4. Monetary Policy

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Money is an old device but the concept of **monetary policy** is relatively recent. Some of the **central banks** that are in charge of running it are venerable institutions, like the Bank of England which was founded in 1694, but some were only created recently, including the US Federal Reserve, which was founded in 1914. Most central bankers nowadays are very **sophisticated policymakers**, but their tasks were initially limited to printing and distributing banknotes and coins backed by gold. Very few central banks enjoyed **real independence** in the 1970s, but major reforms occurred in the last two decades of the twentieth century. There has also been considerable advance in the **theory of monetary policy**. Accordingly, discussions on **monetary strategies and policies** have evolved a great deal over the last decades.

It is only after the **hyperinflation** experiences of the 1920s and the subsequent Great Depression that the concept of a **macroeconomic role for monetary policy** emerged. Indeed, both events have been shown to be related to monetary-policy errors – excessive money creation in the 1920s, excessive money tightening in the 1930s (Friedman and Schwartz, 1971). Those episodes would later lead to a rethinking of the role of monetary policy, but it remained somewhat eclipsed by **fiscal policy** in the first post-World-War-II decades, a time when the Federal Reserve was primarily assigned the role of minimizing the cost of public borrowing.

The **role of monetary policy** was reassessed as a consequence of the mistakes made in response to the inflationary shocks of the 1970s and the

subsequent emergence of disinflation as an overriding policy objective. Like the previous episode, this one prompted a deep rethinking of the relationship between **monetary policy**, **growth**, and **inflation**. A lasting consequence of the inflationary mistakes of the 1970s was also that most countries decided to grant independence to their central banks.

By the late 1990s, a near-consensus had been achieved that monetary policy had to be mainly geared toward achieving **price stability**. However, policy discussions were less and less about objectives and more and more about **strategies** and **tactics**.

One of the most striking aspects of the evolution of monetary policy has indeed been its increasing sophistication and the growing importance of **credible communication** to market participants and private agents.
After the recent financial crisis which started in 2007, there has been an effort from central banks both to convey and make certain their role of **guarantors of financial stability**.

The dramatic worsening of the economic situation in autumn 2008 after the bankruptcy of Lehman Brothers led monetary policy to change the conventional course. Policy interest rates were sharply lowered and soon reached the **zero bound** and several central banks started to engage in **unconventional monetary policy actions**. Beyond **short-term lending to banks**, these consisted in **two main initiatives**: First, the **direct provision of liquidity** to nonfinancial companies through the purchase of short-term securities such as commercial paper. The goal here was to temporarily substitute for a paralyzed banking system. Second, central banks also engaged in **credit easing** or **quantitative easing** and bought longer-term securities such as government bonds in order to keep the asset market operating and lower longer-term interest rates. This illustrated the central banks' mandate to preserve **financial stability** and their unique power to **create money** at will to this effect. Unconventional monetary policies began to be gradually slowed down when central banks were confident enough that normalization of economic and monetary conditions was under way.

This chapter starts with a description of **what central banks do** and a discussion of their **objectives**. In Part 2, we present **the modern theory of monetary policy** and the **lessons** that can be drawn from it. The **current policy debates** are addressed in Part 3.

4.1 Issues

4.1.1 What do central banks do?

a) Liquidity provision

Monetary policy is operated by official institutions called **central banks**, which have the privilege of creating what is called **base money** or sometimes **high-powered money**. This consists in issuing banknotes and in providing liquidity to the financial system in ways that **maintain price stability and promote a safe and efficient payment system**. The first task – the issuance of banknotes – is familiar enough, yet of second-order importance in modern economies. Banknotes represent less than 10% of the economically relevant definition of money (see Table B4.4.1 in Box 4.4). The second task is less familiar, but more important. The best way to understand it is to start from what the central banks actually do on a day-to-day basis.

On any given day, credit institutions (mostly banks) extend credits to households and companies, make payments, and receive deposits from their clients. As these operations do not necessarily balance, banks extend very-short-term loans to each other through what is called the **money market** or the **interbank market**. They are said to provide liquidity to each other. However, the **aggregate balance** between supply and demand is not left to the market participants alone: The central bank also intervenes on the market by providing its own base money to banks. Also, should they face difficulties in borrowing from other banks, banks can turn to the central bank for the money they need to clear payments, **at a fixed price**. This ensures both a safe payment system and a stable price of liquidity.

The central bank supplies enough of base money to ensure that the financial system runs smoothly and, since it enjoys the privilege of creating base money by the stroke of a pen, it does not face any exogenous limit in the supply of credit.

In practice, **liquidity** is provided either through **open-market operations**, i.e. purchases of financial assets by the central bank from commercial banks, or through **repurchase agreements** or **repos**, whereby the central bank holds the corresponding assets on its balance sheet for a fixed period. [It is often said that the central bank **refinances** the commercial bank, hence the notion of **refinancing operation**]. The Federal Reserve normally uses the former mechanism whereas the European Central Bank (ECB) uses the latter. In this last case, commercial banks commit to **buying back**

these assets after a certain period of time (**from one day to a few weeks**), hence the name of repurchase agreements.

The central bank can influence the banks' lending behavior by not accepting all types of financial assets for the liquidity provision. In normal times, there are only a restricted number of financial assets which are eligible as collaterals in the refinancing operations.

The central bank can also influence the banks' lending behavior by asking them to keep a proportion of the deposits received from the public as a deposit with the central bank. This deposit is called a **reserve requirement**.

b) The price of liquidity

When drawing liquidity from the central bank, commercial banks pay a fee in the form of **short-term interest rate**. The higher the refinancing rate is, the lower the demand for liquidity is. Hence by setting a price for its liquidity service, the central bank is able to influence the demand for it. The resulting **money-market rate** will in turn influence all short-term interest rates in the economy and, to a certain extent, long-term interest rates also. And as a consequence it will influence the demand for credit and spending and saving behavior.

In the euro area, banks normally bid for access to central bank liquidity. The ECB can either lend funds at **fixed rate** or at **variable rate**. The corresponding rate is normally the **minimum rate** at which commercial banks can obtain liquidity. This **main refinancing rate** or **refi** is complemented by **two marginal financing rates** that set a **ceiling** and a **floor** to market-rate fluctuations. The three rates are sometimes called **leading interest rates** because they **lead** the market interest rate (see Box 4.1).

Every day, the ECB measures an **average of interbank rates** called the **EONIA** (Euro Overnight Interest Average) from a panel of euro area banks. Figure 4.1 confirms that the EONIA fluctuates around the two **marginal** facility rates. This **permanent arbitrage mechanism**, together with the existence of a **unified euro payment system** called **TARGET**, ensures the unity of money market rates in the area. Since it is so closely linked to the central bank rate, the call rate is often itself considered a monetary instrument, even though this is not the case.

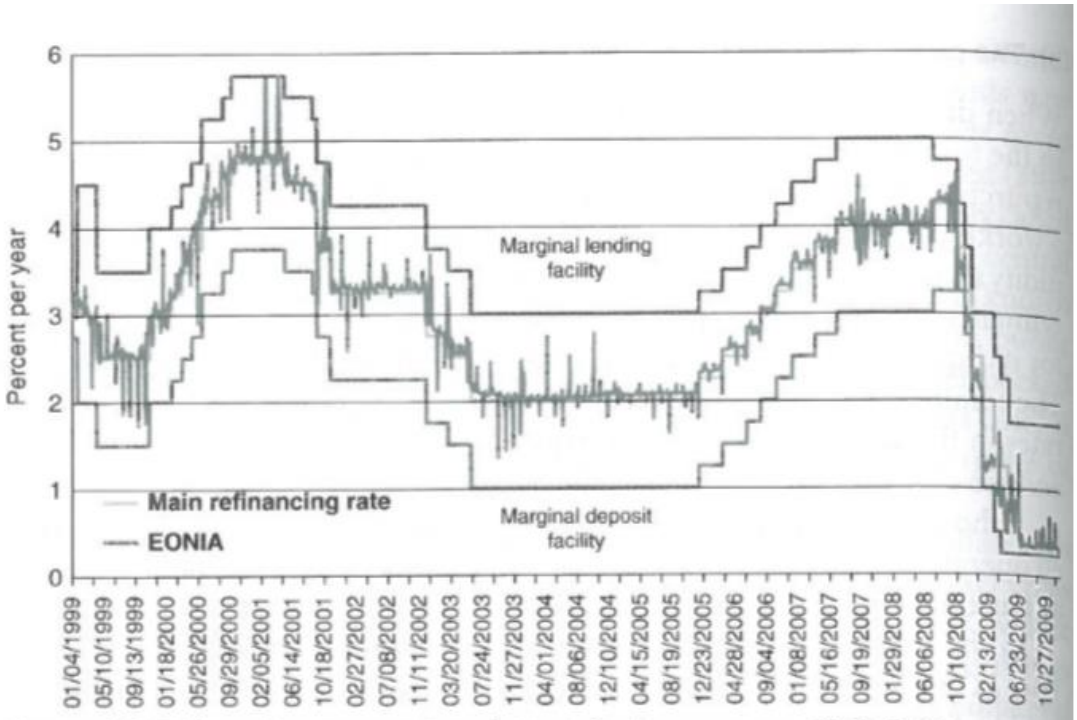

Figure 4.1 Refinancing rates and market rate in the euro area, 1999–2009.
Source: European Central Bank.

Box 4.1 The European Central Bank and the Euro Area's Monetary Policy Instruments

The ECB is a federal institution of the European Union whose statute is a Protocol annexed to the EU Treaty. It is managed by an **Executive Board** of six members, including the president and the vice-president. The monetary policy of the ECB is decided by **Governing Council**, which consists of the Board and the central bank governors of the euro area countries. **Implementation is decentralized**. It involves both the ECB and the national central banks of the euro area. The ECB and the national central banks of the euro area together constitute the **Eurosystem**. The **European System of Central Banks (ESBC)** consists of the ECB and all the central banks of the European Union, including those of countries which have not adopted the euro.

The following instruments are used:

- **Minimum reserves** (2% of the demand deposits and of time deposits shorter than two years – including special, regulated accounts). Compulsory minimum reserves are served the main refinancing interest rates.

- **Two overnight standing facilities**: A **marginal lending facility**, in the form of a repurchase agreement at a high rate, and a **marginal deposit facility** remunerated at a low rate. These two facilities ensure that liquidity is always and unconditionally available to banks. A bank seeking short-term liquidity can obtain it weekly through the central bank's main refinancing operations, or at any time at the marginal lending facility rate or by asking another commercial bank (at the overnight **interbank interest rate**, or **call rate**). Similarly, a bank having excess liquidity can deposit it at the central bank at the marginal deposit facility rate or lend it to another bank at the overnight interbank rate. Arbitrage of both types of banks will insure that the overnight interbank rate fluctuates around the main refinancing rate within a band defined by the two marginal facility rates of the central bank. The overnight interbank rate is a market rate that changes from one transaction to another.
- **Weekly refinancing operations** in the form of competitive bids, through which the Eurosystem provides liquidity to the banks in exchange for public or private securities and loans taken in its balance sheet for two weeks. The corresponding **refinancing rate** is the main rate of the Eurosystem.

In addition, the Eurosystem carries out **monthly** operations for three-month liquidity for smaller banks and can decide **exceptional operations** in certain circumstances.

In the US, the Federal Reserve targets through its **open market operations** the **federal funds rate** which is the rate at which banks can lend to other banks overnight liquidity from their deposits at the central bank (**Federal funds**). It also sets **three discount rates**, for primary credit, secondary credit, or seasonal credit, which are available to financial institutions depending on their **credit quality** (on the principle that the healthiest institutions can get the lowest rate, i.e. the rate on primary credit). The Federal Reserve regularly carries out open-market operations through purchases and sales of US Treasury bills and securities issued by federal agencies. Finally, there is a **reserve requirement** of 3% above a certain threshold of deposits, and the percentage is 10% above a second threshold.

c) Liquidity in stress times

Most of the time, banks routinely extend credit to each other and the central bank can limit its role to monitoring this process and to influencing interest rates through the provision to the banking system of limited amounts of liquidity. There are times however when banks are unwilling to lend to

each other because potential lenders are uncertain of the ability of the borrowers to repay their debts, or because they themselves prefer to hoard cash in anticipation of future shortages.

Regularly, severe financial shocks lead to **liquidity crises**. Recently, when the extent of the US subprime credit crisis began to be realized in summer 2007, the fear that major banks would face funding problems or even bankruptcy as a consequence of the depreciation of financial products held in their portfolios started to spread among market participants. As the losses had not been disclosed yet, each bank started to value counterpart risk and the market for interbank liquidity provision came to a decline (see Box 4.2, p. 247).

Such episodes allow us to better understand what is meant by **liquidity**. An important distinction is to be drawn between **market liquidity** and **funding liquidity**.

- **Market liquidity** can be defined as the ease with which a position in an asset can be liquidated without appreciably altering its price. Threats to it arise when assets that are normally traded in reasonable sizes with little price impact can only be transacted at a substantial premium or discount, if at all. The concept is **asset-specific**.
- **Funding liquidity** can be defined as the ease with which a solvent institution can service its liabilities as they fall due. **Illiquidity** occurs when solvent counterparties have difficulty in borrowing immediate means of payment to meet liabilities that are falling due. This concept is **institution-specific**.

The two types of illiquidity are distinct but **interdependent** because illiquidity of a given market affects institutions which are heavily involved in it, and vice-versa. The crisis in 2007 started as a market liquidity crisis affecting mortgage-related assets and quickly became a crisis of the funding of institutions with significant exposure to the mortgage market.

Central banks assume a crucial role with regard to both categories of risks, especially when funding strains imperil the viability of financial institutions. In 2007-08, in the last stage of its policy action, central banks embarked on outright credit expansion.

d) From short-term to long-term interest rates

Due to banks' arbitrage, short-term market interest rates always remain close to official rates. They also influence interest rates for longer maturities, but this link cannot be seen mechanically.

The **yield curve** (i.e. the interest rates as a function of maturity) is primarily affected by **expected monetary policy**. This is because portfolio managers, who want to invest over a long period, can either hold long-dated assets or roll short-dated assets over time. If they are **not averse to risk**, the long-dated interest rate should be the average of the sequence of expected future short-dated interest rates (Box 4.3). Suppose investors **expect** short-run interest rates (yields of assets) to increase in the future. In this case, they will temporarily prefer buying short-run assets in order to benefit from the future interest-rate rise. This will push long-run interest rates upward compared to short-run ones, and the yield curve will be steeper. In the reverse case (expected interest-rate fall), the yield curve will be flatter or even downward sloping (**inverted yield curve**).

Real-world investors are **risk averse**: Investments with a longer maturity have a **more uncertain return**, hence the existence of a **risk premium** called the **term premium** (i.e. premium from time span) embedded in longer-term interest rates. Accordingly, even when **no change** in short-term interest rates is expected, the yield curve is generally upward sloping: Short-run interest rates are those targeted by the central bank, and longer-term rates are higher. **Inverted yield curves are exceptional events** that can be observed only when a sharp fall in the interest rate is expected (for example, as a result of successful monetary contractions).

Box 4.3 The Yield Curve

Most bonds pay a fixed interest rate and are therefore called **fixed-income securities**. They provide a regular (typically, annual or semi-annual) payment called a **coupon**, and the coupon rate is the ratio of this coupon to the borrowed amount, or **principal**, which is to be refunded at maturity. When issued, bonds are traded on financial markets and the **market interest rate** is defined as the **internal rate of the bond** given its market price. There are a whole range of possible maturities, and hence of interest rates, from a few weeks to 50 years. The standard theory of the yield curve relies on investors arbitraging between a long-term investment (paying the long-term rate) and a succession of short-term investments (each one

paying the corresponding short-term interest rates). As the long investment is riskier (holding the bond until it expires involves an inflation risk, liquidation before the term involves a **capital risk** (i.e. the risk of a fall in the market price of the bond before its liquidation)), the long investment generally yields higher interest than the succession of short investments. More precisely, the interest rate for maturity *N*, i_t^N, can be expressed as a function of expected short-term rates $i_{t+\tau}^l$ and of a term premium ρ_t^N. Thus:

(B4.2.1) $$(1 + i_t^N)^N = \left(1 + i_t^l\right)\left(1 + E_t i_{t+1}^l\right) \dots (1 + E_t i_{t+N-1}^l)(1 + \rho_t^N)^N$$

where $i_{t+\tau}^l$ is the one-year interest rate in t+τ and ρ_t^N is the annualized term premium, defined as the extra return that is required by investors to compensate for holding riskier assets. The term premium grows with *N*. Hence, **the yield curve is generally upward sloping** – absent expected interest-rate variations. It is important to note that the expected interest rates are not directly observable; therefore the term premium is not observable either. However, future interest rates are traded on **forward markets** and this allows it to be evaluated.

Because longer-run interest rates incorporate **expectations** concerning **future monetary policy**, they can change even when short-run rates are held constant. Central banks nowadays tend to avoid creating surprises and they use this property to smooth the evolution of long-run interest rates by communicating their intentions through speeches and interviews. For instance, Figure 4.4 shows that the successive hikes of the main refinancing rate by the ECB in 2006 were incorporated in interest rates of the one-month maturity or more before they took place. Indeed, longer-term interest rates rose smoothly through the year.

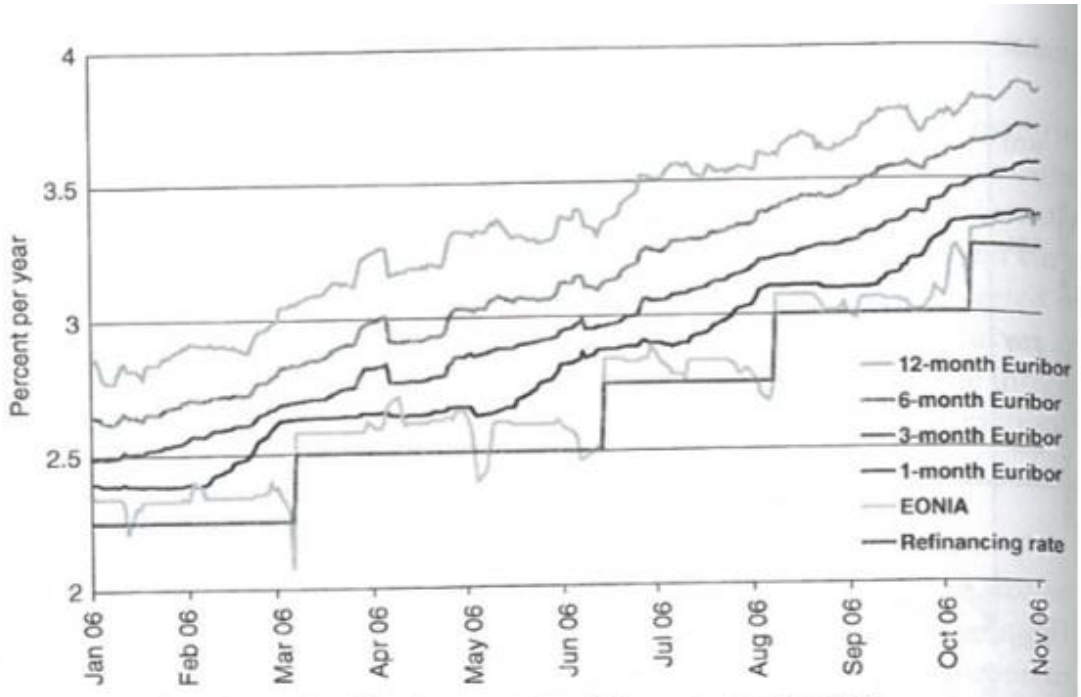

Figure 4.4 Market and policy interest rates: The euro area in 2006.

e) Nominal and real interest rates

A familiar and important distinction exists between nominal and real interest rates. For each maturity, the **real interest rate** is the difference between the **nominal interest rate** and the **expected inflation rate** over the same period. Because the expected – rather than observed – inflation rate enters into its determination, it is sometimes called the **ex ante real interest rate**, while the difference between the interest rate and observed inflation is called the **ex post real interest rate**. Both notions can be used but only the **ex ante real rate** matters for economic decisions.

f) International linkages

Capital mobility across countries distorts the link between monetary policy and interest rates. This is because investors can **arbitrage** not only between short-run and long-run assets, but also between domestic and foreign assets. For instance, the long-term rates in the euro area and in the US depend on **expectations** concerning future monetary policy. However, for each maturity, investors can arbitrage between euro area and the US assets. This makes the interest rates across the Atlantic interdependent. Figure 4.5 illustrates this issue.

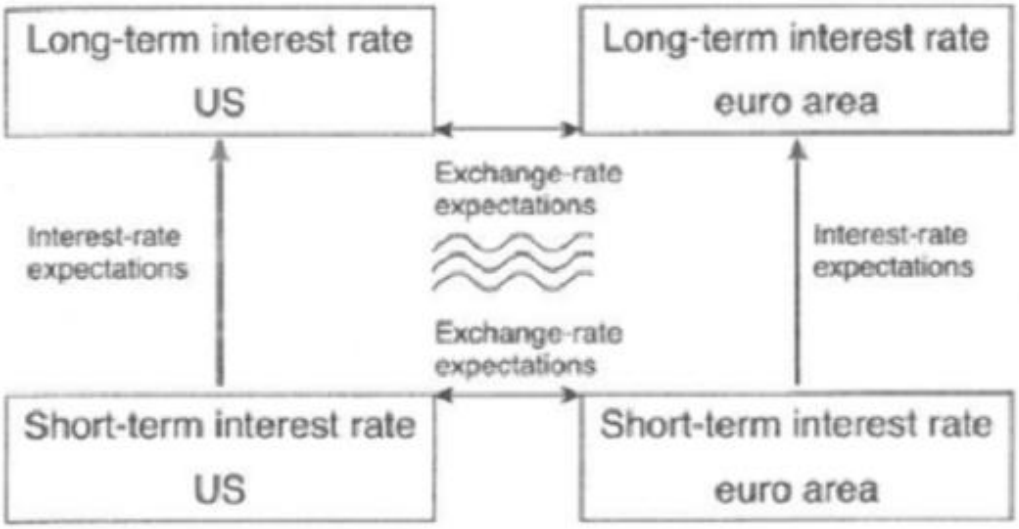

Figure 4.5 International interest rate linkages: A stylized view.

Interdependence does not mean identity, for two reasons. **First,** some countries are considered riskier than others because of higher indebtedness, political uncertainty or weak legal protection and financial supervision. Hence a **country-risk premium** is added to their interest rates in comparison to less risky countries, especially for long-run assets. **Second**, interest rates differ across countries if the exchange rate is expected to vary. This is because investors will require a higher return from an asset denominated in a currency that they expect will depreciate.

g) What about money?

So far, we have refrained from mentioning the **quantity of money** in circulation. However, it has played an important role in theory and policy debates and some central banks maintain objectives for growth in monetary aggregates.

Money is hard to define and even harder to measure (see Box 4.4). The concept is simple – **fiat money** consists in a deposit at a bank (or similar institutions) that can be used together with notes and coins as a **medium of exchange** – but as financial innovation has developed, there is now a continuum of financial instruments which meets this definition.

Historically, **monetary aggregates** corresponding to various definitions of money have played an important role in the discussion about **monetary policy**. In the 1980s, most central banks relied on such aggregates to guide policy. They were essentially used as **observable intermediate objectives** that were supposed to be strongly correlated with **future inflation** as the **quantity theory** of money would predict (see Section 4.2). A central bank targeting low inflation would thus define a **path for monetary aggregates** consistent with its **price-stability objective**. Money would thus serve as a leading **indicator** of future inflation. However, experiences with strict control of monetary aggregates, especially in the US and the UK in the late 1970s, resulted in high interest-rate instability, and monetary aggregates proved to be poor predictors of inflation in a **financial-innovation context**. Aggregates were thus put aside as policy indicators and the US Federal Reserve has even stopped publishing some of them. Nevertheless, the discussion has not ended. The European Central Bank remains more faithful to the aggregates than the Federal Reserve or the Bank of England. We shall return to this discussion in Section 4.3.

Box 4.4 Money and Monetary Aggregates

The traditional definition distinguishes between the money directly circulated by the central bank (coins and notes in circulation plus deposits of commercial banks at the central bank), which is called ***M0*** and is registered as a liability of the central bank, and money issued by commercial banks for their customers. However, while it is clear that a deposit on a cash account is being used for the purchase of goods and services and is therefore equivalent to bank notes, should a savings deposit, that can be transferred overnight into the cash account, also be regarded as money?

Various monetary aggregates have thus been defined: ***M1*** includes both ***M0*** and demand deposits. Hence ***M1*** is the sum of the most liquid liabilities of the central bank and commercial banks. Similarly, ***M2*** includes ***M1*** and deposits with a maturity of up to two years, whereas ***M3*** is the sum of ***M2*** and of money market instruments, i.e. marketable securities with less than one year to maturity (Table B4.4.1).

Table B4.4.1

The money aggregates of the euro area, in billions of euros and in % of *M3* in February 2010

M1	Currency in circulation + Overnight deposits	4565 (49%)
M2	M1 + Deposits with na agreed maturity of up to two years + Deposits redeemable at notice of up to three months	8225 (88%)
M3	M2 + Repurchase agreements + Money market fund shares/units	9321 (100%)

The central bank **creates money at will** (Table B4.4.2). This occurs when it provides liquidity to a commercial bank through buying a financial asset (for example, a government bill) or receiving it in a repurchase agreement: The assets-and-liabilities side of its balance sheet increases by the corresponding amount. The commercial bank, in turn, replaces the government bill by central bank money on the asset side of its balance sheet.

Table B4.4.2
Money creation by the central bank

Central Bank		Commercial Bank	
Bills	Money	~~Bills: 100~~	Deposits
100	100	Money: 100	100

Commercial banks also create money. For example, a commercial bank extends credit of 100 to a customer, who in turns spends it on goods and services. This implies that the customer draws on his deposit account for, say, 80, and transfers the corresponding money to the accounts of other customers in other banks. The bank which initially extended the credit retains at that point only a fraction of the initial deposit (in this example, 20). The other banks receive the deposits of the other customers (80), which can be used to extend new loans (Table B4.4.3). **There is money creation each time the banking sector extends a loan to nonbank customers**, because this amounts to increasing the total amount of deposits in the system.

Table B4.4.3
Money creation by commercial banks

Central bank	Commercial banks	Customers

Claims on Commercial Banks 100	Money 100	Loan 100	Customer Deposit 100 Customer Deposits 80 20	Bank Accounts 100 Bank Accounts 80 20	Debt 100

Note: Assets are on the left, liabilities on the right. Total money created: 200, of which 100 by the central bank and 100 by commercial bank.

If commercial banks extend loans in constant proportion to money received from the central bank, the ratios of ***M1***, ***M2***, and ***M3*** to ***M0*** are constant and called **money multipliers**. Control of ***M0*** thus allows the central to control the total amount of money in circulation. However, the link between ***M0*** and other aggregates has considerably loosened over time, especially because close substitutes to the least liquid components ***M2*** and ***M3*** have emerged as a consequence of financial innovations.

4.1.2 The objectives of monetary policy

The objectives that central banks should pursue constitute their **mandate**. These have varied significantly over time and are still a matter of discussion among politicians and economists. In the 1970s, it was common for central banks to have broad mandates involving difficult trade-offs between alternative targets. One of the lessons drawn from the inflation of the 1970s and the 1980s has been that central banks ought to be given more precise objectives; **price stability** emerged as the dominant one. However, not all central banks have a mandate focused on price stability and those that do may have to pursue other objectives simultaneously. In addition, the financial crisis of 2007-09 has opened a discussion on whether central banks should be less focused on controlling price inflation and gear monetary policy more towards **financial stability**.

a) Price stability

Pursuing price stability amounts to maintaining the real value of money, that is, its **purchasing power**: The quantity of goods, services or assets that one unit of money can buy. More precisely, it amounts to maintaining its **internal value** (its purchasing power in terms of the domestic consumption

basket), which has to be distinguished from its **external value** (the purchasing power in terms of foreign currencies).

Justification for assigning a price-stability objective to the central is threefold: **First**, price stability is a desirable objective from a social welfare point of view; **second**, central banks are best placed to reach this objective; **third**, assigning any other task to them would distract from accomplishing the former.

The **benefits of price stability** are rather intuitive, although, as noted by Buiter (2006), their derivation from theory is not straightforward. The most frequently mentioned is that inflation distorts economic decisions through the **implicit taxation of cash balances** (see the idea of the Cantillon effect; inflation is a regressive tax, not a progressive tax) and the blurring of relative price signals. This is why most central banks aim at keeping the **inflation rate** at a low value. What exactly this low value should be is a delicate question to which we shall return in section 4.3.

The answer to the justification that central banks are best placed to reach the price-stability objective is not obvious either. The **monetarist** answer is best captured by Milton Friedman's sentence that "inflation is always and everywhere a monetarist phenomenon" (Friedman and Schwartz, 1971), which points to a **direct causal relationship** between the quantity of money in circulation and inflation. This proposition implies that price stability requires controlling the amount of money in circulation and makes monetary policy the natural instruments for controlling inflation. However, as we shall see in Section 4.3, the medium-term direct relationship between money and prices has broken down in recent times, and contemporary economic models of the kind we will present in Section 4.2 do not give a special role to money. There must therefore be other justifications for assigning the control of inflation to monetary rather than to fiscal policy.

The **arguments** are both **economic** and **institutional**. **First**, contemporary economic models retain an important assumption called the **long-term neutrality of money**, i.e. the disconnection, in the **long run**, between **nominal variables** (such as the general level of prices, nominal wages, interest rates, the nominal exchange rate …) and **real variables** (real GDP, employment, real wages, real interest rates, the real exchange rate …). Though it has real effects in the short run, over a long horizon, **monetary policy** can best control nominal variables without affecting real variables. This is not the case for **fiscal policy**, which affects the composition of output both in the short run and in the long run. **Second**, controlling **inflation** should not be distracted by other policy objectives that may

influence the **price level**, such as output targeting or the financing of public deficits (except insofar as they help to predict inflation). Independent institutions with a narrow mandate are better equipped to do this. For those reasons, the central bank has been put in charge of price stability in each and every country.

A major achievement of the 1990s was **disinflation** – though Japan overdid it and experienced **deflation**, i.e. a joint fall in output and the price level. This phenomenon had been observed in the interwar period but was considered a historical curiosity. The Bank of Japan was initially slow to react, until it set interest rates to zero and started to aggressively create money, eventually engineering growth and inflation.

How much of the price stability observed in the 1990s and the early 2000s was due to favorable worldwide conditions (**positive supply shock**) and how much to the quality of monetary policies and institutions (**institutional developments**) is hard to tell.

b) Exchange-rate stability

A historically important role of monetary policy has been exchange-rate stability. Until the 1990s, many countries relied on a **fixed exchange rate** as a means of controlling inflation and, after the demise of the Soviet bloc, several countries in transition decided to "anchor" their economy through the setting of a fixed exchange rate.

However, the attraction of fixed exchange-rates has faded away in recent years, though China and some smaller countries continue to peg their exchange rates (i.e. their currency external-value).

c) Output stabilization

Like fiscal policy, monetary policy has a **short-run impact** on aggregate demand. This is because in the presence of price rigidities a lower interest rate tend to encourage investment (through a lower real interest rate) and net exports (through a depreciated real exchange rate), and because higher prices reduce the purchasing power of those assets, like conventional fixed-rate bonds, that are not perfectly indexed to inflation. Monetary policy can therefore be used to stabilize aggregate demand, i.e. support demand through an **expansionary monetary policy** when demand is weak and a **restrictive monetary policy** when demand is ballooning.

The rationale for such **counter-cyclical** monetary policy goes back to the Great Depression of the 1930s but, as for fiscal policy, the desirability and the effectiveness of counter-cyclical monetary policy are debated. The existence of price rigidities, a hypothesis upon which counter-cyclical monetary policy relies, is not much debated anymore. However, the long and variable **lags** involved in the transmission of monetary-policy impulses make the **discretionary stabilization** a delicate exercise and may transform a counter-cyclical policy into a procyclical one. This is why the degree of central bank activism is a matter for discussion. Market **expectations** may also impede counter-cyclical policy through the adjustment of long-run interest rates. For example, the long-run interest rate may increase in a recession if short-term rates are lowered very aggressively and are expected to lead to future inflation.

Central banks behave **in practice** as if they were aiming at **minimizing the output gap**. In 1993, John Taylor showed that the average reaction of the Federal Reserve to US inflation and the output gap could be captured by the following simple equation:

$$i_t = \tilde{r} + \pi_t + 0{,}5(\pi_t - \tilde{\pi}) + 0{,}5(y_t - \tilde{y}_t) \quad (4.1)$$

where i_t is the short-term, nominal interest rate, π_t the inflation rate, $\tilde{\pi}$ the inflation objective, $(y_t - \tilde{y}_t)$the output gap (difference between output and its potential level, and $\tilde{r}$ the "neutral" level of the real interest rate (that is equal to the growth rate of the economy, which maximizes consumption per capita at the steady state according to the **golden rule** of growth theory). Such behavior was later confirmed for other central banks. Equation (4.1), called the **Taylor rule**, has become one of the economists' basic tool to assess interest-rate variations.

Although it has no normative content, the Taylor rule is a useful standard for comparing monetary instances over time and across countries.

The fact that central banks appear to react to the output gap **does not imply** that they have an output-stabilization objective. As a measure of excess supply of goods and services in the economy, the output gap is a **predictor** of future inflation. Raising the interest rate is the appropriate reaction to curb future inflation when demand exceeds potential output, even for a central bank that does not pursue output stabilization per se.

d) Financial stability

Financial stability (i.e. the proper functioning of banks and financial markets) was not a major concern in the context of the highly segmented and regulated post-Great-Depression financial systems of the 1960s. However, after the progressive liberalization of the financial systems in the 1980s and the 1990s, the issue gained prominence with the emergence of the worldwide financial crisis that started in 2007-8.

Responsibility for financial stability is generally shared between **regulatory agencies** that deal with one or several specific market segments (such as securities, banking, insurance, etc.), **the central bank**, and **the Treasury**. In general, the responsibility of regulators and supervisors is **microeconomic** in nature whereas the central bank's is **macroeconomic**. A proper micro-financial framework involves *inter alia* the setting of standards in order to ensure that banks properly manage the risks they are taking and hold sufficient capital to cover them. This is the role of **prudential policy**. It is a necessary condition for financial stability but it is by no means a sufficient one: Even sound financial systems are subject to bubbles.

Because it acts through changing the **relative price** of present and future consumption as well as the incentive to invest, monetary policy heavily relies on the banking and financial sectors that pass monetary impulses onto credit and market interest rates. Therefore, a **safe** banking and financial sector is crucial for **monetary policy transmission** and central banks are very much **concerned by financial stability**. This can lead them to extend large amounts of liquidity to the banks in the **short run** when all of them are simultaneously seeking liquidity, and therefore cannot lend to each other.

The reason why central banks are willing to provide liquidity to markets in times of stress is that events that endanger the ability of some borrowers to meet their obligations may degenerate into a **chain reaction** – what is called a **systemic crisis**.

The **financial stability role** of the central banks raises **three policy issues** which are a matter of ongoing discussion: (1) **Moral hazard**; (2) **compatibility with price stability**; and (3**) implications for the definition of central bank objectives**.

Moral hazard

Through acting as a **lender of last resort** that extends assistance to systematically important financial institutions when they find themselves unable to raise money on the market, the central banks may encourage **imprudent behavior**. Furthermore, the collateral provided by illiquid financial institutions in the context of repurchase agreements may be of inferior quality, which may imply that the central bank *de facto* engages in implicit bail-out (this does not need to be the case; in principle, the quality of assets is taken into account through applying "haircuts").

Compatibility with price stability

In principle, the provision of liquidity by central banks in times of stress should not be conflicting with their macroeconomic objectives and, in particular, with their price-stability mandate. This is certainly true when assistance is provided to one particular institution, but less so when they engage in wholesale liquidity provision like in the aftermath of the crisis of 2007-09. In such situations, loans to banks result in an increase of the quantity of money that could result in inflation if extended beyond the liquidity stress period.

Implications for the definition of central bank objectives

Central banks **monitor** asset prices as these convey information on possible future crisis as well as on possible developments in inflation. In particular, a rise in asset prices may lead to imprudent borrowing and their eventual fall may result in financial disturbance. However, in general, the control of asset prices has not been assigned to central banks' objectives.

None of these three issues can be considered to be settled definitively. The role of central banks was once defined in a context where commercial banks were the main actors in the collection of savings and the allocation of financial resources, but **traditional models** are being challenged by the development of market-based finance, disintermediation, and the development of financial innovation.

Box 4.6 Interest rates and the Pricing of Assets

Banks receive short-term deposits from their customers and hold long-term assets. These assets are loans to corporations and households as well as bonds, equities and real estate.

The **market price of a bond** is **inversely** related to the **interest rate**, for the following reason. Suppose a perpetual bond costs $1 at time t and yields a 4% annual return, i.e. each year the holder of the bond will receive a 4 cent coupon. Suppose that, at time t+1, interest rates have risen from 4 to 5%. This means that new bonds issued in t+1 yield a 5% coupon. Nobody wants to buy the old bond unless it is cheaper. Its price thus falls until it reaches a value *P* such that the bond yields an intrinsic return of 5% despite paying coupon equal to 4% of the bond face value. This requires that (1*4%)/*P* = 5%, i.e. *P*=0.80: A one percentage-point rise in the interest rate triggers a 20% fall in the bond price. For bonds with **finite maturities**, the relationship is less straightforward but still exists. And it can be shown that the loner the maturity, the higher the sensitivity of the bond price to interest-rate changes.

A similar, inverse relation between interest rates and the asset prices also holds for **equities**, but in a less mechanical way. The **fundamental value** of a stock is the price at which the investor is indifferent between, on the one hand, holding the stock and cashing in the dividends attached to it, and, on the other hand, selling it at market value. If investors are **risk-neutral**, the fundamental value is equal to the **net present value of expected future dividends**. When the interest rate *r* is constant and the growth rate of dividends *dt* is *g*, the price *pt* of the stock is given by the ***Gordon-Shapiro* formula**:

(B4.5.1) $$p_t = {}^{d_t}/_{(r-g)}$$

A higher interest rate *r* discounts more heavily future cash flows and thus immediately lessens the value of the stock. In addition, the interest rate may affect the dividend through the macroeconomic equilibrium. In some cases, a decrease in *r* may increase *g* and magnify the stock price increase.

e) Summing up

Of the four objectives we have mentioned – price stability, exchange-rate stability, output stabilization, and financial stability – only the first one is formally included in all central banks' mandates. **Financial stability** is a **core objective** of most central banks, though not necessarily explicitly. The other objectives may or may not feature among the goals of the monetary institutions. See Table 4.1.

Table 4.1
The mandates of four central banks

	Legal vehicle	Price stability	Exchange-rate stability	Output stabilization	Financial stability
US Fed	Full Employment and Balanced Growth Act, a.k.a. "Humphrey-Hawkins Act"	Yes	No, but may intervene on exchange markets, at the request of US Treasury.	Yes, on an equal footing with price stability.	Yes
ECB	EU Treaty (since Maastricht Treaty of 1992)	Yes	No, but exchange rates are part of the second pillar of the monetary-policy strategy, and the ECB has the sole right to conduct foreign-exchange operations.	No, but may intervene on exchange markets.	Not explicitly
Bank of England	Bank of England Act, 1998	Yes, definition of price stability belongs to government.	No	Yes, secondary to price stability.	Yes
Bank of Japan	Bank of Japan Law, 1997	Yes	No, but may be instructed to intervene on exchange markets.	No, only as a consequence of price stability.	Yes

4.2 Theories

Monetary policy has been and still is a very **active field of research**, one of those where the dialogue between theoreticians and practitioners has been the most vibrant and one of those where theory has had major influence on the design of policy institutions. In the 1960s and 1970s, the **monetarist challenge** to conventional **Keynesian wisdom** emerged from what was initially a critique of monetary-policy practices. Similarly, the **rational expectation models**, which would have a profound impact on macroeconomic thinking and policy, were initially developed in that context. The notions of **time consistency** and **credibility**, which would make their way into the basic toolkit of policymakers, were also first experimented within the monetary-policy field. Finally, the contemporary **micro-founded neo-Keynesian models** embodying price rigidities were developed in response and with the aim of providing sound theoretical foundations to monetary stabilization.

We start this section with a discussion of the **principles** that underpin monetary policy. We then move on to assessing its main **transmission mechanisms**, first in a closed- and second in an open-economy context. We end with a short discussion of the **theoretical foundations of financial stability**.

4.2.1 Principles

a) The long-run neutrality of money

The **most fundamental question** is whether monetary policy **affects** real variables. It is now widely accepted that changes in money supply **do not affect** real variables in the **long run**, a property known as the **long-term neutrality of money**. This dichotomy between money and real variables, which was first formalized by Scottish philosopher David Hume in 1742, is a consequence of the role of money as a unit of account: In the long run, doubling the quantity of money in circulation, or replacing a currency by another one of higher value, has no impact on real variables such as GDP, real wages, real interest rates, or the real exchange rate. Only nominal variables (nominal GDP, nominal wages, nominal interest rates, and the nominal exchange rate) are affected.

Hume's **quantity theory of money** is the simplest model consistent with this approach. It states that **output is supply-determined** and that the value of the transactions that can be carried out with one unit of money during a given period – the **velocity of money** – is exogenous. In this setting, there

is a one-to-one relation between money growth and inflation. Controlling money growth allows the central bank to control the inflation rate without incurring any real costs (Box 4.8).

[An important feature of changes in money is the notion of **inflation tax** captured by the **Cantillon effect**].

Box 4.8 The Quantity Theory of Money

Money velocity V is defined as the nominal production allowed by the circulation of one money unit during one year:

$$PY = MV$$

where P denotes the general price level, M denotes the money supply, and Y denotes the real GDP. Assume V is a constant or evolves at a constant rate independently of monetary policy. If the central bank is able to control the growth rate of money supply, then, for a given GDP growth rate and a given evolution of velocity, it is also able to control inflation, since:

$$\frac{\Delta P}{P} = \frac{\Delta V}{V} + \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$$

According to this approach, the definition of a monetary-policy target requires estimating potential-output growth and the trend evolution of monetary velocity. The monetary target then follows.

In the tradition of the *Bundesbank*, the ECB in 1999 drew on the quantity theory of money to define the **first pillar** of its monetary strategy. This consisted in targeting money-supply growth at 4.5% a year, consistent with a 1.5% inflation rate, a 2.5% real GDP growth in the euro area, and a decrease of velocity by 0.5% a year:

$$1.5\% = -0.5\% + 4.5\% - 2.5\%$$

In such an approach, the monetary aggregate plays the role of an intermediate objective that is readily observable and more directly under the control of the central bank than the final objective of price stability, yet whose evolution is a good predictor of the final objective.

In 2003, the ECB decided to downplay this first pillar because money growth had been continuously higher than the target, without any major consequence for inflation (see in the manual the Figure B4.8.1a). It has, however, not renounced monitoring of monetary aggregates (see in the manual Section 4.3). It should also be noted that the link between money and inflation remains robust in high-inflation countries (see in the manual Figure B4.8.1b).

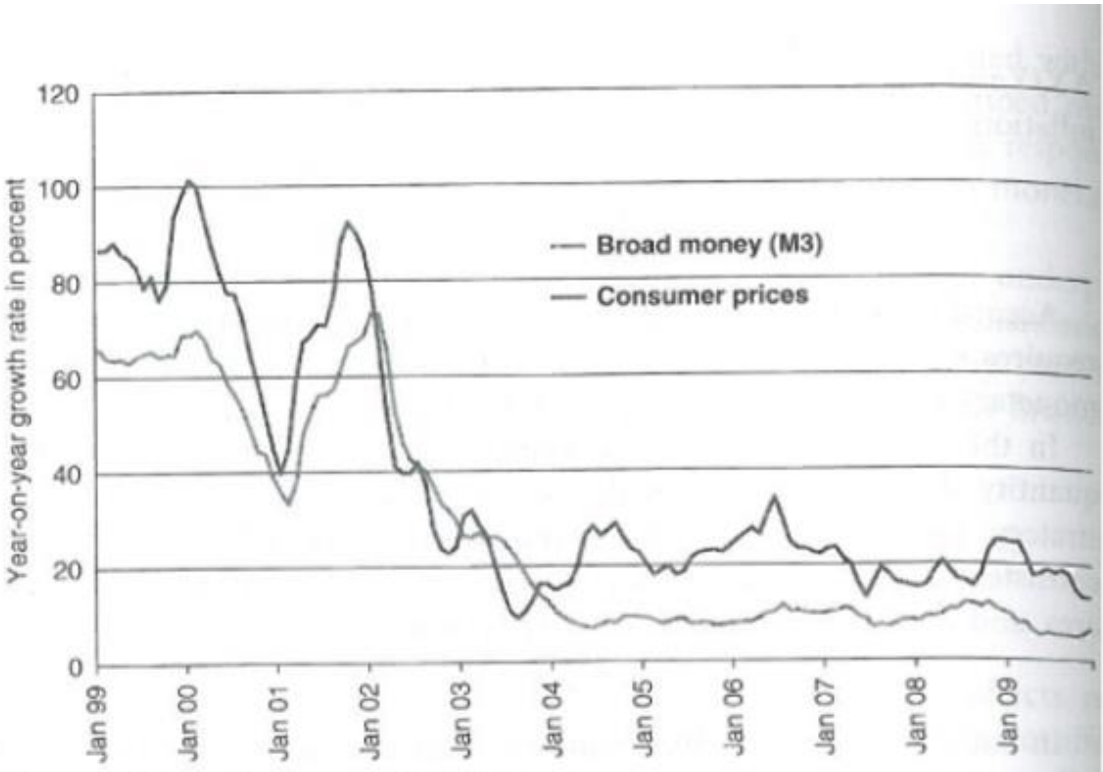

Figure B4.8.1b Turkey, 1999–2009.
Sources: a) European Central Bank, b) OECD.

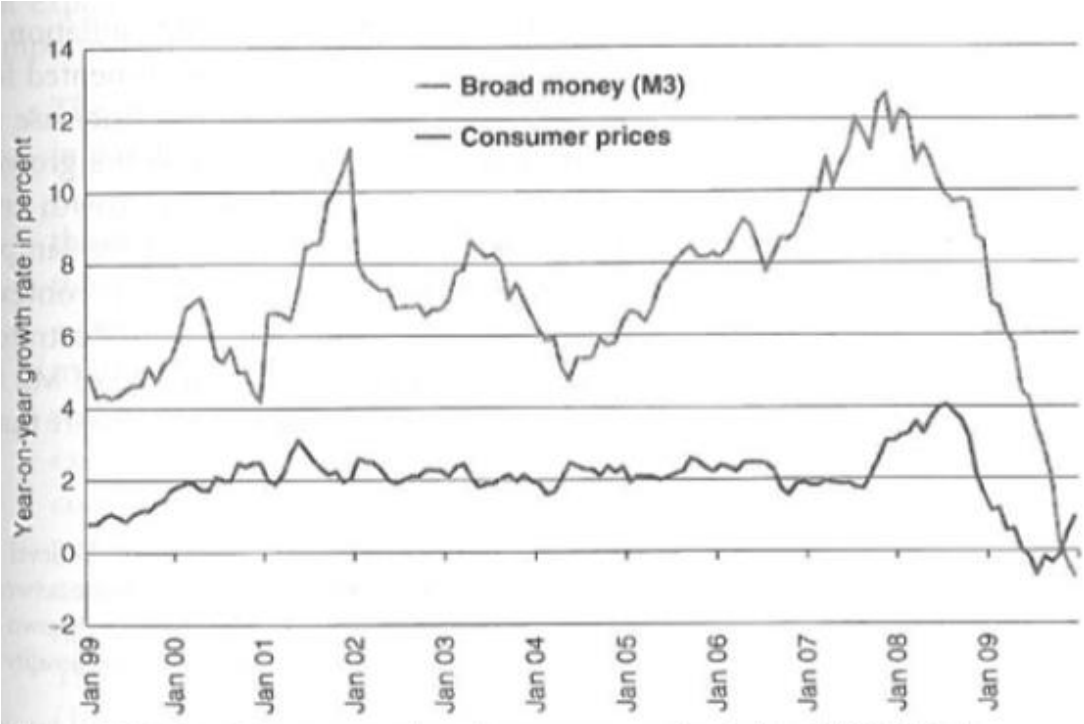

Figure B4.8.1a Money growth and consumer-price-index (CPI) inflation. Euro area, 1999–2009.

The **long-run regularity** concerning the link between money growth and inflation – a consequence of **money neutrality** – raises little discussion. It has been documented in several studies.

However, two important **caveats** should be added. First, the neutrality of money **does not imply** that monetary policy has no influence whatsoever on real economic performance. In particular, high and unstable inflation is widely accepted as having detrimental effects on growth. [In other words, one should distinguish between (a) the independence between the level of nominal variables, including the money stock, and real variables, and (b) the independence between the rate of change of nominal variables and that of real variables. The first proposition, known as the **neutrality of money**, is widely accepted, whereas the second, known as the **superneutrality** of money, is not. This distinction should be discussed and clarified.]

Second, the strength of the relationship between money growth and inflation comes from the **long horizon** and from the inclusion in the sample of **high-inflation countries**. In the short run and in a low-inflation context, there is little relationship between money growth and inflation.

b) Short-run nominal rigidities

One major explanation for the **short-run disconnect** between monetary growth and inflation is the existence of **nominal rigidities**, i.e. the fact that following a shock on the supply of money, prices and/or nominal wages adjust less than fully in the short run. Accordingly, a rise in money supply increases the real value of monetary holdings, which affects other real variables, including the real interest rate and real consumption.

In **Keynes's *General Theory*** (Keynes, 1936), a rise in money supply leads in the short run to a fall in the interest rate. This is because such a fall is the only way to raise money demand if prices do not adjust upward. A lower nominal and real interest rate encourage private agents to hold money balances in spite of their yielding no or little return and stimulates the demand for goods and services (which also in turn increases money demand). If there is excess production capacity, GDP rises. In the longer run, however, prices increase, which brings the interest rate and GDP back to their initial values, consistent with the long-run disconnect between nominal and real variables. **Hence, in the Keynesian framework, money-market equilibrium is achieved in the short run through nominal and real interest-rate adjustment rather than through price adjustment**. Consistent with this determination, the saving-investment balance is achieved through output adjustment: If saving exceeds investment *ex ante* total aggregate demand (consumption and investment) lies below aggregate supply and output will decline to meet the level of aggregate demand.

In brief, **the short-run impact of monetary policy on real variables** such as output or employment relies on **incomplete price adjustment**. Three types of explanation of nominal rigidities have been proposed in the literature: **imperfect information**, **staggered contracts**, and **menu costs**.

The existence of short-term nominal rigidities is **not incompatible** with the long-term neutrality of money. A monetary expansion will have an impact on real variables in the short run, but this effect will gradually be phased out by price adjustment. Higher money growth may speed up price adjustment, because the cost of nonadjustment is greater. In the extreme case of hyperinflation, price adjustment is almost instantaneous.

c) Optimal interest-rate setting

We have indicated in Section 4.3.1 that the central banks' **main monetary responsibility** is to decide on the level of their interest rate (s). But what should guide this decision? In the 1960s the response to this question was

largely ***had hoc*** **and discretionary**. Then the monetarist revolution of the 1970s and the 1980s came, which advocated setting interest rates at a level consistent with the desired path for the monetary aggregates. However, as already mentioned, the link between money growth and inflation has proved to be loose, at least in the short run. In addition, financial liberalization and financial innovations have made the control of monetary aggregates difficult. Consistently, central banks have started looking for an **alternative strategy**. In response, new models of monetary policy have been developed in which monetary aggregates play a secondary role, or are altogether ignored.

This is the case with the model proposed by Richard Clarida, Jordi Gali and Mark Gertler (1999), develops a **"new Keynesian" theory of monetary policy**. In this model, the central bank sets the **short-term interest rate** so as to keep the future inflation rate and the future output gap as close as possible to its targets. The optimal level for the output gap is zero, which corresponds to a situation in which actual output equals potential output. In the model, optimal inflation is also assumed to be zero, but this is only for the sake of simplicity; the inflation target can be set at any constant level without changing the results.

An important aspect of the model is that the central bank is supposed to adopt a **forward-looking approach**. It does not attempt to control the current inflation or output gap but only to control their expected values. In a way, its true objectives are the **forecasts** for inflation and for the output gap. This is because delays in the monetary-transmission mechanisms do not allow the central bank to control current variables. This is an important distinction to keep in mind, and one that matters for discussions on monetary strategies.

Since the output gap is **negatively** related to the real interest rate and **positively** related to inflation, the two objectives of the central bank are **consistent** in the presence of demand shocks (which move inflation and the output gap in the same direction) but **contradictory** in the presence of cost-push, or supply shocks (which move them in opposite directions). The policy implication of this observation is that the central bank should completely offset demand shocks even if it only cares about inflation, whereas it should only partially offset cost-push shocks.

Another implication of the model, which relies on rational expectations combined with auto-correlated shocks, is that the central bank should raise its interest rate by more than one percent when expected inflation increases

by one percentage point, in order for the real interest rate to rise. This rule has been followed by the Fed and by the ECB since 1999.

d) Central bank credibility

The optimal response to an adverse inflationary shock is to set the interest rate at the level that minimizes the loss to the central bank.

This result does not hold if the reason for inflation is that the central bank tries to push output above its natural level, i.e. push the output gap above zero. This is called an **inflation bias**. The problem was formalized by Robert Barro and David Gordon in an extraordinarily influential 1983 paper. It starts from the assumption that the equilibrium output level is deemed too low by policymakers because it involves high unemployment, but that unemployment has in fact a structural character. If the central bank mistakenly targets a higher level of output in order to reduce unemployment, the outcome is bound to be inflationary because only **structural policies** (such as labor market reforms or tax reforms) can lower structural unemployment. As households are assumed to know the true economic parameters and the central bank's preferences, they will rationally expect inflation and efforts to reduce unemployment will be frustrated. Only inflation will remain.

In fact, the mechanism of the inflationary bias originates in the **augmented Phillips curve** theory introduced by Edmund Phelps (1967) and Milton Friedman (1968).

The inflation bias disappears if the central bank can **commit** to a certain inflation target – for instance, because it is **independent** with an explicit inflation-targeting mandate or because it is more inflation-averse (**conservative**) than society. In this case, private agents will no longer anticipate an excess of monetary expansion, or a mitigated reaction to cost-push shocks. By reducing inflation expectations, such a strategy is designed to reduce the need for high interest rates in the short term. This in turn reduces the output cost of fighting inflation. For this to happen, **the central bank needs to be regarded by the public as bound by its mandate or truly conservative**.

Barro and Gordon's study provided a fundamental rationale for central bank independence. Their paper was, however, part of a broader literature that emphasized central bank credibility. The **credibility** of the central bank can be defined as its ability to stick to its own policy announcements. To make these effective in terms of optimal achievements, central bank

may need to tie its hands to a **monetary rule**. A popular rule is **inflation targeting**, where the central bank targets the **average expected inflation rate** over the next one or two years. Another one, especially in developing countries, is a **fixed exchange-rate regime**, where the central bank commits to intervene so as to keep the nominal exchange rate stable.

For the credibility of the central bank, it is also important that the central bank is able to embrace a **long horizon**. This justifies long mandates and independence from politicians bound by the election.

To enhance credibility, most modern central banks combine a mandate to achieve price stability, formal independence from the government, long mandates, and a commitment scheme such as inflation targeting.

e) Are monetary and fiscal policies interdependent?

In the long run, **complete independence** of monetary policy from fiscal policy is only possible if fiscal policy is sustainable or if the central bank is indifferent to the risk of government bankruptcy. If the public debt ratio exceeds its sustainable long-run level and fiscal authorities refrain from undertaking a fiscal retrenchment, asset holders will anticipate either government **default** (where creditors are not reimbursed) or **debt monetization** (where the central bank bails out the government through a massive purchase of its bonds and raises money supply accordingly). In the former case, the central bank may be hurt by the loss of value of its assets. More importantly it is likely to wary of the economic consequences of commercial bank defaults. Hence it is likely that the central bank will prefer the latter case, monetization, with its inflationary consequences.

The **long-run interdependence** between fiscal and monetary policy implies that **lasting monetary stability** is very unlikely if the fiscal authority behaves in irresponsible way. An example of this type was provided by **Argentina** prior to the 2002 crisis: Although the country was committed by law to maintaining a **fixed exchange rate** to the US dollar and the currency issued by the central bank was supposed to be fully backed by the foreign exchange reserves (this regime is called a **currency board**, see Chapter 5), the profligate behavior of the federal and especially sub-federal fiscal authorities was common. Ultimately, the government was forced to abandon the **dollar peg** and this led to a violent currency and financial crisis. In the euro area, the Greek crisis that broke out in 2010 was of the same nature.

The **long-run interdependence** is the main justification for limiting public borrowing in a monetary union, as discussed in Chapter 3.

In the **short run**, there is no consensus on the desirability of coordinating monetary and fiscal policies to achieve a **policy-mix**, at least as long as monetary policy remains effective.

Opponents of coordination point out that coordination by nature threaten central bank independence and argue that the game-theoretical problem involved in the rivalry between monetary and fiscal policy can be solved by making monetary policy fully independent.

Specific coordination issues arise when monetary policy reaches the zero bound on nominal interest rates and embarks on unconventional policies.

4.2.2 Transmission channels

So far, we have only discussed **why** monetary policy can affect real variables. Here, we discuss **how** it impacts aggregate demand, starting with the closed economy. Three main **transmission channels** are generally distinguished: The **interest-rate channel**, the **asset-price channel**, and the **credit channel**. All three obviously operate in parallel and contribute to the general equilibrium outcome, but distinguishing them helps understand how monetary policy works, and what determines the magnitude of its impact.

a) The interest-rate channel

The **interest-rate channel** is the traditional Keynesian channel: In the presence of nominal rigidities, a monetary expansion leads to a fall in the (nominal and real) interest rate, hence to a revival of investment and durable-goods consumption. In the short run, the rise in those categories of spending in turn results in a multiplier effect (see Chapter 3) on the demand for goods and services.

Note, however, that the only interest rate which is directly affected by monetary policy is the **overnight, nominal interest rate**, while aggregate demand depends on expected real interest rates at longer-term horizons. The impact of a monetary-policy move thus depends on (i) which interest rates matter most for economic agents, and (ii) how these interest rates are affected by the change in the overnight rate. Evidence shows that countries differ considerably along the first dimension: For example, mortgage rates in the UK tend to be variable and indexed on short-term rates, which

implies that monetary-policy decisions immediately affect both the cost of new borrowing and the disposable income of indebted households; in contrast, German households borrow at fixed-term, which insulates them from monetary impulses once in debt. There are also differences along the second dimension: As explained in Section 4.1, whether short-term rates affect long-term rates depends on expectations about the future monetary policy. The strength of the interest-rate channel therefore varies across countries. [This has been a topic for research and policy discussions in the euro area as differences in borrowing practices imply asymmetries in the transmission of the same monetary impulse to member countries.]

b) The asset-price channel

The **asset-price channel** relies on the negative relationship between asset prices and interest rates: A decrease in the interest rate generally raises the value of financial assets held by households, who, in turn, partially consume this extra wealth. Such wealth effects played an important role in Japan in the early 1990s, when the burst of the asset-price bubble had a **negative impact on consumption**; in 2001, the sharp fall in US stock prices also had a negative impact on consumption, whereas the rise in real estate prices tended to sustain US consumption during the 2000s. The asset-price channel also affects the **corporate sector**: A rise in stock prices increases the profitability of new capital expenditures (also known as **Tobin's *q***), which supports investment. [Tobin's q is the ratio of the market value of companies to the cost of renewal of their stock of physical capital. It is the **central variable of the neoclassic theory of investment**. When q increases, the market value of the company increases in relation to the replacement cost of the capital; therefore the price of new equipment falls relative to the cost of its financing through issuing shares, which leads to a rise in investment. Thus investment depends on average q or on marginal q (the ratio of the incremental increase of the company's value and the cost of additional capital).]

The importance of the asset-price channel has increased over time as a consequence of the general rise in the wealth-to-income ratio and the increased sophistication of financial markets which allow households to withdraw equity from their wealth without actually selling assets.

c) The credit channel

Finally, the **credit channel** results from the impact of the interest rate on the **supply** of – rather than the **demand** for – credit: In response to an

improvement in their refinancing conditions, banks tend to increase their supply of credit.

The reason for this is a subtle one (Bernanke and Gertler, 1995). In an **imperfect-information world**, it is costly for banks to assess properly the **quality** of all the investment projects for which borrowers – especially for small- and medium-sized enterprises – request loans. Lack of information on the quality of projects forces them to include a **default premium** in the credit cost proposed to all companies – which penalizes or even dissuades good investment projects whose probability of failure is low. However, risky projects may not be discouraged, as borrowers know their probability of failure is high and accept paying the correspondent premium. The more banks increase the interest rate, the more they actually discourage good projects and select bad ones. This **adverse selection problem**, very well known to insurance theory, leads banks to **restrict credit** rather than price risk.

Credit rationing especially affects small- and medium-size enterprises, since they do not have access to capital markets and depend on bank financing.

When the short-term interest rate decreases, the rational response of a profit-maximizing bank is to **relax credit constraints** – hence, an impact on credit supply that does not take the form of price changes. In addition, a lower interest rate also raises the value of the assets used to guarantee the loans, and therefore the companies' access to credit (Kiyotaki and Moore, 1997).

The **banks' financial health** is crucial for the transmission of monetary policy: When the banks' balance-sheets are burdened with **nonperforming loans**, i.e. loans with high probability of default, or **impaired assets**, i.e. financial assets that are not traded any more or whose market value is much lower than when they were purchased by the bank, banks are less willing to grant new loans. This second source of credit rationing – often called **credit crunch** – was the main explanation for the poor effectiveness of Japanese monetary policy at the end of the 1990s and at the beginning of the 2000s. The Bank of Japan brought its leading rates nearly to zero in 1995 but with little effect. Even the adoption in March 2001 of expansionary targets for the monetary aggregates remained without significant impact on credit and economic activity until the banks' finances were restored through recapitalization. Also, in the US and Europe in 2008, the deterioration in the quality of the banks' balance sheets led to credit supply constraints which were initially obscured by companies drawing

massively on credit lines that banks had previously committed to extend to them (Ivashina and Scharfstein, 2010).

The link between monetary policy and fiscal policy therefore does not only run from the latter to the former, through debt monetization. Public money can also be crucially needed to restore the effectiveness of monetary policy, through a recapitalization of banks, and by relieving them of their impaired assets. This latter point was forcefully put forward by the International Monetary Fund (IMF) in the crisis period 2007-09.

It can be noted that none of these transmission channels relies on a direct effect of money growth on inflation, as postulated by the quantity theory of money. In our set-up, the impact of money growth on inflation is channeled by interest rates, asset prices and bank credit through their respective on aggregate demand. A **direct link** between monetary policy and inflation could be introduced by assuming that **price expectations** are affected by monetary policy. It would, however, be illogical to introduce expectations that are not consistent with the assumption of the model.

d) Assessing the channels

The strength of the various transmission channels varies from country to country. The higher the proportion of short-term or variable-rate loans in the country, the stronger is the interest-rate channel. The asset-price channel depends on the extent of asset holdings by domestic consumers. Finally, the importance of the credit channel depends on share of small-to-medium-sized enterprises (SMEs) in output and on their dependence vis-à-vis bank credit.

4.2.3 Monetary policy in an open economy

a) Monetary conditions

…

b) The impact of the interest rate on the exchange rate

…

c) Exchange-rate overshooting

…

4.2.4 Financial stability

…

4.3 Policies

4.3.1 Institutions