original time series.
68. See Brand, Reimers and Seitz (2005) and von Landesberger (2007).
69. See Blanchard (1997), p. 26 ff.
70. See Blanchard (1997), p. 27.
71. To be more precise: in essence, there are more unemployed workers than job openings due to the breakdown of the economy.

72. Seen against this background, one might argue that frictional unemployment can be seen as a kind of transaction cost of trying to find a new job.
73. See Gerdesneier (2011a, p. 26).
74. See Dornbush, Fischer and Starz, (2004), p. 39.
75. 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.
76. See ECB (1999a and 2003) for details.
77. 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).
78. See Pollard (2003), p. 20.
79. 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.
80. See Weber (2007) for a more detailed decription of these issues.
81. This section draws heavily on Gerdesmeier (2015, Chapter 5.5).
82. See Cagan (1956) for details.
83. See also Gerdesmeier (2011b, p. 31ff).
84. See Frenkel (1977) for details.
85. See Hanke (2008, 2009).
86. See also the description in Gerdesmeier (2014), chapter 2.
87. See, for instance, the considerations outlined in Bleymüller et al. (1983, pp. 15ff).
88. See also Gujarati (2003, pp. 148ff).
89. See also Pill und Rautanen (2006).
90. 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.
91. See Hamilton (1989).
92. The regimes would differ, for instance, in their respective means and variances.
93. See Krolzig (1997).
94. See Diebold, Lee and Weinbach (1994).
95. See Amisano and Fagan (2013) and Amisano, Colavecchio and Fagan (2014) for a more elaborated version of an MS-model.
96. 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), Hall and Taylor (1997) and Samuelson and Nordhaus (2005), pp. 570 ff.
97. This chapter follows closely the very intuitive illustrations of the key issues outlined in Gordon (1984, pp. 571ff) and Blanchard (1997, pp. 446 ff.).
98. See Blanchard (1997, Appendix A 10).
99. For the following deliberations, see Gordon (2000) and Issing (2004).
100. We are not sure, who has been the first one to call it like that but we think, it could have been Abramowitz (1956).