CHAPTER 1

The Building Blocks of the Single European Currency

This first chapter will introduce the reader to some basic economic and financial concepts that are necessary to fully understand how the Eurozone works and the fundamental determinants of the Euro monetary system. In § 1.1, with simple words the reader will learn the way a financial product is designed and evaluated, by exploiting the intuitive concepts of uncertainty, probability and risk. Then the most widespread and popular financial products (bonds, swaps, CDS), broadly publicised by the media coverage, are presented and explained with examples and charts.

These tools do not remain in the abstract world but they are immediately put to work in the real world to describe the elementary working mechanisms of the Euro currency area. In § 1.2 we will explore the concept of credit risk with specific reference to a sovereign issuer: we will see that the riskiness of a country is closely related to the size of its public debt (especially when measured in terms of GDP) and that the sustainability of the debt depends on some key factors, inflation being surely one of the major ones. In § 1.3 the single interest rate curve is described by giving its rationale and recalling the history of its birth. In § 1.4 the reader is introduced to the functioning of the monetary policy and discovers the real mandate of the ECB and the striking differences it has with the other central banks. Finally, § 1.5 gives a tutorial overview on a theme – credit risk – that is central in the analysis of the root causes of the Eurozone crisis.

1.1 THE BASIC CONCEPTS: FINANCIAL FLOWS, RISKS AND PROBABILITY DISTRIBUTION

Every financial transaction which involves the exchange of amounts of money over time (let's call them flows) is subject to some form of uncertainty. It is not possible to know for sure how much (and if) you will gain from an investment, or how much will have to be paid for a loan at a variable rate: the randomness in the occurrence and amount of flows is somehow inevitable and structural, and represents the risk of financial transactions.

What is the value, in monetary terms today, of an investment in bonds or a fixed-rate mortgage? If I wanted to transfer the bond of my investment to someone else, how much would I get in return? If I wanted to pay off my mortgage early, how much would I have to pay? These are the main questions which professionals must answer every day to enable the smooth functioning of the financial system. Since these are financial transactions characterised by unavoidable uncertainty, and therefore a certain degree of risk, the only way to deal with them is to try to measure this uncertainty, in some way, through the use of probabilities. All financial products are valued, in the most objective way possible, looking to estimate the probability they have of producing gains or losses for the investor.

Let's try and understand how.

1.1.1 The Risk of Interest Rates

Imagine we are holders of a bond of Bank A, at a variable rate, with a duration of only 6 months. In this experiment, the bank cannot fail. At maturity, therefore, we have the assurance that the bank will return the invested capital (€100) plus a coupon that pays a variable interest rate. The value of the coupon will be uncertain, and will depend on the level reached by the interest rate in 6 months. With many rates possible, many coupon values are possible. For example, in Figure 1.1, nine possible values are considered for the coupon paid: only once does it reach a very low value of around €0.20, once it has a value of €1, three times the coupon pays €1.50, twice there is a coupon of €2 and on two other occasions the coupon exceeds €2.

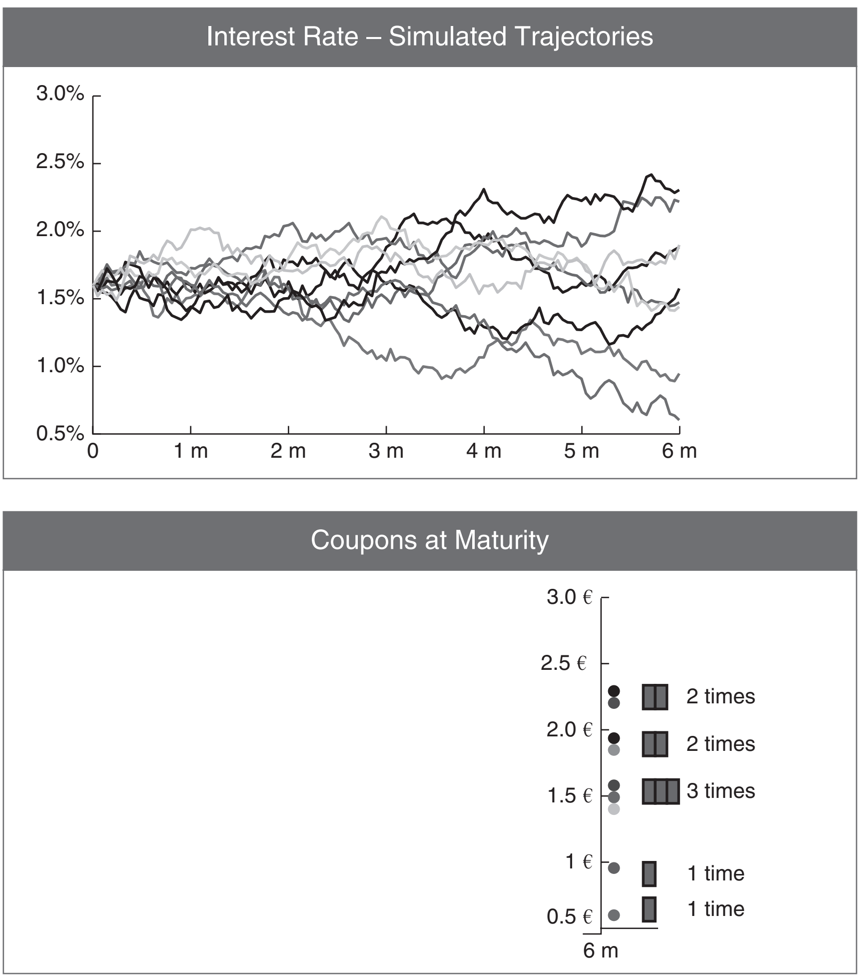

FIGURE 1.1 Possible realisations of the random coupon depending on the possible values of the interest rate

What is happening is that not all levels of the rate can be reached with the same probability. This is fairly intuitive: if we observe a rate of 1.6% today, it is more probable that in 6 months the rate will be 1.7% as opposed to 5% and therefore that you will get a coupon of just €1.70 instead of €5. Now imagine studying the market data today and being able to assign each possible future interest rate a precise probability: the value of the coupon in 6 months is still uncertain, but we have developed an accurate estimation of the probability of gain, which is graphically represented by a bell-shaped curve defined in technical jargon of distribution probability (see Figure 1.2).

The bell-shaped curves which represent the probability distribution contain a wealth of information on the bond that we purchased from Bank A: studying this, we can now say that it is very probable (90% represented by the central and lower areas) that the coupon that will be cashed will not be greater than €2 (total investment of €102); at the same time there is reasonable certainty, more than 90% (central and upper areas) that my coupon will not be less than €1 (total investment of €101). It's

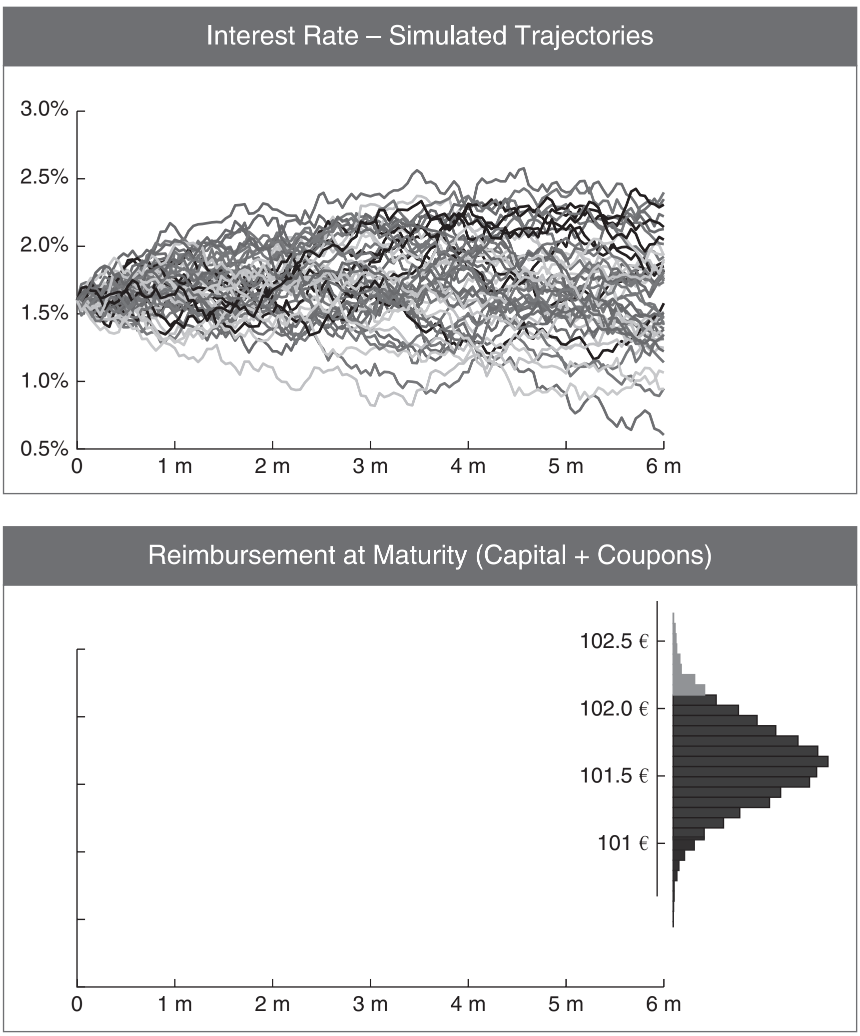

FIGURE 1.2 Probability distribution of the values at the maturity of a floating rate bond issued by Bank A

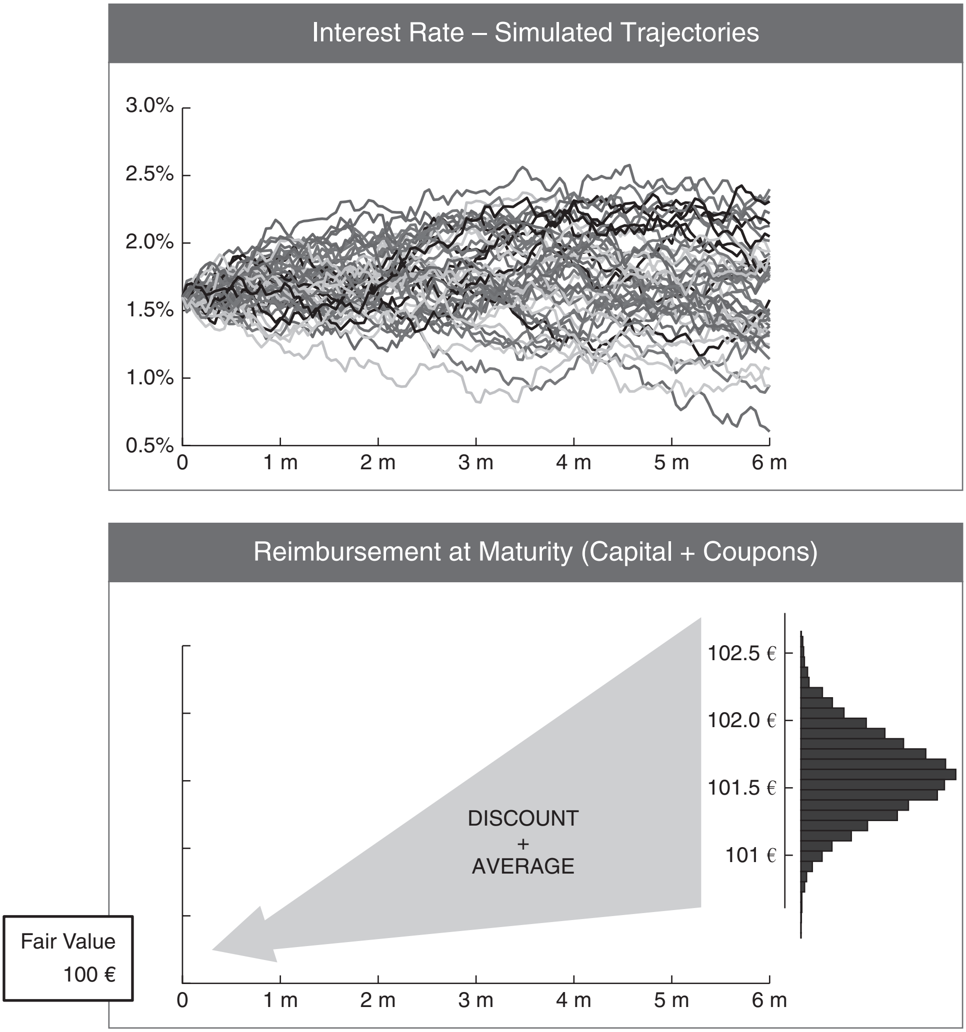

FIGURE 1.3 Calculation of the fair price of a 6-month floating-rate bond issued by Bank A

not the same as having a crystal ball, but certainly for the saver it's a big step forward in terms of the awareness of the benefits of his investment.

However, in order to know the worth of my investment today, knowing the probability distribution is indeed necessary, but still not enough. There are in fact two problems to consider: (1) the distribution assigns many event probabilities at many possible values, but I need just the one value; (2) the distribution describes the coupons obtainable in 6 months, but I'm interested in a valuation today. The operators solve problem (2) by discounting the possible values at maturity by the time value of money, and problem (1) by taking a simple average of all possible values of the investment, once discounted (see Figure 1.3).

The number obtained following this procedure is the fair price at which the market, i.e. the whole set of financial operators, values the bond of Bank A. This price is unique because all the operators use the same procedure to calculate it, and objective because the estimate of the probability distribution of the final values of the bond is based on market data which all operators can access.

Of course, this does not mean that I cannot sell my bond for a lower price, for example 97; if I have an immediate need for money I will probably be willing to accept lower figures with the understanding that the "right price" is 100 and that the difference should be considered as a real loss. This understanding is taken for granted among the professionals, but unfortunately it is not part of the wealth of knowledge of the average saver; an unfair bank could well sell a bond which has a fair price of 93 to Mr Smith, for example asking him to pay 100, counting on the fact that Mr Smith doesn't have the tools to "understand" the benefits of the investment. If our saver was able to read the information of the probability distribution and the fair price in an understandable manner, the unfair bank would have little chance of placing the bond to the investor.

In the above example, to understand the relationship between probability distributions, risks and fair price, we have analysed a very simple bond, but the procedure stands as valid for any kind of financial product available on the market. In fact, it is precisely through observation and the proper reworking of the probability distribution that financial products are engineered.

In Figure 1.4, the probability distribution is constructed and the fair price of a bond is calculated, with a maturity of two years and paying four semi-annual coupons, based on the dynamics of our interest rate. As we can see, with the exception of the numbers of coupons considered, nothing changes in the valuation procedure previously described. In fact, in correspondence to a certain number of possibilities of the interest rate (first panel), we have different probability distributions for the four coupons every 6 months (second panel); adding these coupons and the principal returned at maturity, we obtain the probability distribution of the bond. Once this probability distribution is obtained, the possible values of the bond are discounted in order to take into account the time value of money, and finally the average of these discounted values is calculated (third panel); the only value that emerges from this procedure is the fair price of the financial product at stake.

1.1.2 Swap Rate of a Floating Rate Bond

A floating rate bond like the one described in Figure 1.4 has uncertain results by definition, given that it is not possible to know beforehand the actual return that the investor will get; conversely, a bond at a fixed rate, such as a government bond, pays the same coupon regardless of changing market conditions. At a first reading, the two investments are therefore not comparable. However, the professional financial operators still have the need to compare the fixed rate with the floating rate transactions, and they do so by calculating a fixed rate that is representative of the operation at a variable rate: the swap rate. Let's try to understand this further.

Let's reconsider the 2-year floating rate bond issued by Bank A in Figure 1.4. The fair price of this bond is now 100. Now let's try to answer this question: given a fixed coupon bond with the same number of bond coupons from Bank A (four), which fixed interest rate should I pay to have a fair price equal to 100, that is, the same as our floating-rate bond?

Imagine being able to calculate this fixed rate and obtain a value equal to 1.4%. Through this indicator we are saying that the holder of the floating rate bond will get on average the same return as the holder of a bond with an annual fixed coupon rate of 1.4%; the bonds are different and will yield differently, but for professionals the two bonds are considered equivalent (always on average) for the purposes of comparison, so much so that they have the same value. In the first panel in Figure 1.5, the horizontal line represents the (fixed) swap rate in comparison to the possible developments of the floating rate. In the second panel, the fixed coupon corresponding to the swap rate is represented by the horizontal line.

Let's take a last example and consider government bonds: if I have a CCT (the standard Italian floating-rate bond) and a BTP (the standard fixed rate bond) sharing the same maturity, and the bonds have the same fair price, the interest rate paid by the BTP will be the swap rate of the CCT.

Swap rates are very helpful for professionals because they can condense into one number for each contractual maturity (the so-called interest rate curve) all information relating also to floating interest rates. For now we have considered just one issuer at time (Bank A or the Italian Republic). Let's try to

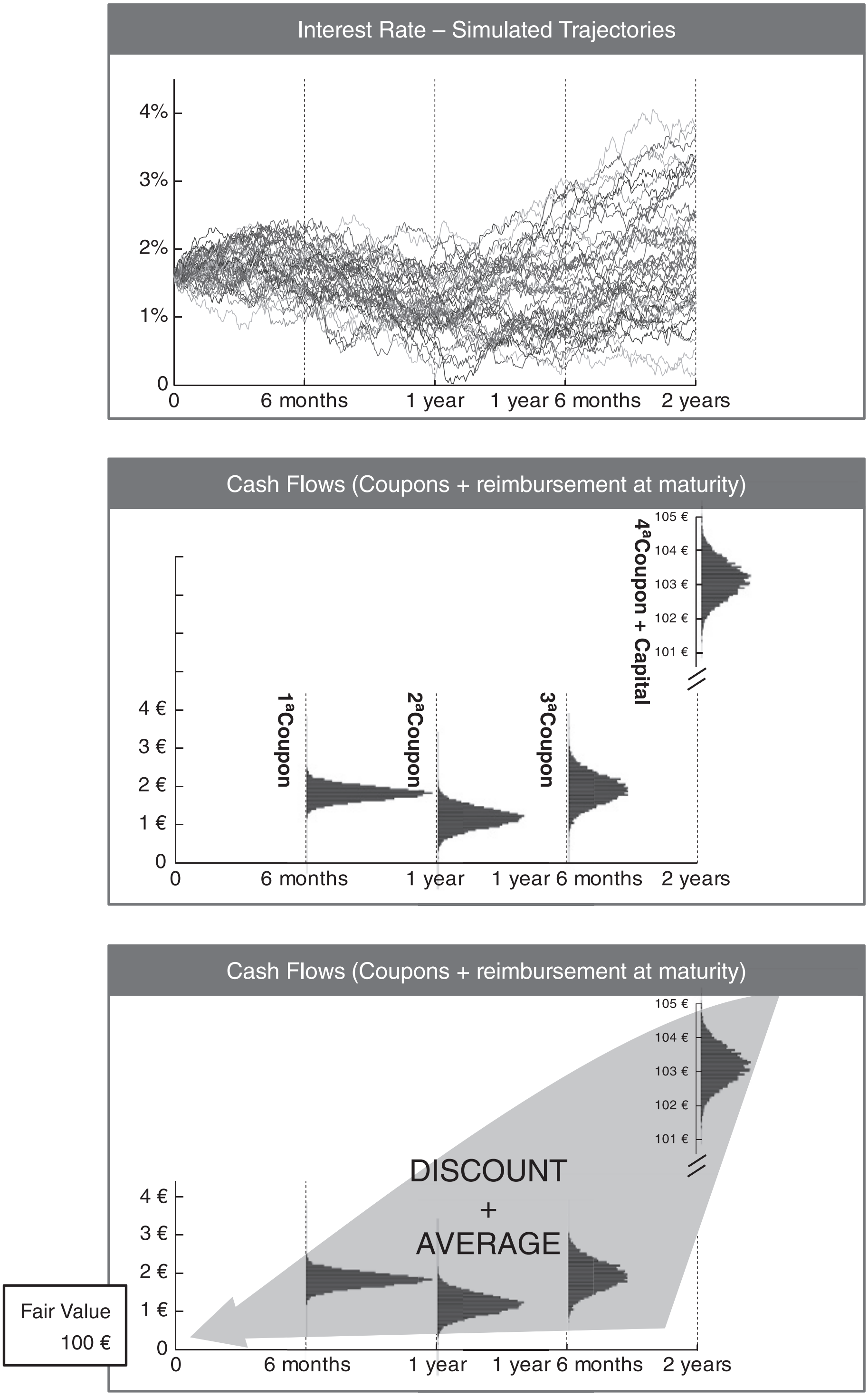

FIGURE 1.4 Probability distribution of the values at maturity of a 2-year floating-rate bond issued by Bank A and calculation of the fair price

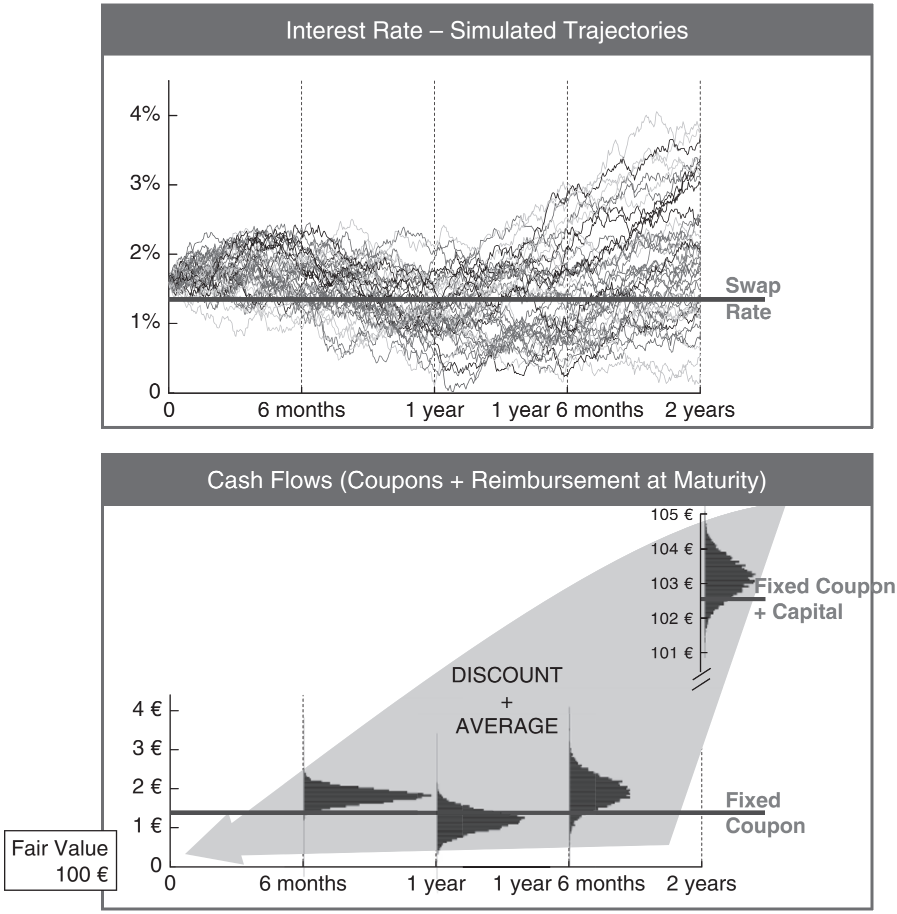

FIGURE 1.5 Calculation of the swap rate of a 2-year floating-rate bond issued by Bank A

complicate things for a minute: consider a set of other banks belonging to the same banking system, like the European one (Eurosystem); by averaging the swap rates of every issuer, it is possible to get an image of the state of the banking system as a whole through the publication of a single interest rate curve.

We will return to this argument when it is time to analyse the functioning of the European banking system.

1.1.3 The Credit Risk

From the arguments made in the previous section it is clear that every bank can calculate its own swap rate according to variable interest rates that it pays, and these swap rates can be different according to the issuer.

How do we explain these differences?

As usual, we start with a very simple example. We have a very solid issuer, which basically cannot fail (e.g. in this historical period, the market considers that of Germany). In this case, applying the methodology previously described, it is fairly straightforward to calculate the swap rate for this issuer (1.1% per annum). Since the swap rate is a fixed rate, we can construct the probability distribution of the bond of our solid issuer (Bond D) which pays the swap rate of 1.1% per annum. Let's have a look.

The probability distribution calculated in the first panel of Figure 1.6 is rotated and shown in an enlarged form in the second panel. On the horizontal axis of the blue figure, the possible values of the

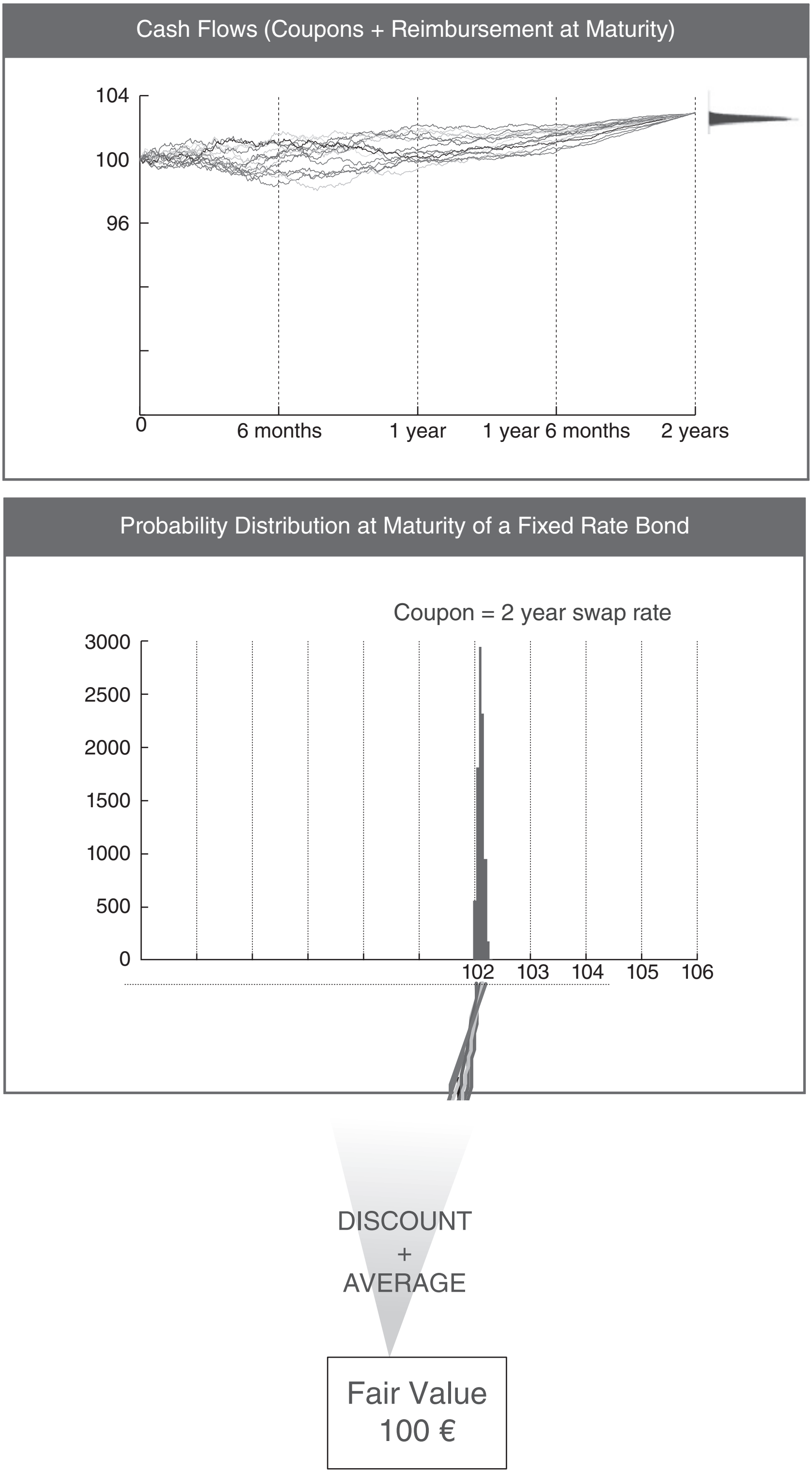

FIGURE 1.6 Probability distribution of the values at maturity of a 2-year floating-rate bond issued by State D

bond at maturity are plotted, while on the vertical axis it is shown how often these possible values are going to be achieved. From the analysis of the distribution it is clear that investors at maturity will clearly get back the capital invested (€100), inclusive of the accrued coupons that are based on the swap rate of 1.1% per annum (represented by the spread of the distribution around the value of €102).

Now let's imagine a state that's not so "solid", where there are serious doubts that it can fulfil the obligation to repay the capital at the maturity and/or pay the eventual periodic coupons (for example, Greece today). The government of this state (GR) issues a bond that pays the same rate as solid State D, which is still 1.1% per annum.

Intuitively, the bond issued by GR looks riskier, but pays the same rate as that of State D. How will the probability distribution of this bond look and what would be the fair price that the investor would have to pay? Figure 1.7 answers our questions.

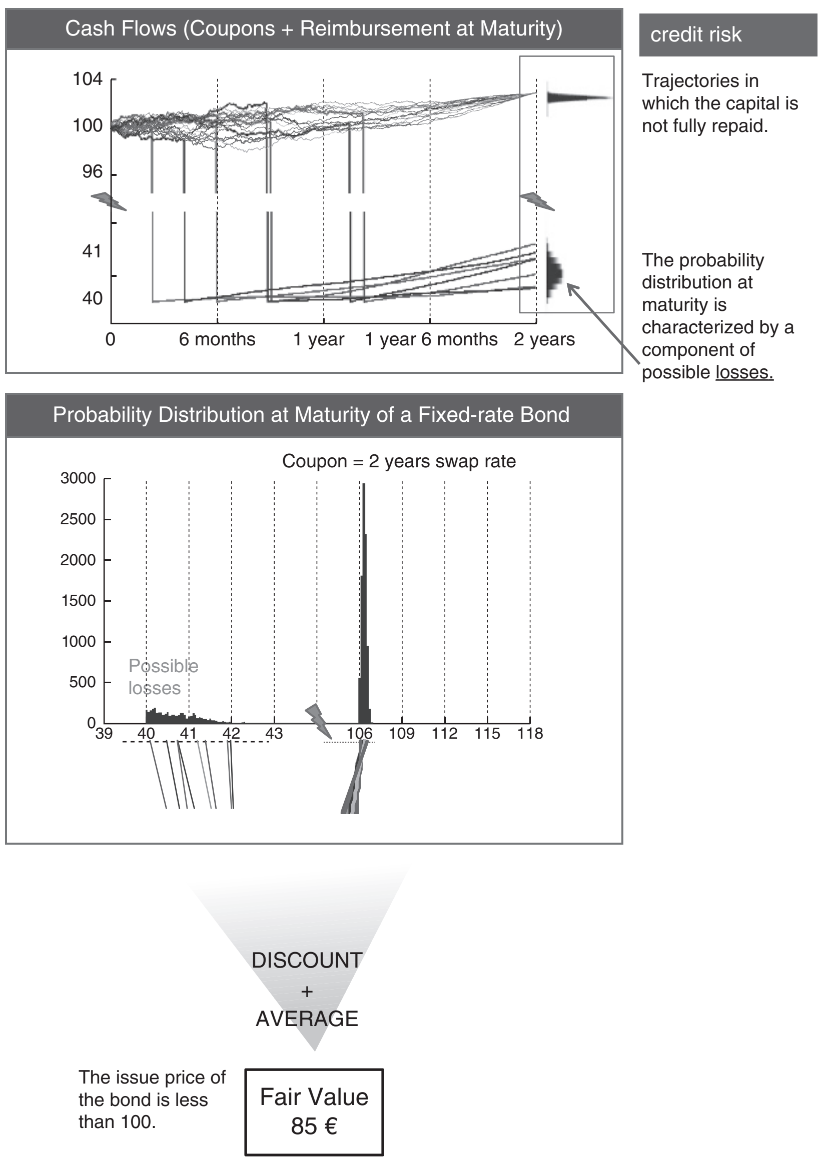

FIGURE 1.7 Probability distribution of the values at maturity of a 2-year floating-rate bond issued by State GR

Figure 1.7 shows that in a number of cases it is possible that State GR doesn't pay back the capital at maturity and doesn't pay some coupons, going into default. Since in these cases the investor will get much less than the promised return, it is fair that today the bond is cheaper, since he bears the risk of possible losses.

Conclusion: a riskier bond as a result of the possibility of default of the issuer, with the same return offered, is worth less than a risk-free bond.

Now it is clear that a bond from GR that only pays 1.1% per annum is not very attractive to investors. There is only one possibility for the State GR in order to raise funds on the markets: to make bonds more appealing for the investor by increasing the interest rate offered.

It's clear that if profit rises, the fair price that an investor would have to pay to buy the bond would rise too. If the profit increases sufficiently to bring the fair price to the value of the risk-free bond of State D (100), the investor will be completely compensated for the credit risk of the State GR by higher yields.

Conclusion: a riskier bond as a result of the possibility of the issuer's default pays more than a risk-free bond with the same fair price.

At this point of the analysis a question arises: how can market participants measure the credit risk of a specific issuer?

The default risk of a sovereign issuer can be observed and measured through complex statistics on the health of the economy and public finances; clearly these data provide estimates subject to a certain variability and implemented in a given moment, while operators need constantly updated and trustworthy information in order to close their financial transactions in real time. Other indicators are therefore needed for their businesses.

The solution is simpler than one can imagine: we said that a riskier bond, to be successfully sold, must pay more. Consequently, the differential (the so-called credit spread) of yield between a risky bond issued by State GR and a risk-free bond like that issued by State D is an immediate and safe measure of the credit risk perceived by the operators. This reasoning is summarised in Figure 1.8.

The more that an issuer is considered risky, the more it will have to pay in order to sell his bonds at an issue price equal to that of the risk-free bond of State D (see Figure 1.9).

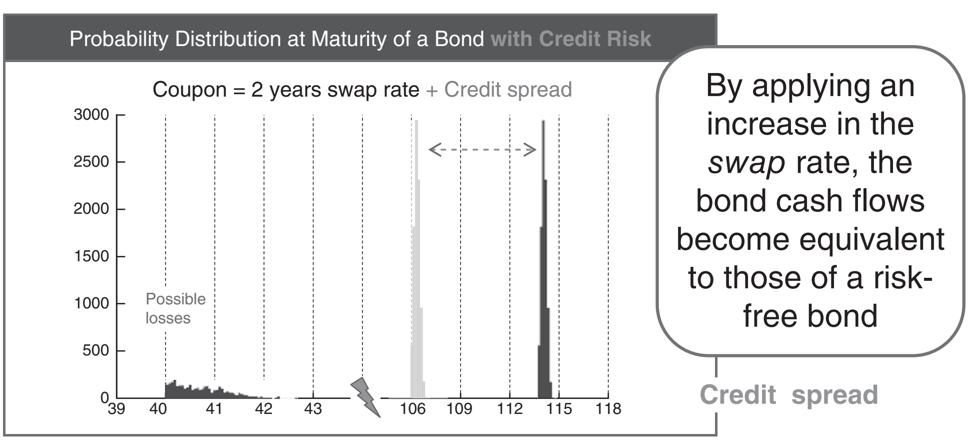

FIGURE 1.8 Probability distribution of the values at maturity of a 2-year fixed rate bond issued by State D and of a 2-year fixed rate bond issued by State GR

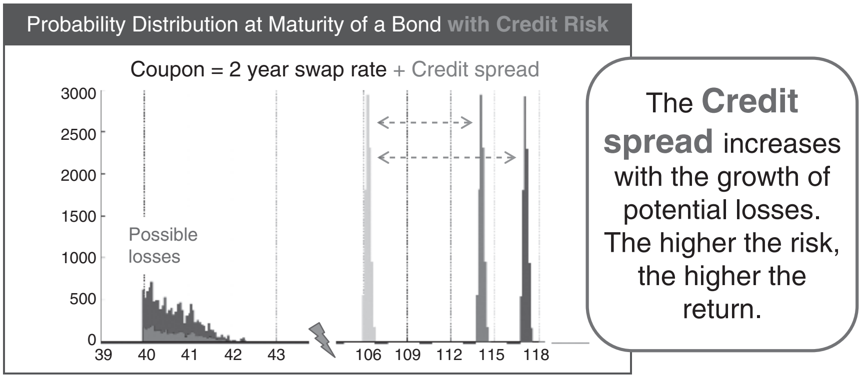

FIGURE 1.9 Probability distribution of the values at maturity of a 2-year fixed-rate bond issued by State D, of a 2-year fixed rate bond issued by State GR, and of a further 2-year fixed rate bond whose issuer is riskier than GR

1.1.4 The Credit Default Swap (CDS)

In the previous section, we learned that the credit spread measures the extra return necessary to compensate the holder of a specific bond of the perceived credit risk of the issuer; this is an indicator which assumes that the investor is materially the owner of the bond and bears the risks of insolvency.

On the financial market at the beginning of the 90s, operators started negotiating the financial derivative products – so-called Credit Default Swaps or CDSs – that allow you to acquire (and sell on) the risk of default of an issuer without having to be the holder of the underlying asset. In simple words, the buyer of a CDS gets insurance against the default of a given issuer in exchange for the payment of a periodic premium. If all goes well, the CDS buyer only pays the premiums and doesn't receive anything until the expiry of the contract; but if the issuer defaults, the CDS seller must refund the buyer with a sum that covers the loss in the value of the bond. It is reasonable to assume that the higher the perceived credit risk of the issuer, the higher the periodic premium required by the seller to provide the insurance. This premium (the CDS spread) is therefore a further measure that operators use, alongside the credit spread, to assess the credit risk of a particular subject (banks, companies, sovereign states).

Figure 1.10 presents a summary of the definition of CDS.

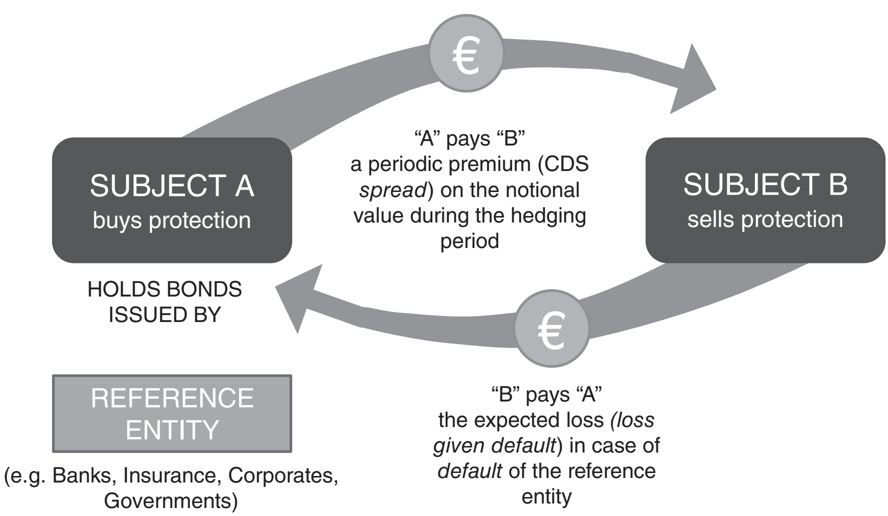

FIGURE 1.10 Credit Default Swap contract (CDS)

Later we will explore the similarities and the differences between these two different measures. At the moment it is enough to remember that in one case (credit spread) the material possession of the bond is assumed while in the other (CDS spread) the presence of the bond is not necessary.

1.2 SOVEREIGN CREDIT RISK, PUBLIC DEBT AND INFLATION

The credit risk on bonds issued by a state is also known as *sovereign risk*. One of the main factors that impact on the magnitude of sovereign risk (and, accordingly, the associated default probability) is the size of the government debt. Intuitively, the bigger the debt, the higher the probability of not paying it (in terms of capital at maturity or interests coupons).

Let's explore now in details the structure and the evolution of the public debt. To this purpose, it's useful to think at the state as a firm whose accountability presents obviously positive financial flows (the fiscal revenues) and negative ones (the public expenditures). The difference between revenues and expenditure is known also as primary balance. The public debt accumulates when this difference is negative, since in this case part of the expenditure has to be financed through government bond issues. As it can be expected, the government debt is characterised by the payment of interests to the investor that compensate him for the risks borne. From the government point of view, these flows of interests represent an expense known, in technical jargon, as the cost of debt servicing. It follows that the debt grows over time if the government produces primary deficits or if the primary surplus is not sufficient to cover the interests expense on the accumulated debt.

In the following we will assume for the sake of simplicity that the primary balance of the government will be always zero, i.e. that at every moment the tax revenues match exactly the public expenditure. However, a debt exists since it has been inherited from the past. It's not so difficult to argue that under this hypothesis the debt dynamics are influenced only by the interest burden; for example, if at a given year the debt is equal to €2,000 billion and its servicing cost is €100 billion, the year after the debt will grow to €2,100 billion.

Hence, if the interest rates are positive, the public debt tends to grow indefinitely over time. At first glance one could think that this phenomenon should increase the debt amount up to a level to be considered unsustainable, and it should trigger soon or later the state's default. However, the sustainability of the public debt depends also on another important factor: the size of the economy of the issuing state. By following again an intuitive reasoning, the same stock of debt can be more easily sustained the bigger (in terms of GDP) is the reference economy. In fact, a high GDP implies the capacity for generating sufficient streams of fiscal revenues to service the debt adequately (i.e. paying interest and principal at maturity). For these reasons, what really matters is not the size of the debt in absolute terms but in relative terms with respect to the GDP: this new quantity is the Debt/GDP ratio. We will discover shortly that the Debt/GDP ratio is a key quantity in the definition of the so called "Maastricht parameters" that lie at the foundations of the Eurozone.

Let's see what the variables are that influence the Debt/GDP ratio. Given the hypothesis of a primary balance in equilibrium, the debt growth is mainly governed by the nominal interest rate. Economic theory tells us that this rate is set in order to compensate the investor for the market and credit risks borne. But there's much more: in fact, we also have to consider the inflation rate. A rational investor, in fact, will not want the money earned in the form of yields on securities purchased to be reduced or zeroed by the growth of prices and therefore he will require that the nominal interest rate also includes the inflation rate. In other words, the nominal interest rate is the sum of a component that rewards such risks, known as "real interest rate", and the inflation rate. These two components therefore govern the dynamics of public debt.

Figure 1.11 sums up the concepts contained in the definition of real interest rate.

Let's study now how GDP behaves. The variation of GDP from one period to another depends on a quantity known as "nominal growth rate". Also this rate (as the nominal interest rate) is formed by two components: the "real growth rate" that measures how the quantity of goods and services

FIGURE 1.11 The real interest rate

produced by an economy changes over time and the inflation rate that is used to express the overall value of goods and services by using the current level of prices.

From this perspective one can comprehend why economists claim that the Debt/GDP ratio should remain constant if the real interest rate on debt matches the real GDP growth rate. If the real interest rate on debt is higher (lower) than the real growth rate, this ratio will increase (decrease) over time. Apart from our simplification in setting the primary balance to 0, this explanation is exactly how the standard theory for the evolution of Debt/GDP ratio is explained in economic textbooks.

In order to better understand the meaning and implications of this theory let's observe that inflation rate influences in the same manner both the evolution of the public debt and that of the GDP. Accordingly the dynamics of the Debt/GDP ratio (and hence the sustainability of public debt) turn out to be invariant with respect to inflation.

Is this theory really true? Not exactly. The theory that we have seen so far assumes that the interest rate paid by the government is the same for the entire stock of public debt. However, in any single period only a given percentage of the overall debt has to be repaid; if we maintain, for the sake of simplicity, the hypothesis of a null primary deficit, it follows that the expiring part of the debt will be refinanced at an interest rate aligned with the current market conditions. Conversely, the remaining stock of debt that has not to be refinanced has an interest cost connected with the previous market conditions.

In this more realistic framework, debt and GDP are always connected with the dynamics of the inflation, but in a different way. In fact the GDP is measured at current prices and grows automatically when inflation increases, while the debt follows the dynamics of the inflation rate only partially. Numerous reasons can be considered: the fact that only a part of the debt expires at a given period, the different interest rate (fixed or variable) paid on the various classes of government bonds, the term structure of the debt and the discrepancy between the current inflation rate and the one embedded in the servicing cost of the debt.

Anyway, what matters is that the inflation rate affects in different ways the two components of the Debt/GDP ratio and so it has a net effect on its dynamics. In other words, if the inflation rate is positive, the denominator grows more than the numerator and so the ratio improves. Vice versa, if the inflation rate is negative (deflation), the GDP decreases faster than the debt and hence the ratio deteriorates.

In normal market conditions the inflation makes the public debt more sustainable for reasons connected with the technical features of the debt. It is clear, hence, that when the debt becomes difficult to manage, the control of the inflation rate is an important policy tool.

Let's make a further passage ahead in our line of reasoning. As it has been said above, the possibility of using the inflation to contain the growth of the Debt/GDP ratio comes from the fact that the debt servicing cost reflects only partially altered the current inflation rate. But then, if the government policy is able to manage the sensitivity of the interest rates to the growth rate of the prices, the abating effect that the inflation rate has on the debt can be amplified. In other words, the inflation increases but the nominal interest rates remain constant; in economic theory this policy measure is known as "financial repression", since in the long term it induces negative real interest rates and hence an erosion of private savings invested in government bonds.

Empirically, it can be proved that negative real interest rates have characterised the economy of numerous countries in different historical periods. For example, in Italy (see Figure 1.12) several sub-periods of negative real rates can be found for short-term government bonds (BOT); in some cases the values are relevant, (up to –6% in the second half of the 70s). But there's more. Also in more recent times – in 2003 or in 2010–2011 – Italy has experienced negative real interest rates, even if limited to a minimum of –1%.

Italy is not an isolated case. Among the countries that have witnessed negative real interests rate can be included Japan, USA and Germany. Figures 1.13, 1.14 and 1.15 illustrate the pattern of inflation, nominal and real interest rate in the period 2000–2014 for United States, Germany and Japan.

In the case of Japan, the persistence of negative real interest rates since 2013 can be explained by considering the huge monetary expansion undertaken by the Bank of Japan. In the USA the negative real interest rates for short-term bonds start from 2008 and can be explained by the synchronous contribution of an easy monetary stance (especially in 2008–2009) and the recognition of US Treasury Bills as a *safe haven* (2011–2012), worthy of being bought even at a zero nominal rate.

The German case follows a different pattern. In fact, the negative real interest rates experienced in Germany not only in the short term but also in the medium/long term cannot be explained by a policy of *financial repression* but by a prevalent *safe haven* effect, for which German government bonds have become the safest perceived investment (see also § 3).

Let's spend some more words about *financial repression*. We said that this policy requires to keep nominal interest rates constant while letting the price level grow. The intended effect on the cost of debt servicing is to reduce its sensitivity to the inflation. Accordingly, also the evolution of the Debt/GDP ratio benefits more of high inflation rates; in fact in the case of an ongoing *financial repression*, the growth of prices has a limited impact on the interest burden, hence allowing the government to reduce the Debt/GDP ratio or to increase debt but in a way that does not increase its relative size with respect to the GDP.

Figures 1.16, 1.17, 1.18, 1.19, 1.20, 1.21, 1.22 and 1.23 compare the evolution of the Debt /GDP ratio with the pattern of the inflation in selected countries (Argentina, France, Germany, Greece, Italy, Spain, UK and US) in a historical perspective.

The common trait to all these charts is the inverse relationship between the Debt/GDP ratio and the price growth. This phenomenon is particularly evident after the two World Wars, where inflation has been used as a tool to absorb the huge public debt generated by military expenses. The 70s are another significant period due to the energy crisis and the forced reduction of oil usage. The concept that eventually emerges is that inflation can be manipulated to manage debt in periods of crisis.

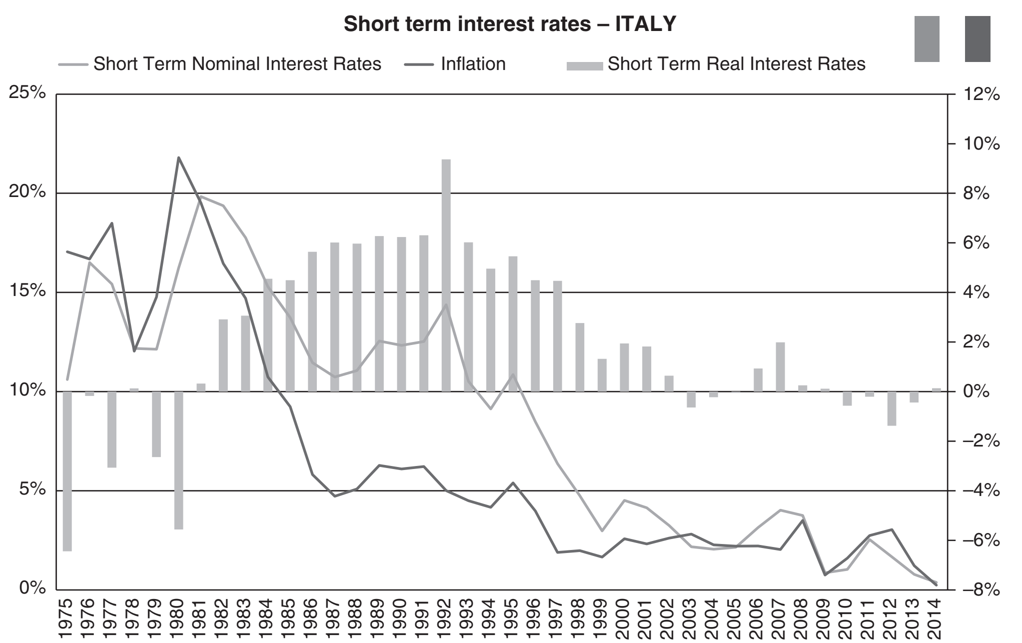

FIGURE 1.12 Inflation, nominal and real interest rates in Italy (1975–2014)
Source: Bank of Italy

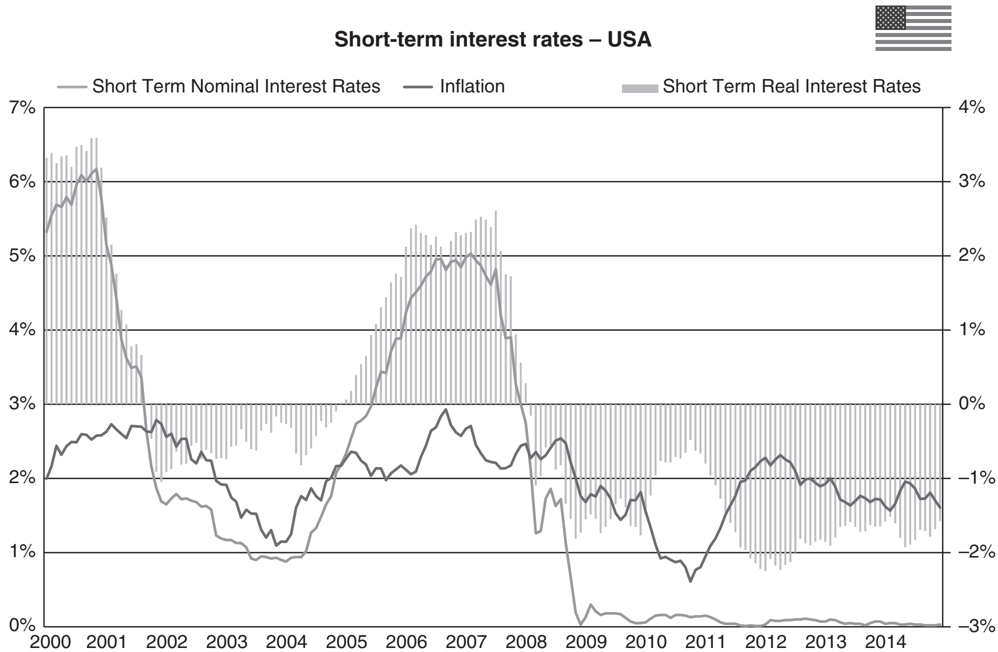

FIGURE 1.13 Inflation, nominal and real interest rates in the US (2000–2014)
Source: Bank for International Settlements

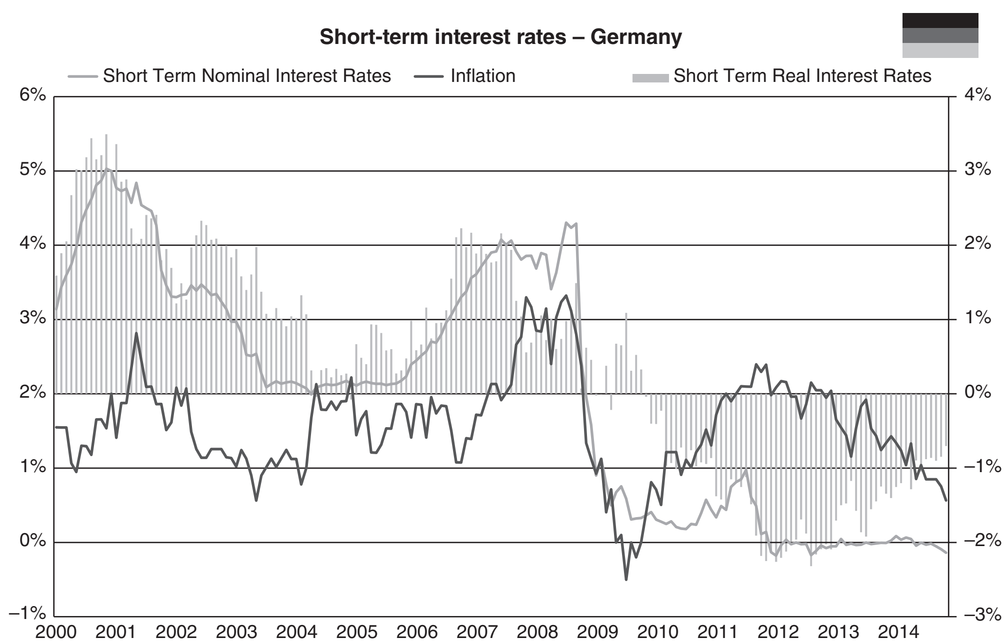

FIGURE 1.14 Inflation, nominal and real interest rates in Germany (2000–2014)
Source: Bloomberg

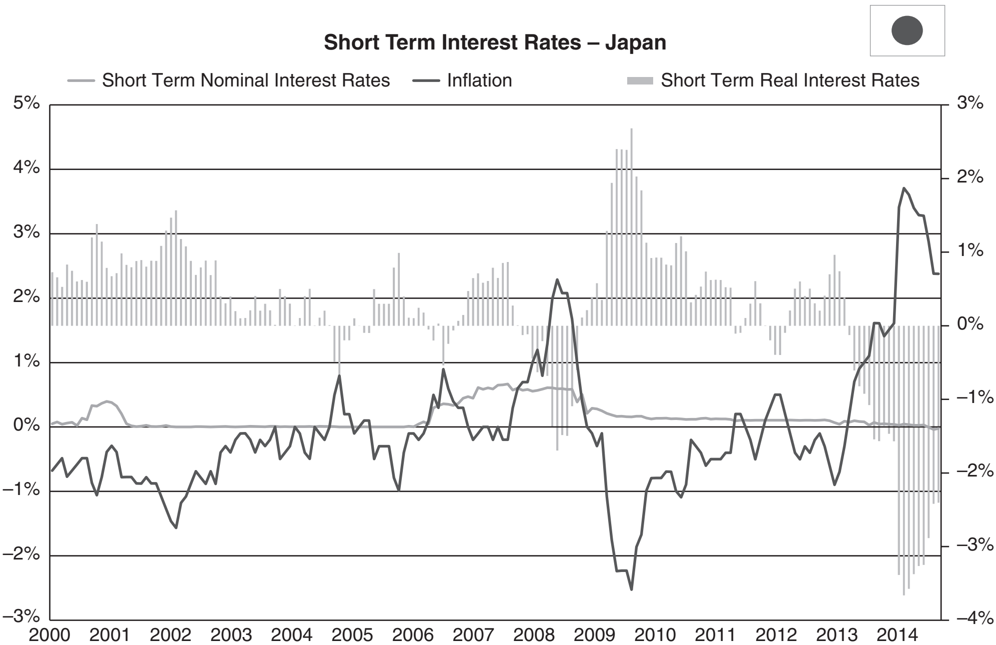

FIGURE 1.15 Inflation, nominal and real interest rates in Japan (2000–2014)
Source: Bloomberg

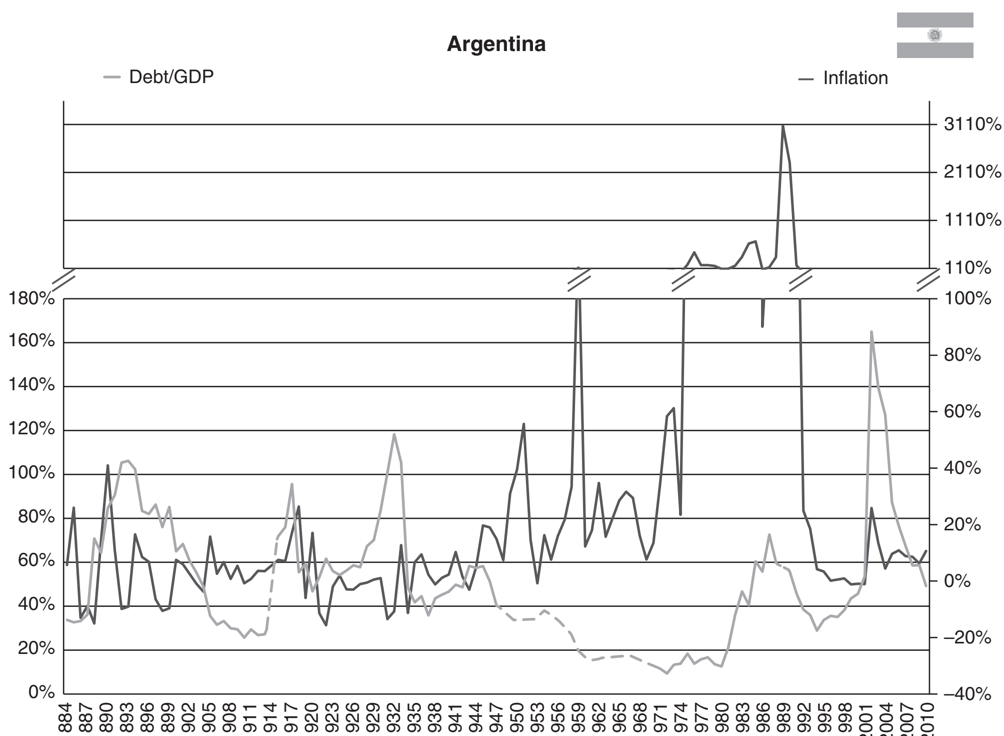

FIGURE 1.16 Inflation and Debt/GDP ratio in Argentina (1884–2010)
Source: IMF – Financial Affairs and Reinhart and Rogoff Database

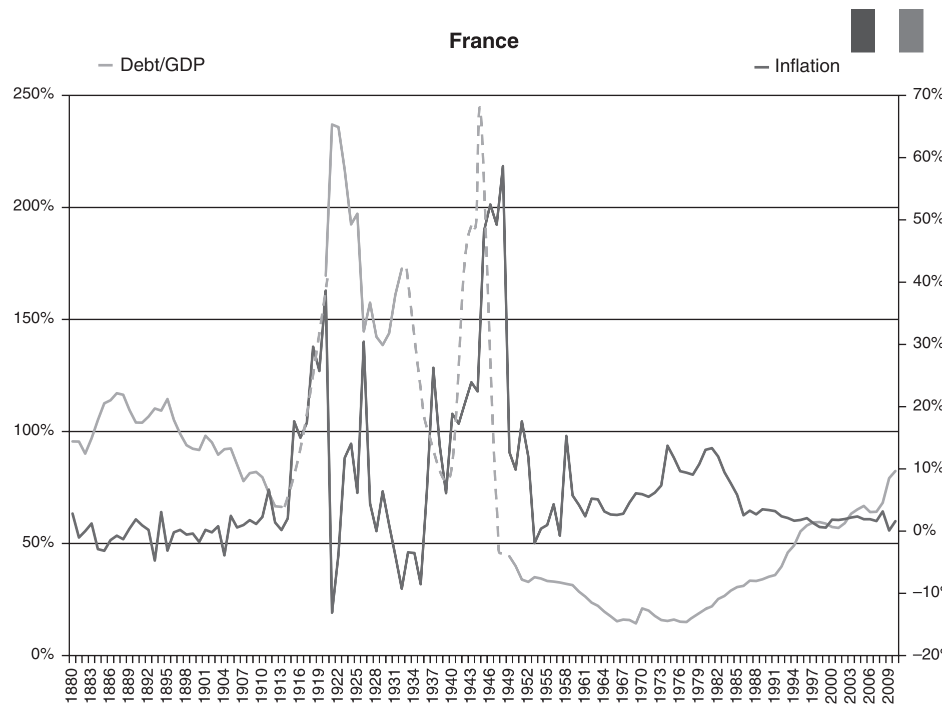

FIGURE 1.17 Inflation and Debt/GDP ratio in France (1880–2010)
Source: IMF – Financial Affairs and Reinhart and Rogoff Database

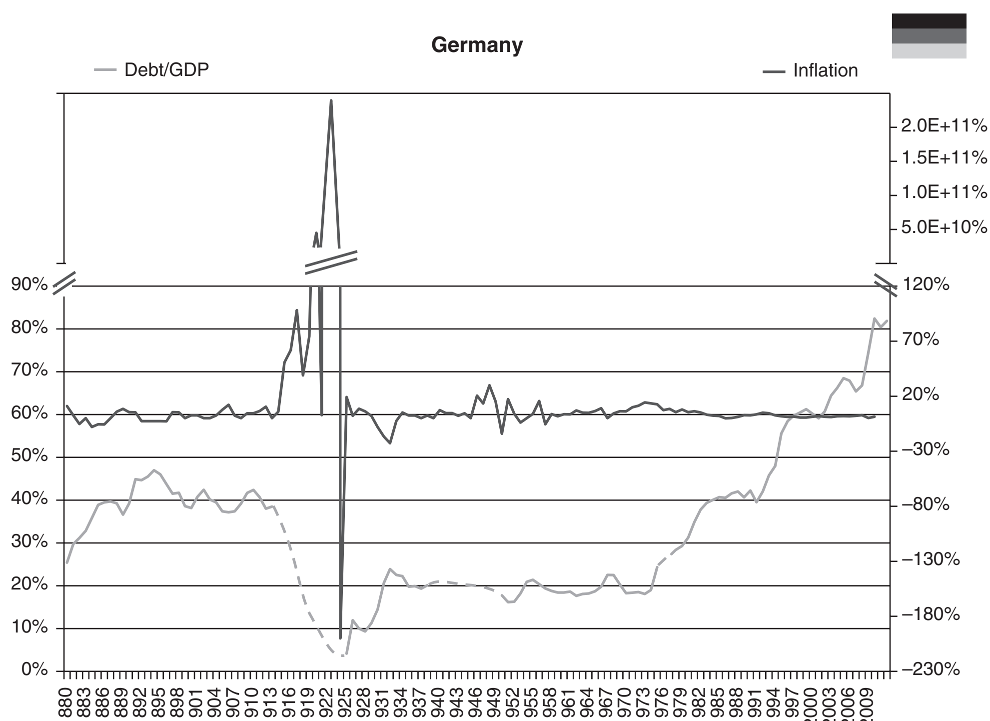

FIGURE 1.18 Inflation and Debt/GDP ratio in Germany (1880–2010)
Source: IMF – Financial Affairs and Reinhart and Rogoff Database

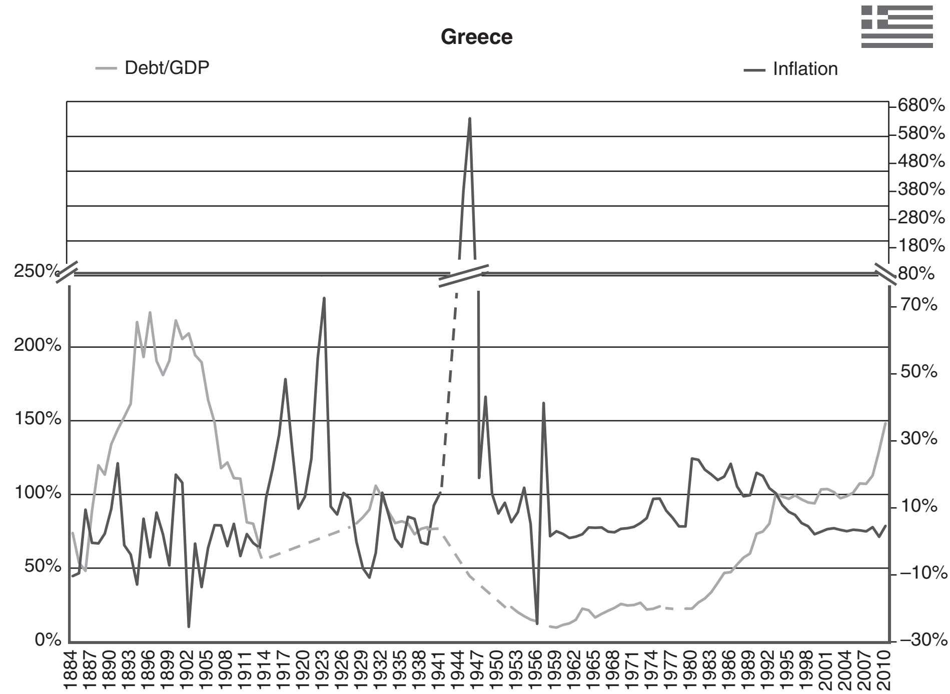

FIGURE 1.19 Inflation and Debt/GDP ratio in Greece (1884–2010)
Source: IMF – Financial Affairs and Reinhart and Rogoff Database

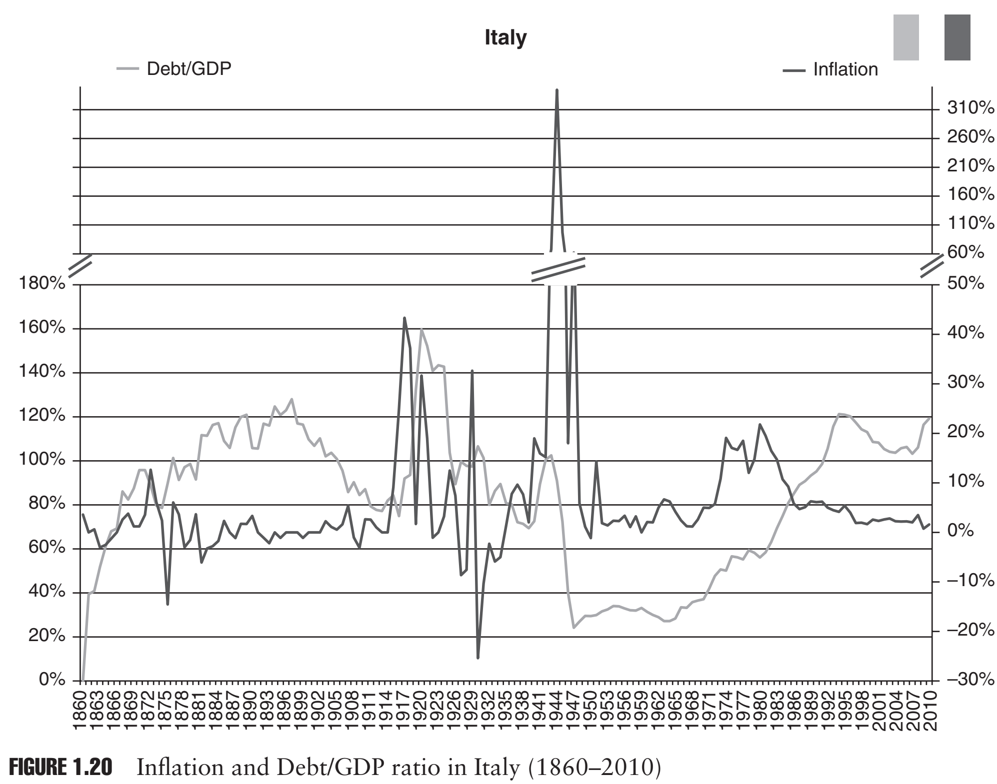

FIGURE 1.20 Inflation and Debt/GDP ratio in Italy (1860–2010)
Source: IMF – Financial Affairs and Reinhart and Rogoff Database

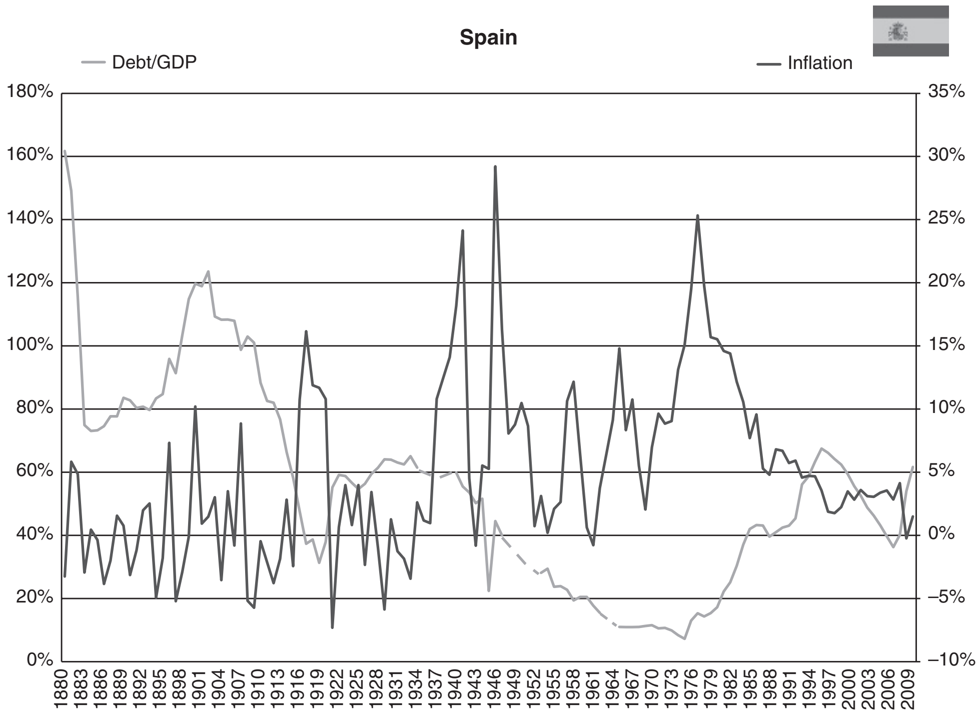

FIGURE 1.21 Inflation and Debt/GDP ratio in Spain (1880–2010)
Source: IMF – Financial Affairs and Reinhart and Rogoff Database

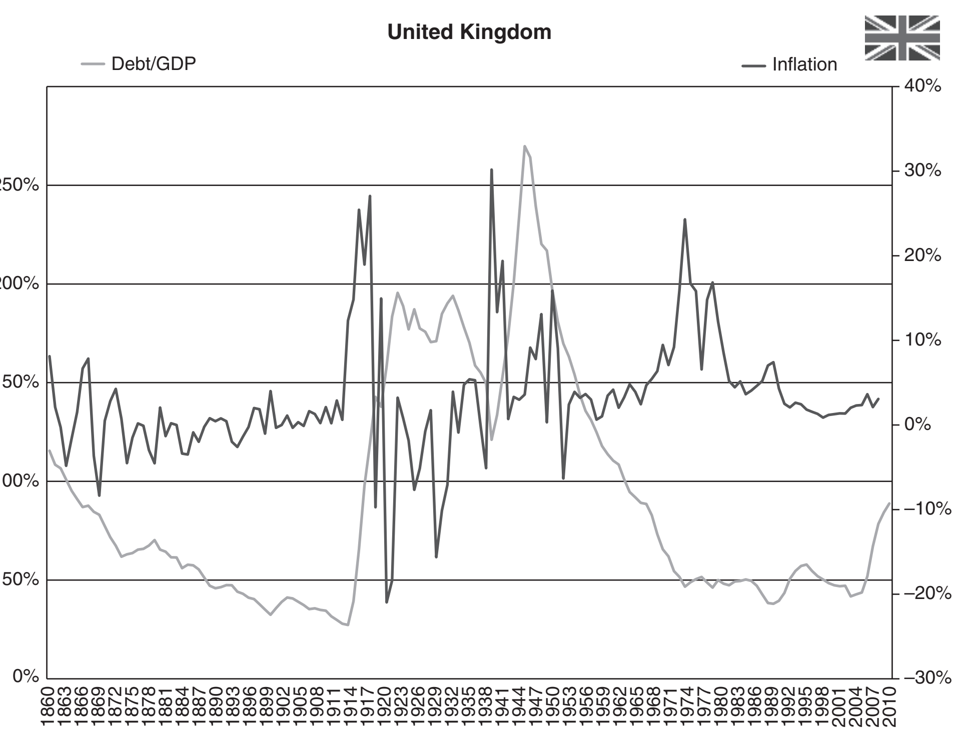

FIGURE 1.22 Inflation and Debt/GDP ratio in UK (1880–2010)
Source: IMF – Financial Affairs and Reinhart and Rogoff Database

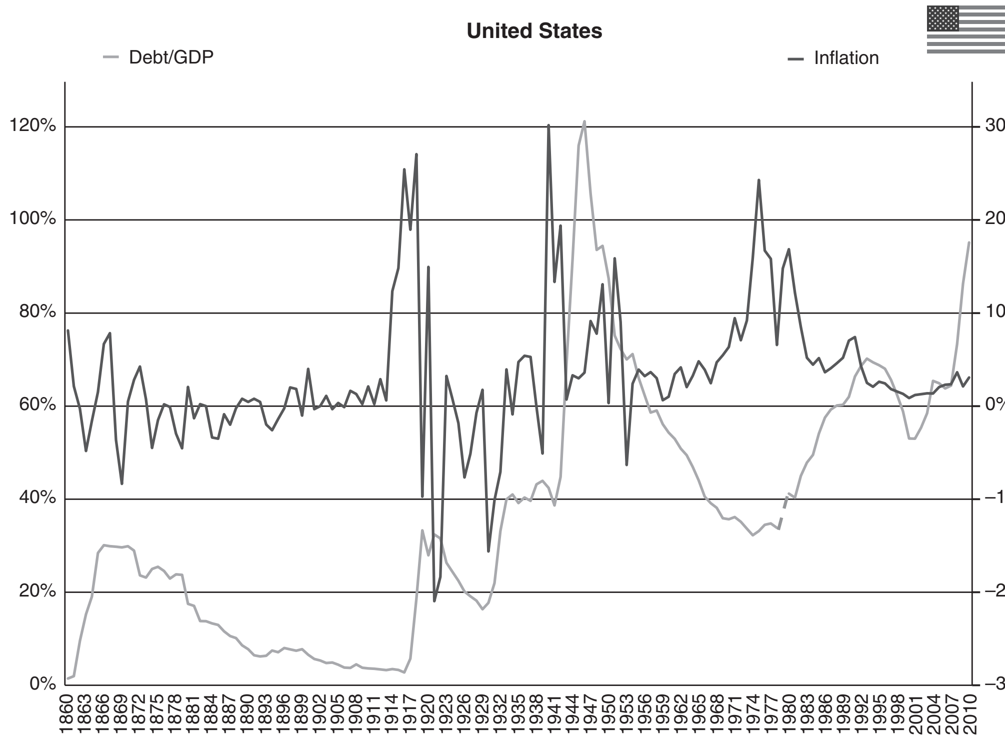

FIGURE 1.23 Inflation and Debt/GDP ratio in the US (1860–2010)
Source: IMF – Financial Affairs and Reinhart and Rogoff Database

1.3 SINGLE CURVE OF INTEREST RATE: EURIBOR, EURO SWAP, EUREPO

A single currency area represents an extension of the territory where the economic agents regulate their financial transactions through a shared currency having legal tender. Generally this area coincides with the territory of a sovereign state, whose government is able to forcibly impose the use of this medium of exchange (the "forced circulation"), and has sovereignty over the issuance of new currency.

In a monetary system, it is quite natural that within the currency area there can be no subject less risky than the state itself: in fact, if a state is destined to default on its debt, it is probable that any company or bank belonging to the nation will equally be in trouble. In addition, a state can always decide to repay a debt issuing new currency, which must be accepted in every case by the counterparty.

Consequently, the set of interest rates (the "single curve") referred to the government of a sovereign state is the benchmark for the entire economic system of the nation. This implies that the interest rates paid by the government can be considered as "risk-free" interest rates (even if they are not) because it is not possible to invest their savings in anything less risky. Not even foreign business: for example, the United States may be perceived as a healthier state than Mexico, but for a Mexican citizen to invest in American government bonds means taking the risk of the exchange rate between the dollar and the peso, therefore for this subject, the low-risk investment remains a bond issued by the Mexican government.

The Euro currency area is the exception to the rule.

1.3.1 A Single Curve for All Government Bonds of the Euro Area Countries

The nations that have joined the Euro have exclusively surrendered their monetary sovereignty to the European Central Bank, while keeping all the other typical functions of any sovereign state, including the ability to borrow by issuing public debt securities. This fact is central in understanding the functioning of the Euro and its structural problems.

If the Eurozone does not have a federal government like that of the United States that can issue sovereign bonds, how is it possible to identify which investment is risk-free and therefore the single curve of interest rates?

Until 2007, when the effects of the international financial crisis from the United States to Europe started to unfold, the solution to the dilemma was guaranteed by the substantial convergence of the sovereign yield curves of all Eurozone countries. In essence, the risk perceived by the market operators was substantially the same for any government bonds considered: Italian, German, Greek etc. Same perceived risk, same return: the different curves of the various countries were practically indistinguishable from each other, realising in practice a single interest rate curve (see Figure 1.24).

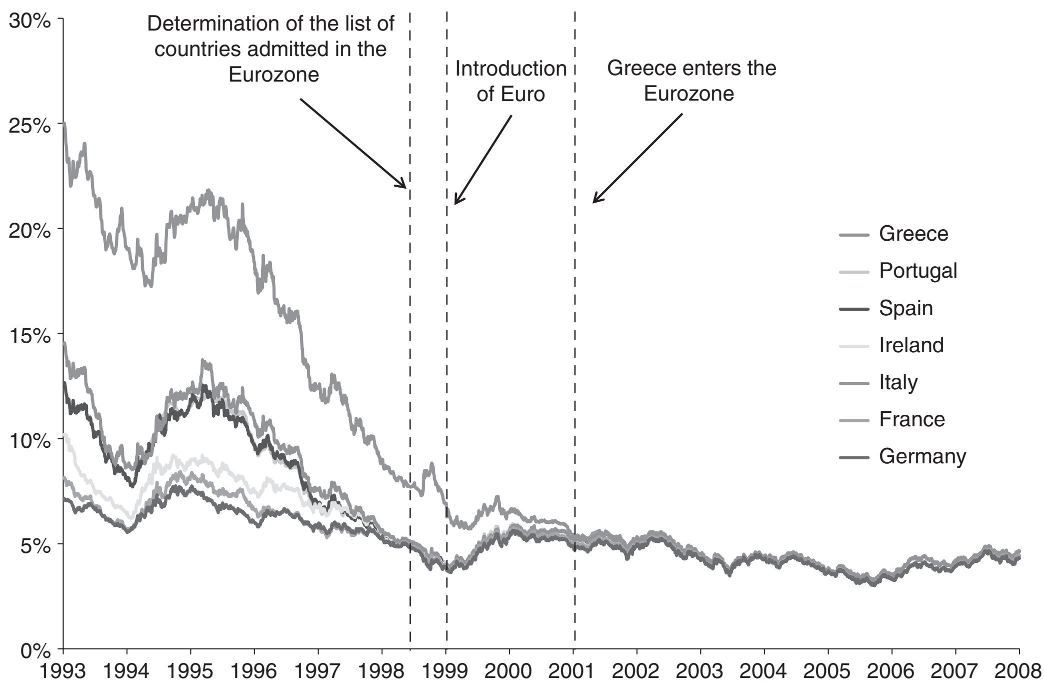

FIGURE 1.24 Interest rate on 10-year government bonds of various Eurozone countries
Source: Bloomberg

The explanation of the phenomenon is hidden in the term "perceived". In reality, the economies of the various European countries have always been profoundly different, with different growth rates and levels of debt and inflation. The risk of a bond issued by the Greek government has always been different from that of a German bond: the market simply ignored this phenomenon, assuming that the differences were so low as to be negligible. In retrospect, it was a serious error of judgement, favoured by the architecture of the European financial system that will be discussed in detail later.

Furthermore, the governments of the countries that joined the Euro voluntarily decided to give up printing money in order to repay their debts (the so-called monetisation); this structurally increases the risk of default of a sovereign State because it automatically reduces the room for manoeuvre. This point will be further explored later.

1.3.2 The European Interbanking Market: EURIBOR, EUROSWAP, OIS

The European financial system is largely bank-centred. Historically, the percentage of loans granted by banks in the Eurozone has always been more than 100% of GDP, and in recent years was around 150% (see Figure 1.25), despite the evolving global crisis.

As a result, the interbank market, through which banks cover part of their financial needs in the short term, assumes a notable importance in the complex functioning of the European financial system. Before going into the analysis of the system of relations between finance and real economy, let's examine better the structure of the interbank system.

The reference interest rates for the European interbank market are determined by the daily operations of a panel of 45 banks (see Figure 1.26). In general, at a fixed time of the day (11.00 am) every bank communicates a series of interest rates; these rates represent an estimate by the bank of the levels

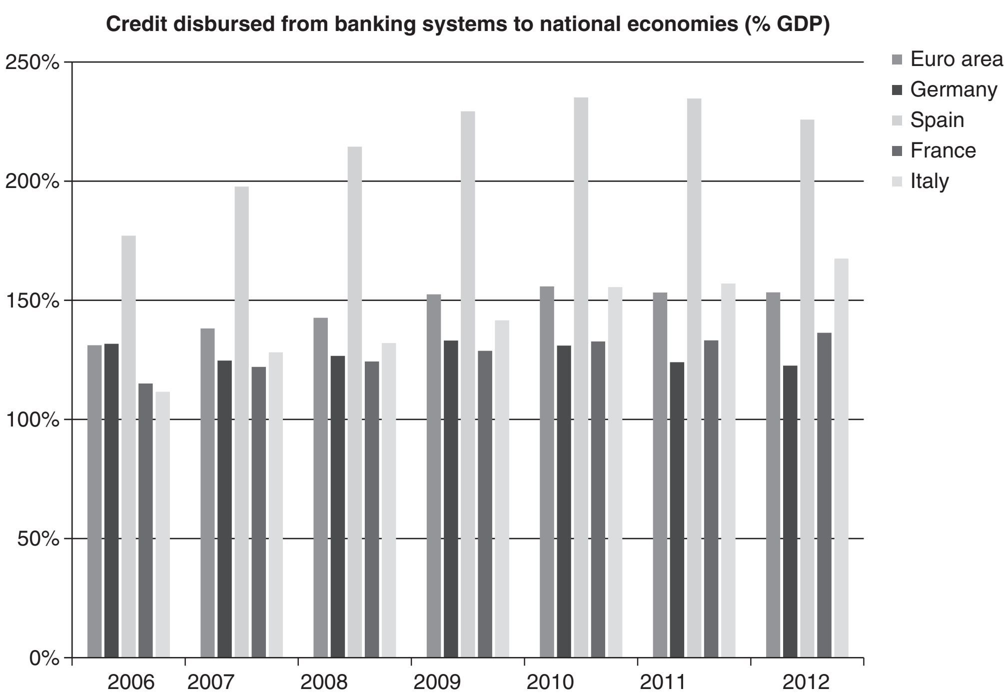

FIGURE 1.25 Credit disbursed from the banking systems to the national economies (Eurozone)
Source: World Bank

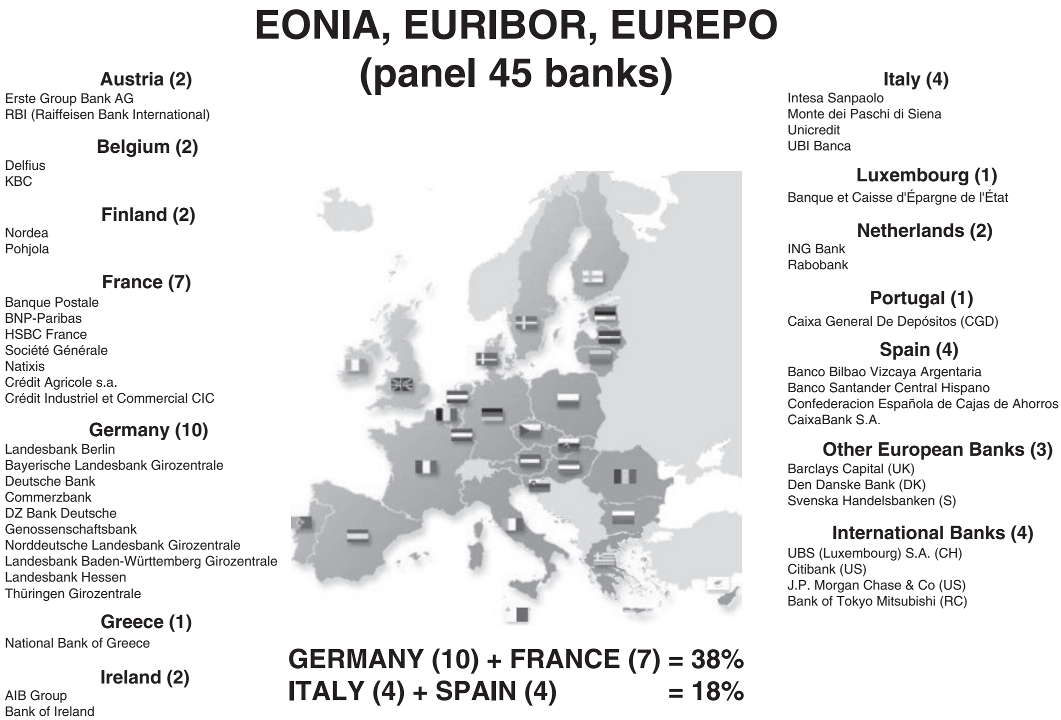

FIGURE 1.26 European banks involved in the determination of the interbank interest rates in the Eurozone
Source: European Central Bank

of the rates charged by the other panellists. These estimates are then collected and averaged, not before eliminating the most extreme values from the sample.

They take on different names depending on the type and maturity of the operation in question. In particular, with regard to the standard operations of interbank loans:

- EONIA: for very short-term lending operations (1 day or overnight);
- EURIBOR: for short-term lending (up to 1 year); and
- EURIRS: for medium- to long-term lending (for at least 1 year).

Figure 1.27 graphically represents the structure of the curve for interbank loans EONIA/EURIBOR/EURIRS. Loan maturities are represented on the horizontal axis, while the vertical axis shows the rates at which the transactions are settled; as a consequence, in the bottom left area we can read the interest rates relative to short-term and very short-term transactions, while rates tied to loans with a longer maturity, such as 30 years, appear in the top right. As it can be easily guessed, rates related to longer maturities tend to be higher, even if this rule is not always the case.

Interest rates reported in the EONIA/EURIBOR/EURIRS curve are clearly calculated keeping in mind the risk of the transaction. Any bank that lends money to another bank takes on the risk of not seeing its loan being honoured and thus it determines the interest rate to apply according to the rule which we have already learned: the higher the perceived risk, the higher the yield.

However, it is possible to access some low-risk operations on the interbank market, so low as to be considered practically negligible. This regards the Overnight Index Swap (OIS), namely transactions in which banks exchange fixed and variable money flows; in a standard transaction a bank makes a series

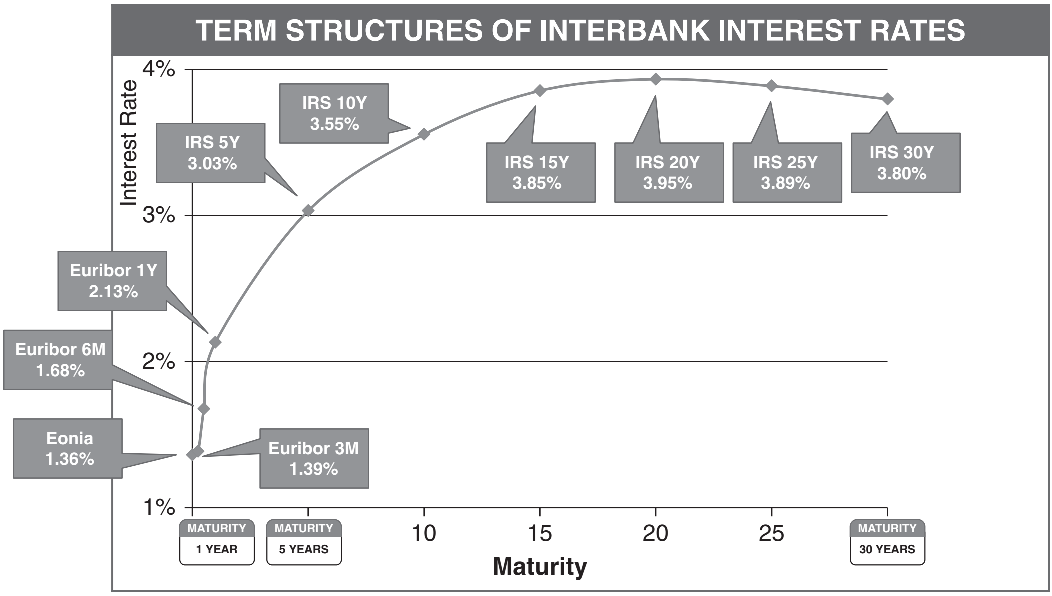

FIGURE 1.27 Term structure of the interest rates on interbank loans
Source: Bloomberg

of variable payments that are anchored to the performance of the interest rate relative to very short-term loans (EONIA at 1 day), in exchange for certain payments calculated on the basis of a fixed rate swap (OIS). It is important to note how this swap rate by construction reflects the "average expected level" of the interbank overnight rate (EONIA) during the swap, thus implying a level of the EONIA rate which incorporates the estimates of the operators. The OIS rates, since they are linked to the EONIA rate at the shortest maturity, are therefore very low and are always below the interbank lending curve, even if these rates concern technical operations for the treasury management which don't have the same relevance as obtaining a real loan. Figure 1.28 graphically represents the structure of the curve relative to the Overnight Index Swap transactions. On the horizontal axis contract deadlines are highlighted, while the vertical axis shows the rates at which transactions are settled; as a consequence we can read the interest rates relative to the very short-term and short-term transactions at the bottom left which, given the lack of relevance of the expectations for the short term, are not surprisingly very close to the rates on the interbank loans, while at the top right we find the swap rates related to the longest maturities such as 30 years, where the role of expectations is very relevant.

This interest rate curve has a very important and informative benefit: since it describes the reward of transactions that are very low-risk, the differential with the interbank interest rate curve represents a very clear measure of the perceived credit risk within the interbank system (*EURIBOR-IRS/OIS spread*). When banks don't trust each other and tend to lend very carefully, this differential widens a lot, while during peaceful periods the distance between the two curves is not significant (see Figure 1.29).

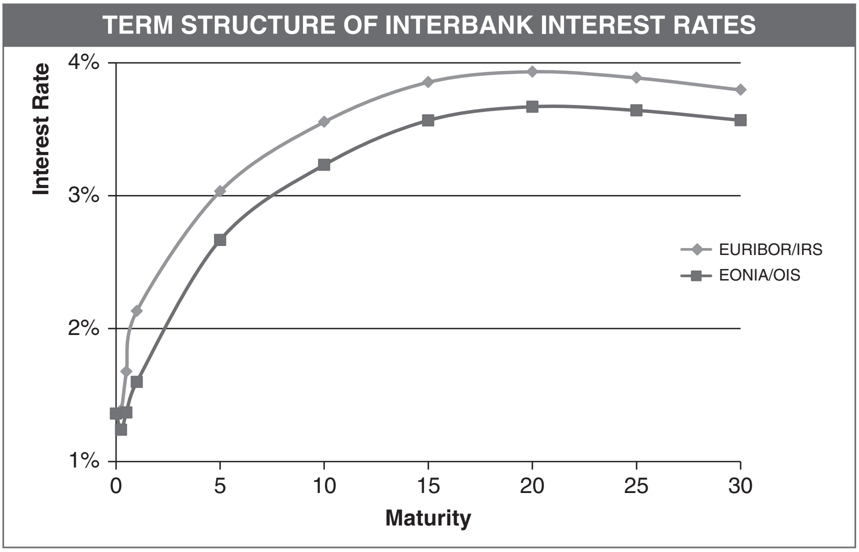

FIGURE 1.28 Term structure of the interest rates on Overnight Index Swap (OIS) transactions
Source: Bloomberg

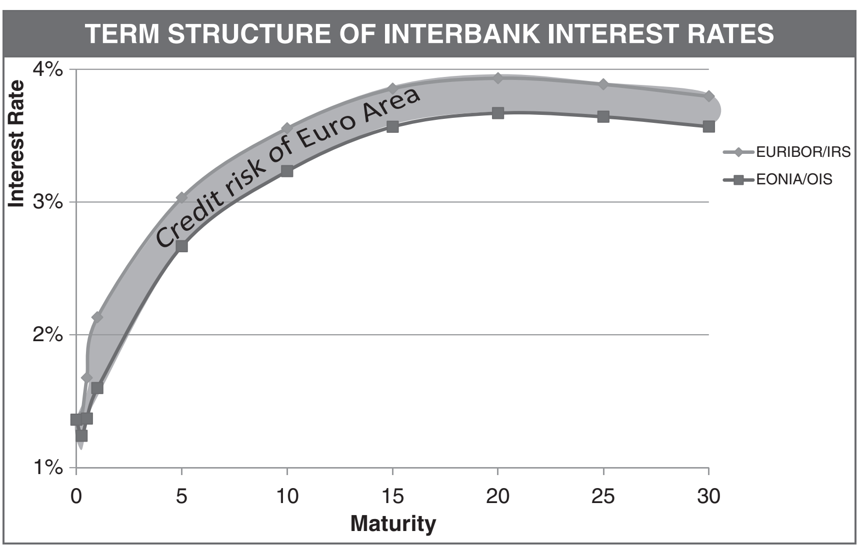

FIGURE 1.29 Term structure of the interest rates on interbank loans and on Overnight Index Swap (OIS) transactions with evidence of EURIBOR-IRS/OIS spread
Source: Bloomberg

1.3.3 Interbank Warranties: the Collateral and Eurepo Curve

Credit risk which characterises each interbank lending transaction in an irreversible way can also be managed in a different way from the classic method of requiring a higher return from subjects perceived as being risky; it's enough to ask for a financial asset (also cash) in guarantee. The bond or the liquidity offered to guarantee interbank lending is called collateral in technical jargon and the collateralised interbank lending market (i.e. secured) is known as the *Repo* (*Repurchase Agreements*) market.

A Repo lending operation is actually very simple: as a bank, I ask to borrow an amount from another bank, usually for short periods (less than one year). I get to pay a very low interest rate, lower than the standard market of interbank loans. However, in exchange for this favourable interest rate I must put as a guarantee ("post collateral" in jargon) a financial asset of my property for the entire duration of the loan, preferably something low-risk, such as a government bond. In such a way, if I am unable to repay the loan, the lending bank will automatically recoup by acquiring the ownership of the government bond.

A Repo can also be seen from the opposite side (the so-called *Reverse Repo*): as a bank, I need to borrow a government bond for my own activity, and I ask for it from another bank in exchange for a sum of money in cash posted as guarantee, with a value slightly discounted. If my activity is unsuccessful and I am unable to return the bond, for the lending bank it will be as though it was sold, seeing as it immediately obtains the money posted as guarantee.

The European collateralised loan market is therefore very important and of a great size as it allows great flexibility in the management of liquidity to participating banks. The curve of Eurepo interest rates (*European Repo*) represents, for any given maturity, the rate on a secured loan where the collateral posted is the best available; in this historical period, it isn't difficult to guess that such collateral coincides with German government bonds (the Bund).

The Eurepo rate, being representative of a loan secured by the best possible guarantees, can also be treated as an interest rate at minimum risk and used to measure the credit risk of an interbank loan.

Figure 1.30 shows us the Eurepo curve together with the other curve that the market considers essentially risk-free, the OIS.

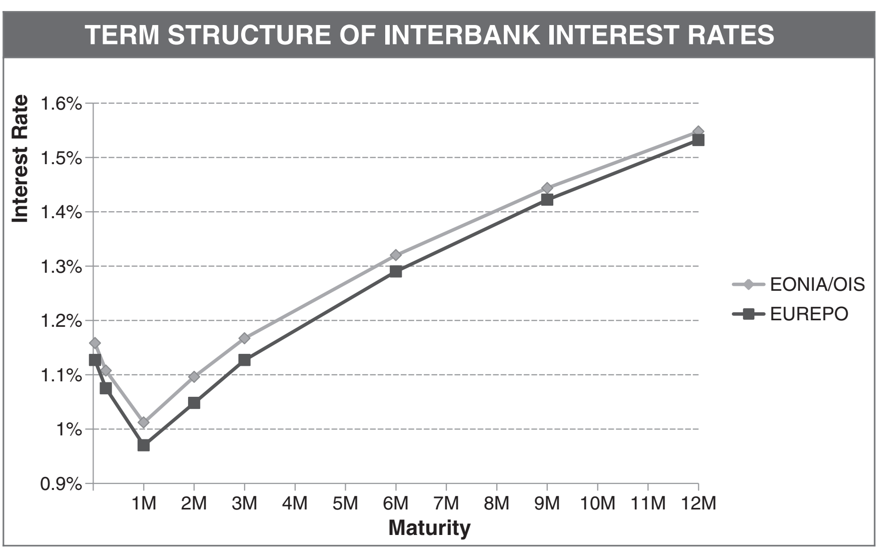

FIGURE 1.30 Term structure of the interest rates on Overnight Index Swap (OIS) transactions and on collateralised loans (Eurepo)
Source: Bloomberg

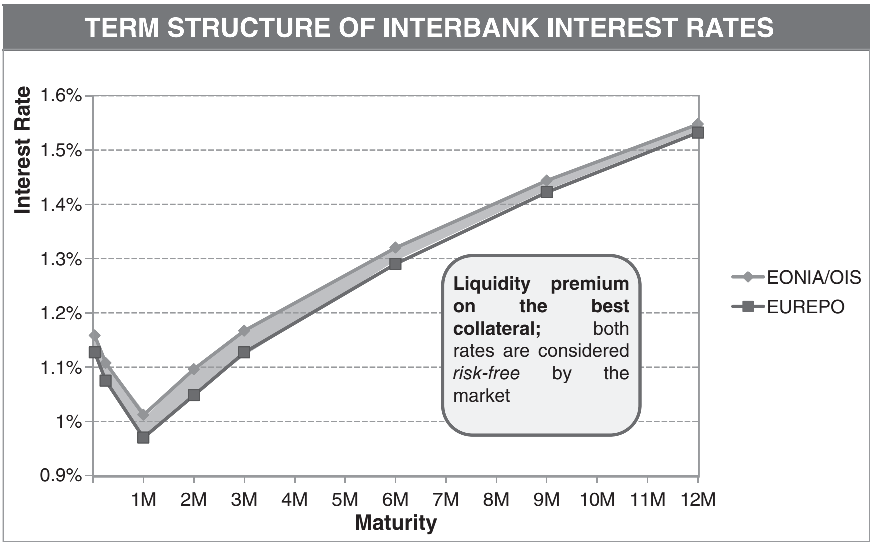

FIGURE 1.31 Term structure of the interest rates on Overnight Index Swap (OIS) transactions and on collateralised loans (Eurepo) with evidence of the OIS/Eurepo spread
Source: Bloomberg

What's interesting to note? In this circumstance the Eurepo curve is actually lower than the OIS curve, even if both are very low-risk. Therefore, the difference in this case has to depend on another phenomenon: the presence of the guarantee in the Repo operation. In fact, the bank which is lending funds at Eurepo rate is getting a German government bond as guarantee, which represents a valuable financial asset, much demanded by the market; by applying a lower rate than that detected in the OIS transactions, the lending bank is therefore recognising to the borrower a premium for the quality of the collateral posted (see Figure 1.31).

The answer we have provided is exhaustive, but it stimulates several others. Since it is possible to guarantee a wide variety of financial assets, which may include government bonds of other countries such as Italy or Spain, what will happen in these cases?

Historically, there were essentially two answers to this question. The first, developed in the period before the introduction of the single currency, the market quoted a different interest rate depending on the type of collateral posted. This principle is imaginable as it mirrors the general rule that if the risk of a financial asset is higher, the higher the return has to be; in this case, the lower the quality of the collateral (i.e. the higher the risk), the higher the rate of return demanded in the loan. As a consequence, it was possible to observe different Repo curves according to the origin of the collateral: a Repo Italy curve, a Repo Spain, etc.; these are the so-called *special Repo*.

After the introduction of the single currency and listing of the Eurepo rate, for reasons of standardisation and liquidity of the transactions, the market developed a second solution: the rate applied in a Repo operation is always that of Eurepo, but whoever decides to post a collateral different from the best available (the Bund) suffers a penalisation (*haircut*) in the valuation of the guarantee. For example: if I post a €100 Bund to guarantee interbank loans, the lending bank will value it exactly at the face value (100); if I, as the borrowing bank, decide to post BTP for €100, the guarantee will be valued at €95, given that Italian bonds are perceived as riskier; therefore, to get a €100 cash loan, I will have to post BTP for a face value of €105.26.

This procedure is technically called *collateral discrimination*, and in the next few chapters we will discover how it is at the base of much of the tension that the European financial markets experienced during the most critical phase of the current international crisis.

Of course, if there is a substantial convergence in government bonds yields, the difference between the special Repo rates and the Eurepo rate is not so significant. However, with the explosion of the international financial crisis and the acceleration of the divergence process in the bonds yields of the different Eurozone governments, a progressive disconnection between the Eurepo rate and the special Repo rates has emerged. The phenomenon worsened with the Eurozone debt crisis and the collapse to extremely low yields of the Bund curve; accordingly the Eurepo rate has morphed in a mere replica of the German special Repo curve. In the period 2011–2014 the interbank loans that take the Eurepo rates as benchmark have become thinner; as a consequence the number of banks that have been effectively quoting the Eurepo rate on the market has reduced considerably. This progressive marginalisation of the Eurepo rate in the "new normal" framework of the Eurozone interbank market has pushed the EU authorities to discontinue the publication of Eurepo data till the beginning of 2015.

1.4 THE MONETARY POLICY IN THE EUROZONE AND THE MECHANISMS OF TRANSMISSION

Our reader has now all the tools to understand a fundamental piece of the Eurozone architecture: the monetary policy and the role of the European Central Bank. This economic policy tool assumes a greater importance with respect to other currency areas (like the USA), since it can be considered in all respect the only instrument that operates fully and produces its results at a European level. § 1.4.1 goes immediately to a core point – the prohibition of sovereign debt monetisation – absolutely necessary to understand how the Eurozone crisis was born and has been managed by the European authorities, while § 1.4.2 is a more technical section but yet accessible and describes with more detail how the decisions of monetary policy taken by the ECB are transmitted to the financial system and the real economy.

1.4.1 Policy of the ECB and the Prohibition of Sovereign Debt Monetisation

As the economic history of the last two centuries teaches us, monetary policy practised by a central bank can pursue different goals.

Following the suspension of the dollar's convertibility into gold in 1973, the power to issue currency that is legal tender in the hands of the central banks has become more persuasive and more dangerous at the same time: on the one hand, the financial operators are forced to use the newly minted currency as a medium of exchange, so liquidity injections directly impact on the activity of the economic system, while on the other hand, the devaluation of the currency and inflation that may arise assume greater importance.

The dilemma is: does the objective of the monetary policy have to be the growth of the economy and employment, or price stability? In the US currency area, the Statute of the Federal Reserve (FED) leaves little room for interpretation (see Figure 1.32).

In a nutshell: the statute of the FED at a first glance does not exclude the inflation lever in times of recession to preserve employment. In fact, since 2008, through three interventions of *Quantitative Easing* and the open market operations of the Treasury Bills, the FED has been substantially expanding the monetary base in dollars through the purchase of long-term government bonds (fictitious monetisation) to support the American economy (with discreet success).

Instead, the European Central Bank came about in a very different context, dominated by the rigorous policy of price control of the German Bundesbank and marked by the inflationary waves of the 70s–80s which seriously damaged the competitiveness of European industry. It is not by chance, therefore, that the Statute of the ECB defines a completely different principle (see Figure 1.33).

In conclusion: the ECB by statute cannot use the financial leverage (inflation) to anti-cyclical ends. This implies that in a recessive context, the ECB can only implement temporary measures to increase

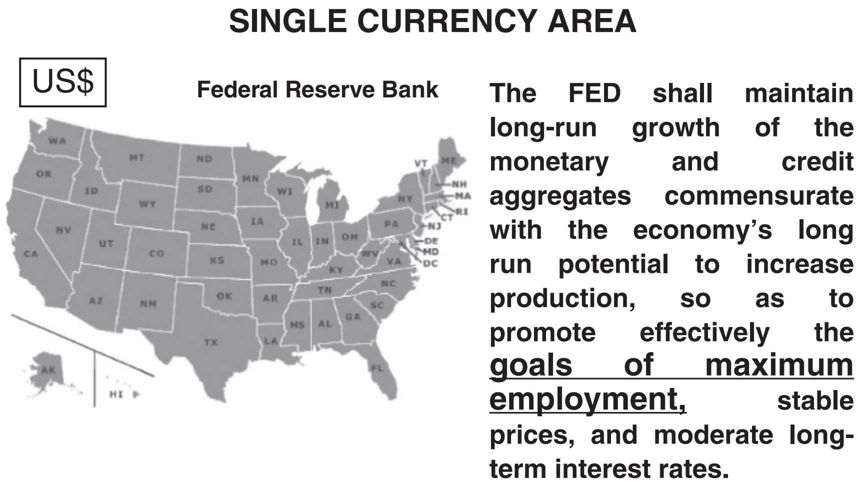

FIGURE 1.32 Excerpt from the Statute of Federal Reserve Bank (USA)

liquidity in the financial system: very often it is forgotten that the exceptional measures of funding to the banking system (i.e. the LTRO, Long-Term Refinancing Operation) and the purchase of government bonds (like the Securities Market Programme or SMP) are temporary measures which provide for automatic sterilisation in definitive times. Timid openings towards a proactive use of the financial lever were recorded in the second half of 2014, when the continuing conditions of low inflation below

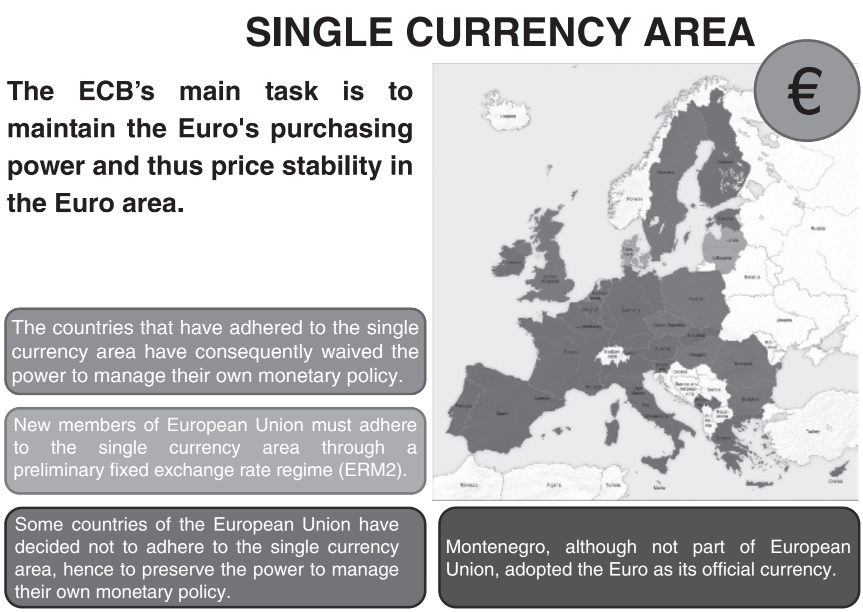

FIGURE 1.33 Excerpt from the Statute of the European Central Bank (EU)

the ECB's target (2%) led to President Draghi suspending the SMP sterilisation programme, actually freeing around 160 billion of additional liquidity into the European financial system.

Nonetheless, in the past (2008–2009), the burden to support the economy fell back on the fiscal stances of Eurozone governments, resulting in a sharp increase in government deficits. The current crisis of public debt thus has its natural trigger in the previous recession, and it seems that since 2011 even fiscal policies have veered towards restrictions of public spending and increased tax coefficients. In this context of austerity, all the efforts of growth made by the Eurozone governments are scarcely credible, given that economic policy has in fact encouraged a deepening of recessionary conditions.

Now let's look closer at the tools used by the ECB to implement its monetary policy objectives, which we often hear spoken about in the media and television debates.

1.4.2 Transmission Mechanisms of the Monetary Policy

In short, there are four tools that the ECB can use to influence the money supply in circulation:

1. reserves (minimum and free) of the Eurosystem;
2. the interest rates related to refinancing operations;
3. the interest rates related to the reward of overnight deposits;
4. the eligibility criteria of the collateral as guarantee of refinancing.

During the evolution of the crisis, much emphasis was given to the signals on interest rates associated with the refinancing operations of point (2), while the reserve ratios of point (1) didn't have much relevance, which has remained largely unchanged. As a consequence we will focus our attention directly on point (2).

Figure 1.34 illustrates the evolution of the short-term refinancing operation rate (MRO, main refinancing operation) practised by the European Central Bank from when the Euro came into existence (in 1999) to June 2014. The trend is represented as a "stairstep" due to the fact that the operations of changing the conditions of lending occur at distinct moments, after months (or even years) and for the majority of time the refinancing rate remains constant.

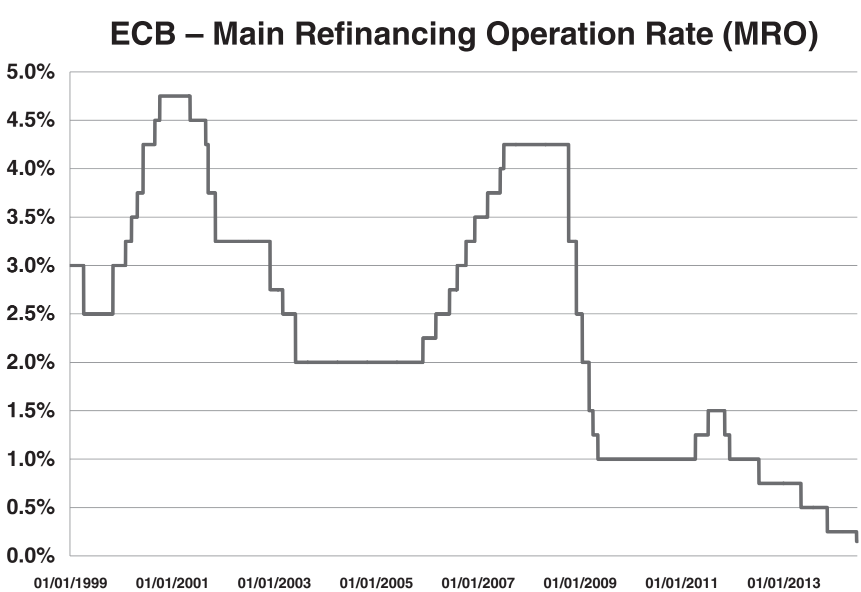

FIGURE 1.34 Evolution of the ECB short-term refinancing rate (MRO rate)
Source: European Central Bank

Starting from 2008, the method of disbursing funds has been structurally changed from a floating rate mechanism to a fixed rate one, and for unlimited amounts. To understand, let's look at an example: in 2007 a European bank that wanted to access funding from the ECB was taking part in an auction with other competing banks, in which limited amounts of funds were allocated at the best rate which could be offered; as a result, until 2008, the rate shown in red in Figure 1.34 represents the minimum level from which to start the auction. Since 2008, the ECB has periodically offered unlimited liquidity at a fixed default rate to any applicant upon presentation of adequate collateral; in this case there is perfect correspondence between the rate represented in the graph and that applied to banks. In principle, this measure should be temporary and reversible, but given the developments of the crisis and its impact on the European banking system, it is extremely difficult to think of withdrawing it without devastating impacts on the activities of banks.

Figure 1.35 illustrates the evolution of the rate applied on last resort refinancing operations (MLF, Marginal Lending Facility) practised by the European Central Bank from the year the Euro came into existence (1999) to June 2014. The trend is represented "stairstep" due to the fact that the operations of changing the conditions of the loan occur at distinct moments, after months (or even years) and for the majority of time the refinancing rate remains constant. This loan is granted by the ECB for unlimited amounts and selected maturities, at any moment in which the bank might need it; for this reason the interest rate charged is obviously higher compared to the standard MRO rate and banks make use of it only when they are really pressed with an urgent need for cash, usually for very short periods (a few days).

A LTRO all in all is a refinancing operation in the medium to long term (from 3 months onwards). In simple terms, it offers unlimited liquidity at very convenient rates and gives the banks a lot of time to return them. One of the reasons why the ECB is very reluctant to carry out a new LTRO long-term (e.g. 3 years) before the existing ones run out is linked with the feeling that the banks could pay back the funds of an LTRO with those obtained with a following one and expand credit in an uncontrolled manner, relying on a regular succession of long-term refinancing operations. In other words, a series of LTROs is equivalent to a permanent expansion of the monetary base and this goes against the founding principles of the European Central Bank.

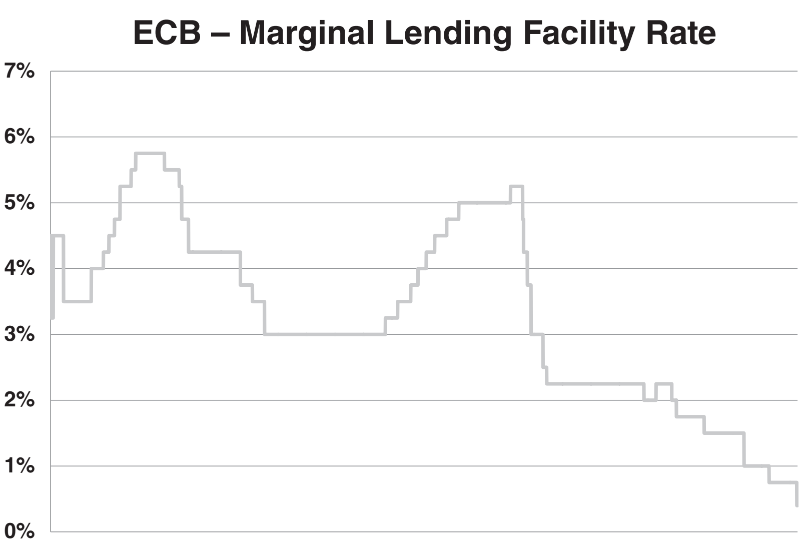

FIGURE 1.35 Evolution of the ECB rate on Marginal Lending Facility (MLF)
Source: European Central Bank

In simple words, what do we mean by point (3)? If a bank has excess liquidity which it doesn't manage to use profitably in lending to the real economy or in the investment on financial assets, it can in the last resort deposit this liquidity at the ECB, receiving a very low rate: it's clear that the higher this rate is, the more it tends to "attract" liquidity from the banking system towards the Central Bank and to crowd out the investments, in a typical restrictive measure of liquidity reduction.

Figure 1.36 illustrates the evolution of the rate on overnight deposits practised by the European Central Bank from the year the Euro came into existence (1999) until June 2014. The trend is represented "stairstep" due to the fact that changes in the conditions of deposit occur at distinct moments, after months (or even years) and for the majority of the time the deposit rate remains constant.

The overnight deposit rates have continually fallen since 2008, reaching a negative value in June 2014.

The repeated intervention on the level of overnight rates between autumn 2011 and summer 2012 was necessary to hold a disconcerting phenomenon which manifested as a result of the large LTROs of December 2011 and February 2012, which had injected over €1 trillion into the European financial system in a little over 2 months. Figure 1.37 gives us the overall picture of this situation.

At the end of June 2012, around €800 billion worth of cash lay unused in the deposit accounts of the ECB. Keep in mind, however, that almost all of those funds had been borrowed through LTRO loans and thus at a passive rate of 1% at best. With a continuing decrease in remuneration from 0.75% in 2011 to zero, it was real liabilities with a dry cost for banks, and yet they were not mobilised. After zeroing the rate of remuneration of overnight deposits, finally a massive shift of liquidity was obtained, with the halving of the amount deposited. Where did these funds suddenly finish, given the impossibility of such a sudden increase in funding to the real economy and of a massive programme to purchase financial assets? The answer is simple if you look at the amount of deposits to the standard treasury accounts at a zero-value return which every bank as a full member of the Eurosystem holds at the Central Bank (see Figure 1.38).

Figure 1.38 tells us that in July 2012 the banks simply moved over 50% of funds from one account to another, since from the point of view of the returns, the accounts had become equivalent.

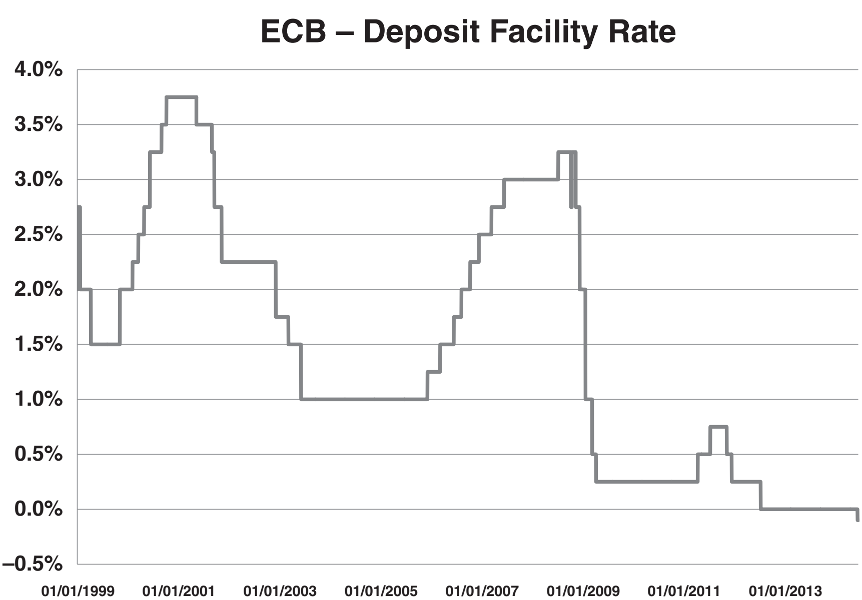

FIGURE 1.36 Evolution of the rate paid by the ECB on overnight deposits
Source: European Central Bank

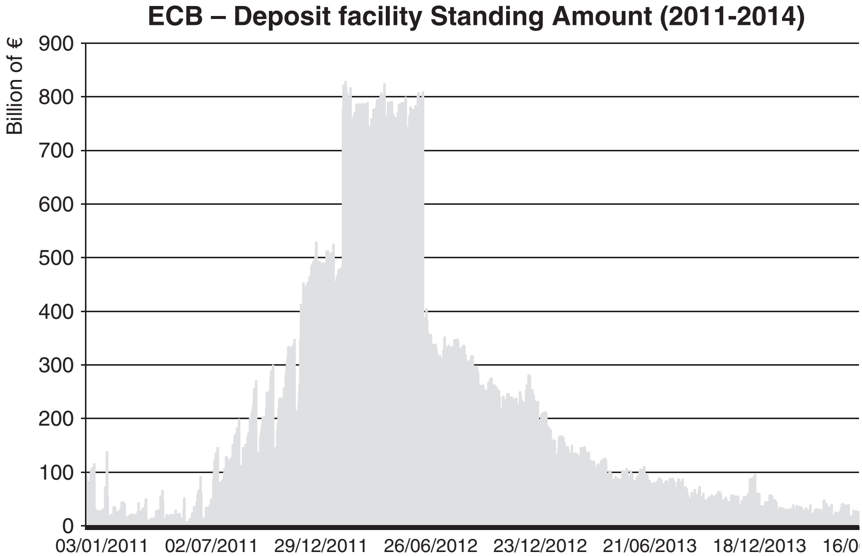

FIGURE 1.37 Amount of overnight deposits at the European Central Bank
Source: European Central Bank

Only minimal flows reach the markets, marginally influencing the performance of European government bonds. The facts then demonstrated that the measure didn't in any way stimulate an increase in loans destined for productive activities.

Figure 1.39 gives us an overview, showing us how the total of deposits at the ECB (overnight and standard) have changed very little after the decision of the ECB to clear the remuneration of the deposits and the outflows from the Central Bank were actually very modest. Cash held in treasury

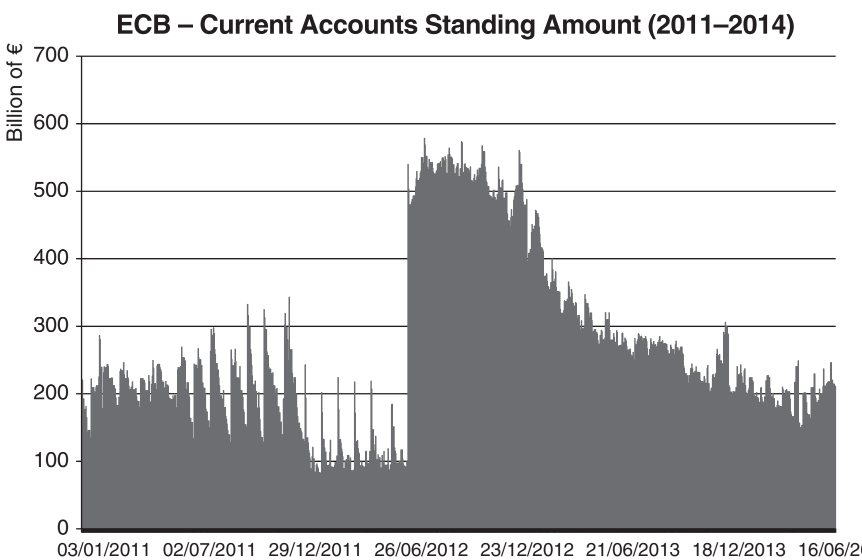

FIGURE 1.38 Amount of standard cash deposits at the European Central Bank
Source: European Central Bank

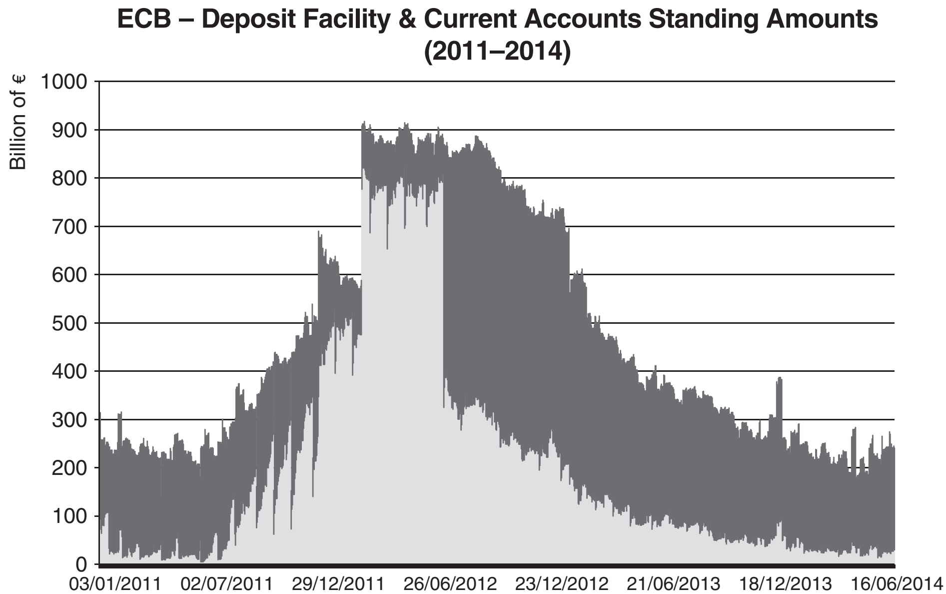

FIGURE 1.39 Total amount of cash deposits (standard and overnight) at the European Central Bank
Source: European Central Bank

accounts and deposits decreased gradually during 2013 and 2014, principally for the use of funds in the purchase of government bonds and to start the LTRO repayments from January 2013.

What can be inferred from the dynamics of these accounts?

A partial explanation is this: in the presence of a deep recession, most of the possible investments in the stock markets or in the lending to the real economy simply is not profitable enough (bankable) for the banking system; if we expect a further reduction in the values of financial assets in circulation, to purchase them to then register a loss in the financial accounts is not a rational strategy for the banks; in other words it is as though the banks should incur a cost and not make a profit from investing and therefore they decide to maintain their available resources on standby.

Further to this, part of the liquidity provided through the LTROs has been used to buy government bonds of countries in financial difficulty, given the high monetary returns. This fairly standard mechanism in the mode of operation of the European financial system has shown itself to be dysfunctional during the period of the crisis, and led to a strong interconnection between financing difficulties of governments and the banks' liquidity stress.

A specific study will be dedicated to this issue later.

Point (4) is not discussed much in the traditional channels of disclosure because it is highly technical, but it is the basis of the understanding of the reinforcing factors of the current crisis. In simple terms, even refinancing operations at the ECB are collateralised and require the presence of a financial asset in collateral. The Central Bank can change their accepting conditions of the type of collateral (the so-called collateral eligibility), making it more tolerant of activities of poor quality (and of higher risk), and can in the same way change the valuation criteria of the collateral, in a similar way to discrimination by the market.

Before 2008, the policy of discrimination of the ECB was very bland and aimed in an undifferentiated way at financial assets at higher risk, with a rating lower than A on all the scales of the major agencies; the market basically accepted the policy dictated by the Central Bank and there were no distortions induced by different treatment compared to that of the interbank market.

Since 2008, the ECB has actively started to intervene in this channel, changing the criteria for eligibility of collateral and the "haircuts" on the value of collateral several times, in order to facilitate the refinancing of banks. As we have explained, even the market started its own policy of discrimination, but this time independent to that of the Central Bank. This provoked distortions in the interbank market, generating undue advantageous positions in some cases and exacerbating the difficulties of finance in others.

We will look closer at this argument too in the following chapters dedicated to the "pathological" functioning of the Eurozone financial system.

1.5 RECOGNITION AND MANAGEMENT OF THE SOVEREIGN CREDIT RISK

In § 1.2 we introduced the concept of the sovereign credit risk and investigated its relationship with the size of the public debt (especially when compared to the GDP) and with the role of the inflation.

From an empirical standpoint, the sovereign credit risk is far more than a theoretical possibility. A dispassionate study of economic history teaches us that sovereign states can fail, and they fail at regular time intervals. And it does not only refer to marginal governments and underdeveloped economies: the default events of sovereign states are an event not unusual even for Europe.

As an example, consider that in its 180 years of life from the declaration of independence, Greece has declared default on its sovereign debt five times. In 1932, at the height of the Great Depression, 50% of the world's governments resorted to practices of selective default or invasive restructuring of debt.

As we have learned to notice, the level of interest rates paid on government debt is a good approximation of the perceived credit risk of an issuer. For sovereign states, in reality, this is not entirely correct: in fact we know that, at worst, a government in financial difficulty that has the possibility of autonomously creating a monetary base will monetise at least partially its debt by imposing its own Central Bank to buy government bonds by printing money. Obviously, this cannot be an indiscriminate and systematic practice, given that traders will automatically adjust their devaluation expectations by raising the inflation rate to the roof, but it works for emergencies.

In this "classic" context, the level of interest rates of government bonds is more a measure of the rate of devaluation of the currency than the risk of insolvency of the nation.

Obviously, the question changes in the Eurozone area, and becomes very similar to the *standard* case described in the first section. In fact, the ECB is in an independent and supranational institution that by statute cannot monetise the debts of member countries; as a consequence, if a state tends to pay more, the reason behind this is that the market is sensing an increased risk in insolvency.

So to summarise, if we do not know *a priori* whether a sovereign state is really free to monetise its debt and print currency, by simply looking at the interest rates that the government pays on the debt, we are not able to properly assess the credit risk. This is because the interest rate paid by the bond is a compensation given to the investor for the support of more risks, all connected to the material possession of the bond, also including that of the devaluation of the currency in question.

This observation almost automatically suggests the solution to this problem of measurement: in fact, an indicator of credit risk that is not tied to the material possession of the bond, such as a CDS, should properly assess the real risk associated with the issuer. Let's check if this is true by looking at some examples.

1.5.1 The Credit Default Swap on Sovereign Debt

Figure 1.40 gives us the value of the CDS spread of the USA, measured in June 2012 (a rather delicate moment in history where the CDSs of main countries floated near the maximum). Let's remember that by buying a CDS, it allows us to be insured against a default of the US government in exchange for the deposit of a periodic premium, represented by its CDS spread. The CDS spread is measured in basis points (bps): for example, if I read that the CDS quotes 100 bps this means that I have to pay a total premium equal to 1% of the insured value.

So to protect yourself in five years' time against the default of the US costs less than 0.5% of the insured value, which is only a reference value because it is not necessary to be in possession of the bond

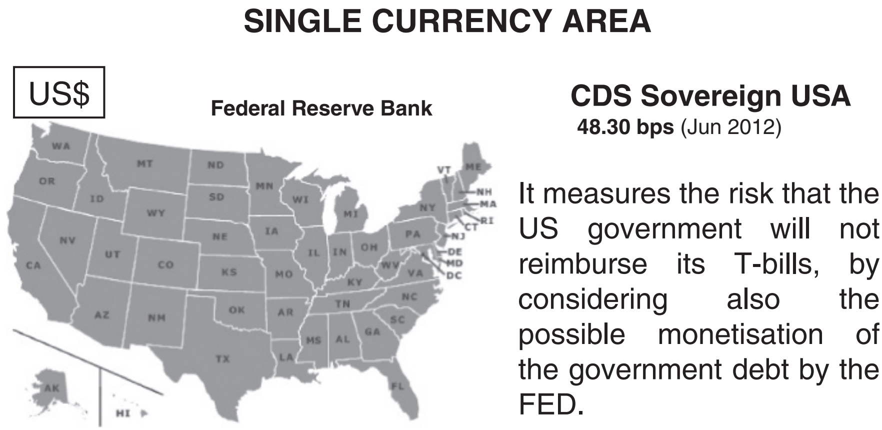

FIGURE 1.40 Market quote of the US sovereign CDS in June 2012
Source: Bloomberg

to purchase insurance. At the same time we know that the USA has the possibility to monetise the debt because the statute of the FED does not rule it out. In other words, the value of the CDS spread is very low because the market is conscious that the USA will make use of the monetary lever well before getting into difficulty in terms of fiscal sustainability.

However, the various states which form part of the US federation, though being able to issue debts, cannot automatically be covered by the federal government. According to the line of reasoning so far, we thus expect premiums that have to be paid, represented by the CDS spreads, to be higher on average. That is: to insure against the risk of default of a state of the US federation costs more on average because the risk

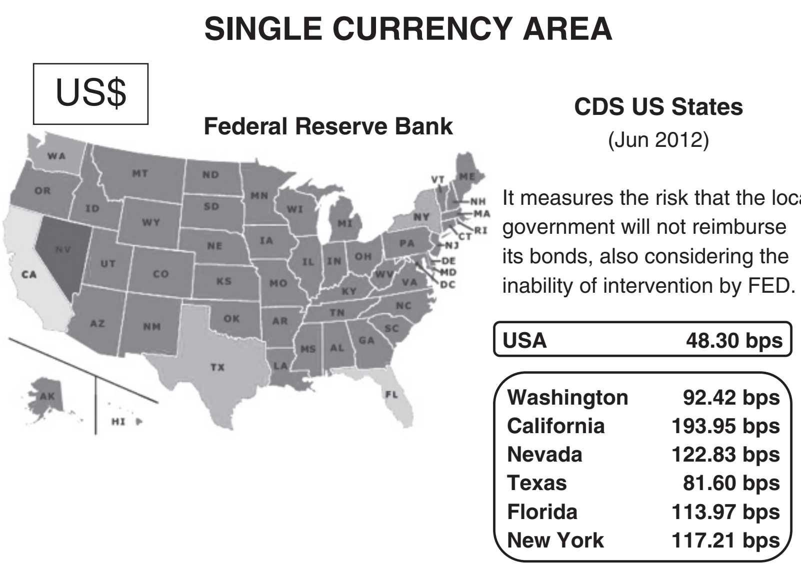

FIGURE 1.41 Market quotes of the CDSs of the individual states of the US federation in June 2012

of that state not being able to honour its own debts is higher compared to that of the federal government, given the impossibility of printing money independently. Let's see if Figure 1.41 supports our theory.

The results of the analysis are positive: in fact, the individual states of the American federation, which do not have the possibility of monetary seigniorage, present insurance premiums against the default much higher than the federal government (for California it climbs up to 2% of the insured value).

Now let's move to Europe and analyse the level of CDS spreads for the main countries of the Eurozone and countries belonging to the European Union which decided not to join the single currency, such as the United Kingdom (see Figures 1.42 and 1.43).

Even the European figures seem to confirm that to try to insure against the risk of default of a sovereign state that has adopted the Euro (and has thus given up monetary policy) is very expensive, even if the state in question is reasonably solid, such as France.

To "protect ourselves" from a possible default of France in June 2012 we have to pay nearly 2%, while only slightly more than the 1.3% you pay to buy protection from the Czech Republic, which has an economy infinitely less robust and competitive compared to that of the French. Yet the interest rates paid by France are very low and in some cases verge on zero!

An additional complicating factor to take into account is the currency of the contract settlement of CDS. In theory, the CDS can be settled in any currency: it is possible to sign a CDS that insures against a default of Italy, indifferently in Euros, dollars, or in yen, and in the same way a CDS for the United States is negotiable in dollars, Euros or yen. However, rationally it is to be expected that if a state ends in default, its reference currency will also be under severe stress, such as a possible sharp devaluation (if the government holds the monetary leverage and decides to monetise the debt to the extreme) or even a possible disappearance (like in the case of the European nations). This risk is also known as a settlement risk, or *convertibility risk*. As a result, it is not surprising to discover that the most frequently traded CDSs are those which settle in different currencies than that of the state which could go into default. Moreover, the CDSs denominated in foreign currency are more costly (i.e. a higher premium

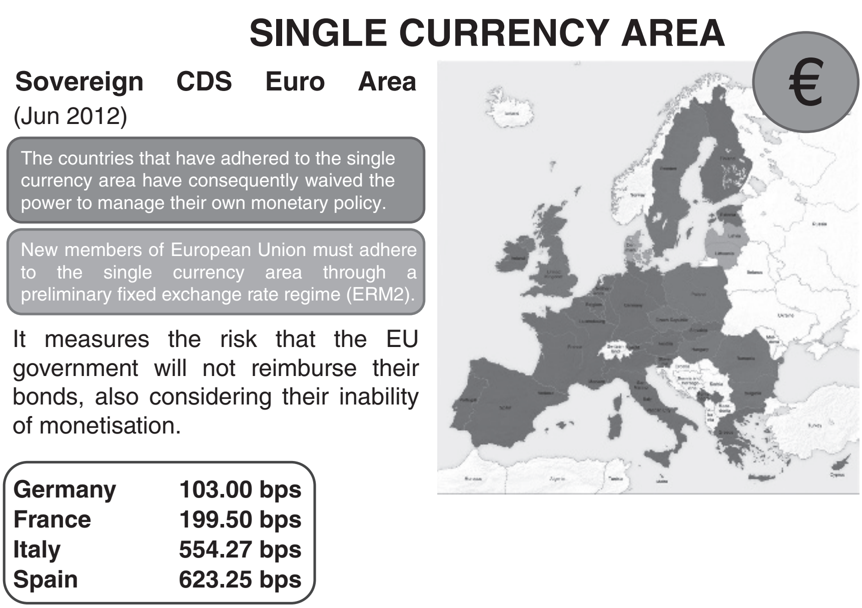

FIGURE 1.42 Market quote of the CDSs of the individual states of the Eurozone in June 2012
Source: Bloomberg

SINGLE CURRENCY AREA

Sovereign CDS Euro Area
(Jun2012)

Some countries of the European Union have decided not to adhere to the single currency area, hence to preserve the power to manage their own monetary policy.

It measures the risk that the EU government will not reimburse its T-bills, also considering the possible monetization of the government debt by their central banks.

Sweden	**62.53 bps**
UK	**72.50 bps**
Czech Republic	**133.33 bps**
Poland	**222.25 bps**

FIGURE 1.43 Market quote of the CDSs of the European states that do not adhere to the Euro in June 2012
Source: Bloomberg

has to be paid) since they can give full protection against the convertibility risk. Let's take a look to Figures 1.44 and 1.45 for a summary of this concepts.

The differences between the premia paid on the Dollar-denominated and Euro-denominated contracts is therefore a positive quantity, known in technical jargon as *quanto spread* (see Figure 1.46).

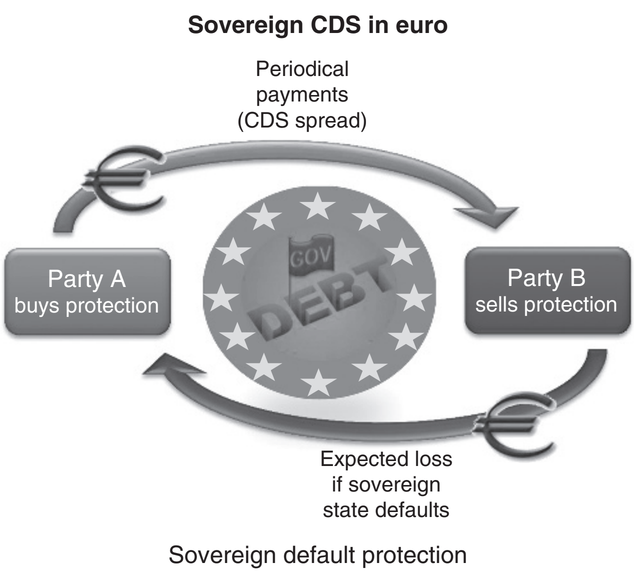

FIGURE 1.44 Definition of a sovereign CDS denominated in Euro

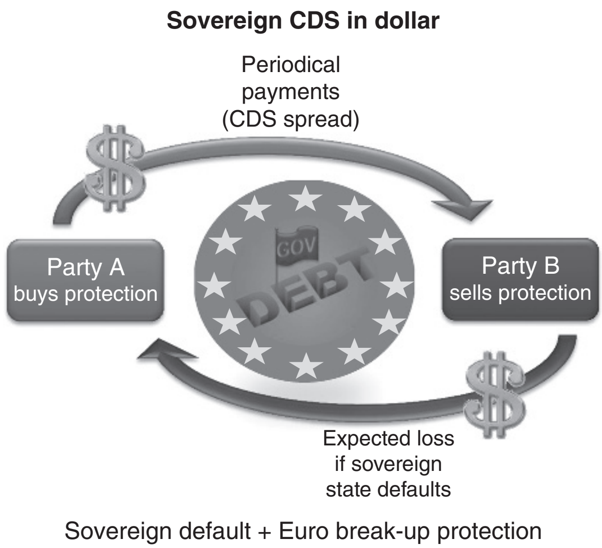

FIGURE 1.45 Definition of a sovereign CDS denominated in Dollars

This quantity embeds information that is strictly related to the convertibility risk, i.e. it is a metric able to track Eurozone break-up risk, as an EU country close to default would consider a return to its national currency, along with a forced debt restructuring and a competitive devaluation.

At the present time, there are significant trades only for the CDSs on the United States and settled in Euros, and for the CDSs on the European states settled in dollars and yen. Other contracts theoretically possible (i.e. CDS on the USA settled in dollars and European states settled in Euros) since 2010 have been more expensive and much less negotiated, which is likely to be due to the increase of perceived risk of sovereign credit. During periods of increased financial stress for the single currency, even a suspension of trading CDSs in Euros has occurred. The topic will be addressed in detail in Chapter 6 dedicated to assessing the risk of the break-up of the Euro.

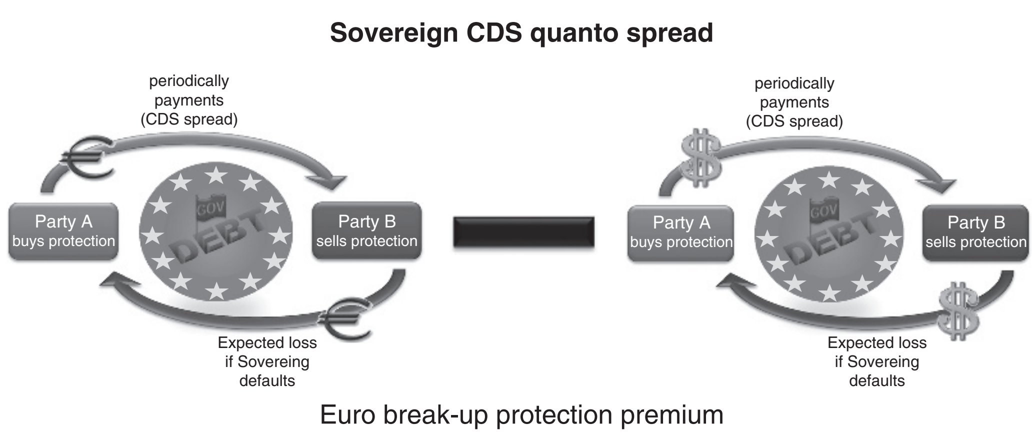

FIGURE 1.46 Definition of Dollar/Euro CDS *quanto spread*

The relationship between yields on sovereign bonds and CDS spread levels is therefore more complex than it seems and deserves to be studied carefully. We will dedicate the entire next section to study the details.

1.5.2 The Concept of Basis and the Relations of Arbitrage

Let us understand the substantial differences between owning a government bond and having sold a CDS to protect against the risk of default of the issuing state. In both cases we are surely exposed to the eventuality that the state is insolvent during the term of the contract, risking the loss of a good portion of the notional value of the bond, whether in our control or not. Furthermore, in both cases we perceive a stream of money coming in, represented on one side by the bond's coupons and on the other side by the premium of the CDS.

Can these two streams of money, or by extension the rate of return of the bond and the CDS spread, be directly compared? In reality, no.

The two operations are not in fact financially equivalent. Let's look at an example: Mr Smith, the subject of our experiment, has no money in his pocket. To be able to come into possession of a bond, Mr Smith must borrow a sum of money equal to the nominal value (the usual €100); obviously he will pay a borrowing interest rate on this figure. We call this cost to start the operation "cost of funding".

In order to sell a CDS, Mr Smith instead does not have to ask to borrow anything, a signature on a contract is enough and he is in the position in which he can begin to perceive the premiums secured by the counterpart.

So in the first case, the coupons of the bond have to be high enough to compensate for the cost of the funding, as well as providing an appropriate return. For this reason the yield of a government bond is usually (not always) higher than the corresponding CDS spread.

A fair comparison can therefore be made between the CDS spread on one side, and the difference between the bond yield and the cost of funding on the other side. For simplicity's sake, Mr Smith

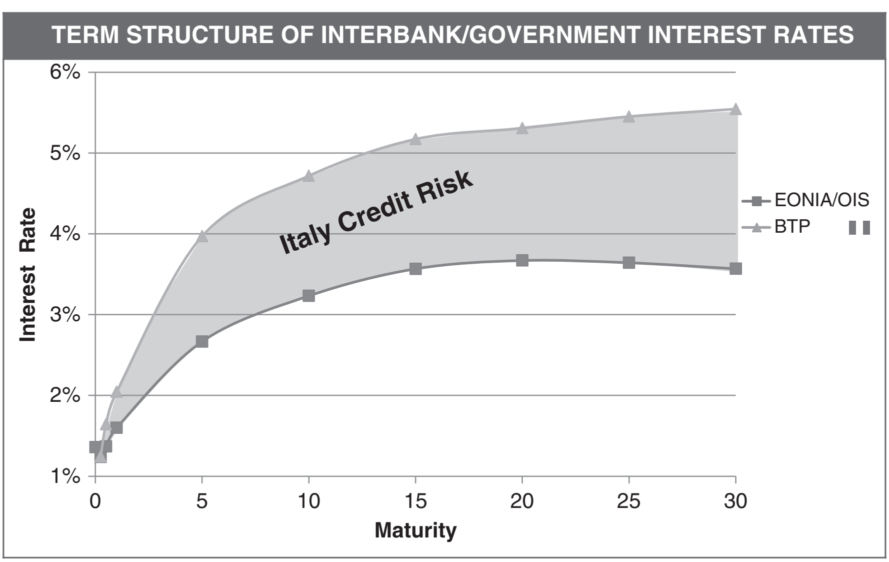

FIGURE 1.47 Representation of the Bond spread on an Italian government bond (BTP)
Source: Bloomberg

borrows the risk-free interbank interest rate that we learned about in § 1.3 as an OIS rate. From now on we will call this difference *Bond spread*.

Figure 1.47 puts the yield curve of the BTP and the curve representative of the OIS rate on the same graph, for maturities ranging from very short-term up to 30 years. The shaded area shows the distance between the yields of the BTP and the OIS rate for each maturity, which is the Bond spread.

This contrast between Bond spreads and CDS spreads is very interesting as it is as though we are comparing two identical financial products. In fact, in the first case, paying the cost of funding is as if I came into the possession of, through a zero-interest loan, a bond with a coupon equal to the CDS spread. Basically, I have just described the substance of the CDS contract; the only difference is that in one case I have the ownership of the bond, in the other not, but the cash flows received are the same.

Now, if I buy two identical products, which are exposed to the same type of risk and perform the same function, it is reasonable to expect that their prices will be identical. This is because, if it wasn't like this, Mr Smith could embark on a series of financial transactions for the purchase and sale of these products in order to make a risk-free profit. In these cases we speak of arbitrage transactions.

Of course it could be presumed that Mr Smith does not have the technical or financial expertise to devise such a financial strategy, but on the market there are full-time professionals dedicated to these strategies, called arbitrageurs. They look to take advantage of every little opportunity they can to make a profit without taking on risks whatsoever. As a result, it is widely accepted that on the market it is very difficult to run into comfortable situations where simple buying and selling can lead to a significant gain without risking anything: it is assumed that this opportunity has already been exploited by our handful of arbitrageurs.

This reasonable assumption shared by the market ensures that identical financial products, beyond the label, have identical prices, known as absence of arbitrage. Figure 1.48 summarises the reasoning so far: if it is assumed that all occasions of arbitrage have been widely exploited by traders, on the market a substantial equality between the CDS spread and the Bond spread on the corresponding government bonds has to be recognised.

Obviously, we are not satisfied with this *sui generis* explanation and we try to understand in detail how a good arbitrageur could devise the purchase and sale of government bonds and corresponding CDS to make a risk-free profit.

To get to the heart of the matter, we still need a simple concept: the basis.

The basis is simply the difference between CDS spread and Bond spread. Therefore, if we are in the absence of the arbitrage, the basis must be identically equal to 0 (see Figure 1.49).

Instinctively, a basis different from 0 is an indicator of the possible presence of arbitrage.

The reader therefore imagines being an arbitrageur in front of his screen monitoring in real time the values of the basis, for all the Eurozone countries. He verifies that the value of the basis for Italy is positive in this moment, that is, that the value of the CDS spread is greater than the value of the BTP Bond spread. There is definitely a gain. What does he do?

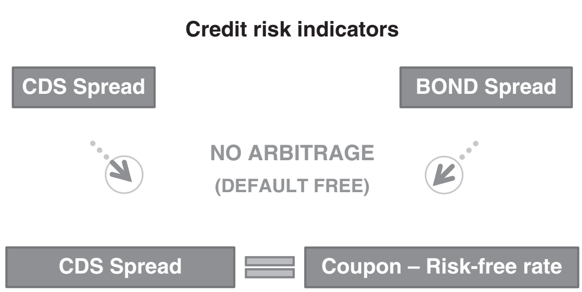

FIGURE 1.48 Relation between CDS spread and Bond spread in absence of arbitrage
Source: Bloomberg

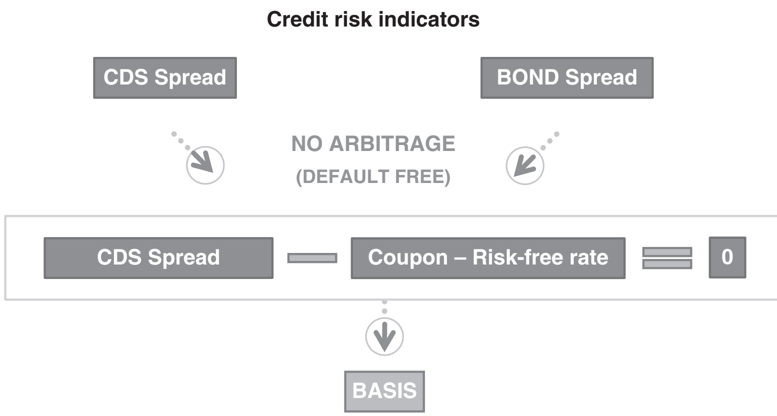

FIGURE 1.49 The basis in absence of arbitrage

It's easy to say: first of all, he immediately sells a CDS contract on Italy on the market (it's only a signature on the contract, it doesn't cost anything). Now, however, it is exposed to the risk of default of Italy. Consequently, he goes on the interbank market and takes a loan with a Repo contract (see § 1.3) for a BTP, that sells immediately on the same market. The resulting figure is what he needs to liquidate in the case of default by the buyer of the CDS; however, if Italy goes into default, the BTPs will be worth very little, so he will be able to rake the bond from the market at a low cost and return it back to the bank that lent it. So if there is default, he doesn't risk anything and earns the premiums on the CDS contract sold.

And if there is no default? Much better: in the meantime you can make the most of the premiums of the CDS spread and eventually buy the BTP back and return it to the lending bank. Without risk.

Figure 1.50 summarises the operations required by the positive basis arbitrage strategy.

Opposite case: the value of the basis is negative, that is the value of the CDS spread is less than the value of the BTP Bond spread. What can be done to make a gain?

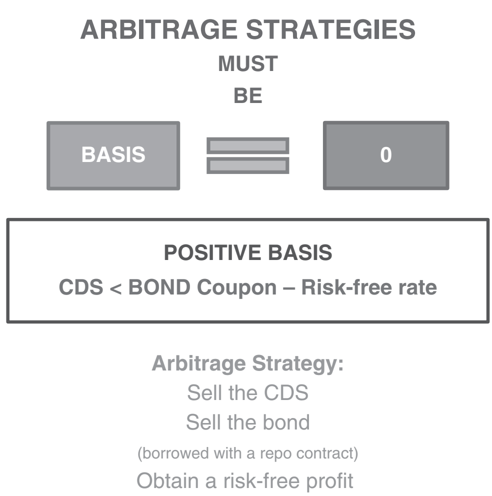

FIGURE 1.50 Positive basis arbitrage strategy

The strategy is the opposite: the arbitrageur works on the interbank market and borrows a sum, then uses this to buy both the BTP and the CDS.

If Italy goes into default, the arbitrageur is insured by the purchase of the CDS, so will not lose anything, and at the maturity of the loan can easily pay back the sum borrowed. In the meantime, cashing the coupons of the BTP pays the premiums of the CDS and the positive difference can be kept in his pocket. If Italy doesn't go into default there are even less problems, seeing as the maturity of the BTP returns the capital invested with which the arbitrageur repays the sum taken as a loan, after having cashed in all the positive differences between the BTP Bond spread and the CDS spread.

Figure 1.51 summarises the operations required by the negative basis arbitrage strategy.

Instinctively, the negative basis strategy is simpler to implement, seeing as it simply requires an interbank loan and the purchase of financial instruments: simple and convenient. Then the profit can be enjoyed given the extent of the negative basis. In fact, situations of negative basis tend to disappear quickly from the market.

The positive basis strategy is instead very technical and the profits are not quantifiable as clear. If the size of the basis is minimal, it is plausible that there is no interest from the arbitrageurs to set the operation.

Furthermore, the simple fact of holding a bond, especially if of high quality (i.e. low-risk), can also result on different benefits in the funding activities and collateralisation. The bond can in fact be put as collateral at the ECB or on the interbank market to get loans at very competitive rates. All of these factors tend to increase the demand for government loans and consequently reduce the yields, making the basis positive. A contained positive basis should therefore be the norm on the market (see Figure 1.52).

The phenomenon of the slightly positive basis (CDS spread being higher than the Bond spread) is constant over time but only for Germany and France. Different patterns are observed for peripheral countries.

To verify this, Figure 1.53 shows the development of the bases for Germany, France, Italy and Spain during the period from 1 January 2009 to 28 July 2014.

Immediately, you can note how the behaviour of the bases is significantly different for the various nations considered. In particular, the bases of France and Germany seem to demonstrate a low variability over time, while those of Italy and Spain have a much livelier trend. In order to understand the underlying causes of these trends over time, let's add some important events to the graph which characterised the period 2011–2013, and the first half of 2014 (see Figure 1.54).

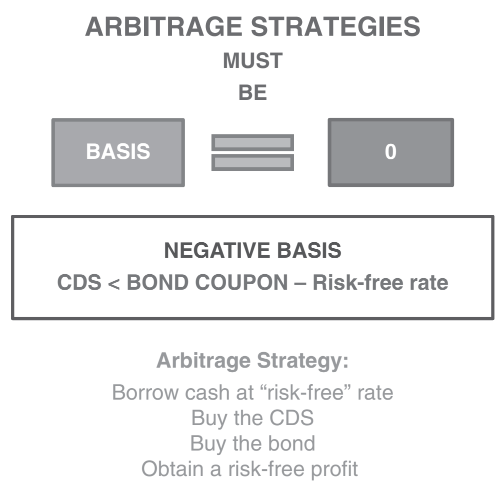

FIGURE 1.51 Negative basis arbitrage strategy

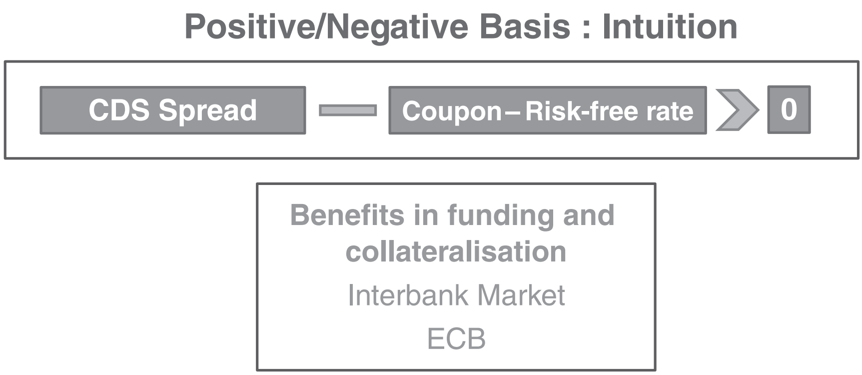

FIGURE 1.52 Underlying reasons of the positive basis phenomenon

Let's try to comment on the graph. At first glance, it is possible to note that during financially stable times the bases tend to be weakly positive; then, in association with traumatic events for the market, they deteriorate towards significantly negative values.

Can we therefore say that the presence of negative bases is a sign of stress for the financial markets? The answer is yes. The triggering of negative values of the basis can be thus explained: if there is tension in the markets due to the sovereign debt crisis of countries perceived as fragile, the yields on government bonds of that country shoot up quicker than the CDSs as a result of the massive sales which reduce the price bonds. In this case, to physically own a bond is no longer so attractive compared to the sale of a CDS contract, because over and above the direct support of a significant risk of default, it entails the presence of non-negligible risks of regulation (until the possible disappearance of the settlement currency – the so-called "break-up of the Euro") and liquidity, given that the bond is sold on volatile markets at prices, which in certain circumstances can become very penalising for the investor.

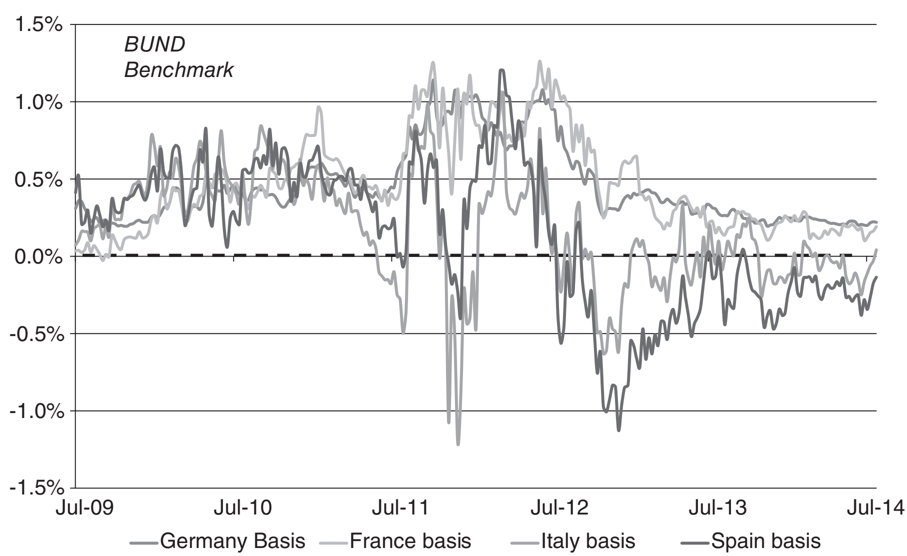

FIGURE 1.53 Development of the bases for Germany, France, Italy and Spain
Source: Calculations on Bloomberg Data

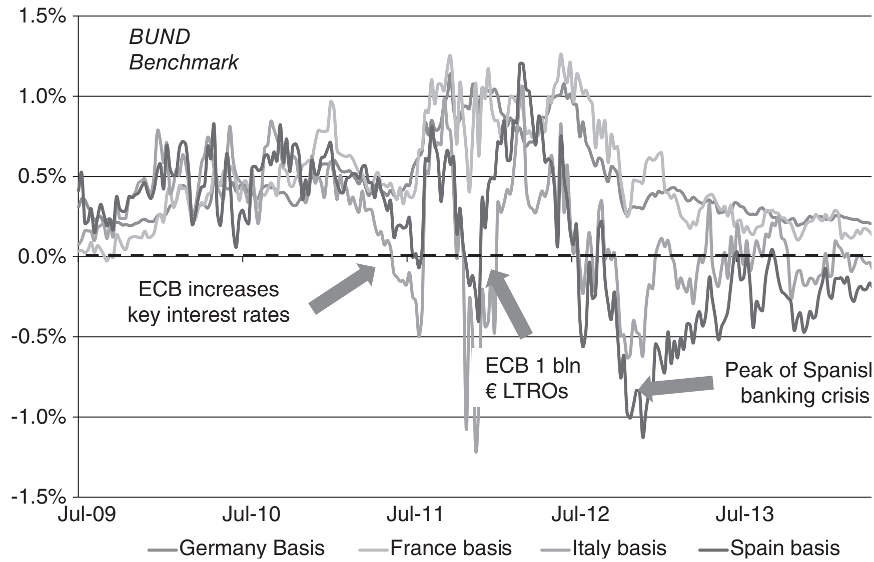

FIGURE 1.54 Development of the bases for Germany, France, Italy and Spain with indications of significant events

This is what happened to Italy during the turbulent period of the change in government in November 2011, and for Spain (with repercussions for Italy) during the deep crises of its banking system during 2012. Figure 1.55 summarises the guidelines for this reasoning.

Aggravating the situation is the fact that during the periods of market stress, it is a lot more difficult and expensive to access interbank funding: for the arbitrageurs it is therefore a lot more complicated to implement arbitrage strategies that we have described; as such, the basis tends to persist in the negative zone. It is not by chance that the Spanish basis never firmly returned in positive territory but remained slightly negative until July 2014, signalling a banking system under pressure. From the graph it is possible to appreciate how, during the moment in which the ECB flooded the market with huge loans at low interest rates (i.e. the LTRO), the negative bases disappeared in a few weeks, highlighting

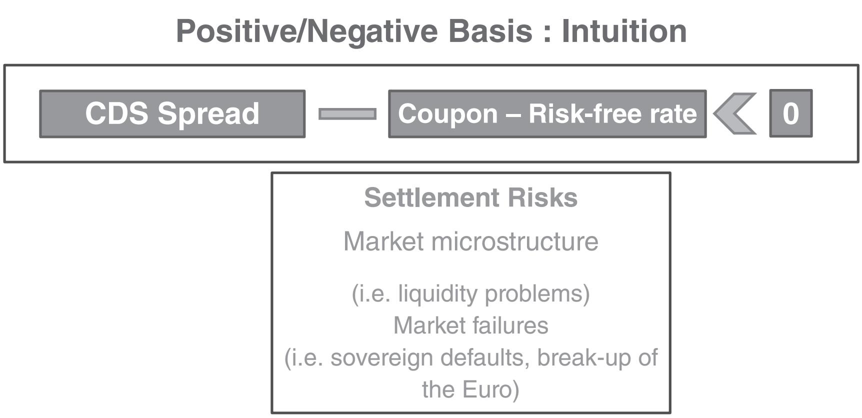

FIGURE 1.55 Underlying reasons for the negative basis phenomenon

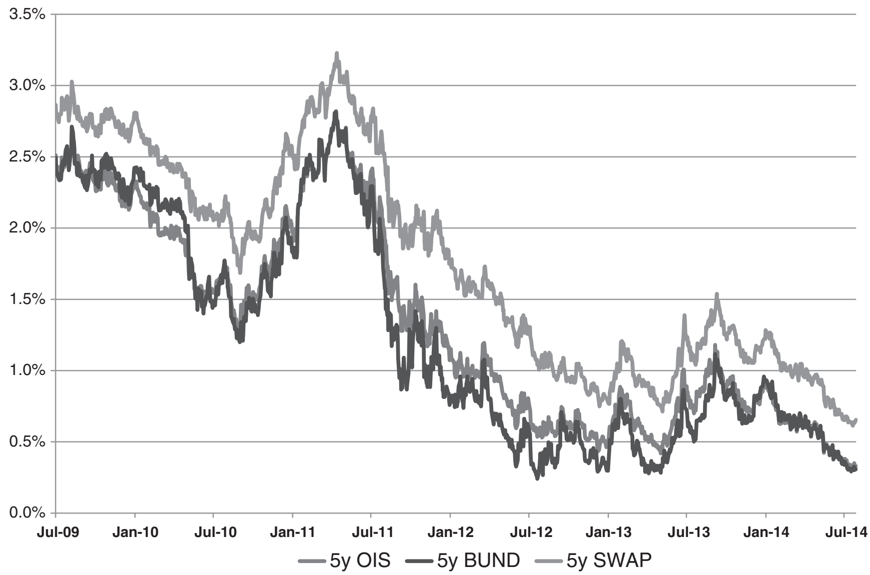

FIGURE 1.56 Evolution of the 5-year OIS and SWAP and yield on the 5-year Bund: period 2000–2014
Source: Bloomberg

that the traders had temporarily found the means to exploit arbitrage opportunities induced by the negative basis.

1.5.3 The Cash Synthetic Basis

Now let's try to point out some operational aspects of our theory. Arbitrageurs on the market must build their own strategies in a very quick time, finding all the necessary tools in a matter of seconds; from this point of view, contracts based on the OIS rate are not very attractive, because it is often difficult to find the kind of maturity and the amount necessary. Pragmatically, operators use, as a first approximation of the OIS benchmark, the government bond of the Euro area which has the yield performance closest to that of the risk-free rate: the *Bund*. Figure 1.56 confirms that indeed *Bund* and OIS have very similar yields, especially when compared to the performance of the classic interest rate swap on interbank loans.

Obviously, for Germany, if we replace the OIS with the Bund, for simple arithmetic, the basis reduces the CDS spread and does not provide much additional information

We are approaching these aspects a bit technically in order to highlight, albeit from a theoretical point of view, that the analysis of the dynamics of the basis is very important, and how, in the operational practice of markets, it is often reduced to using simpler indicators, that may be rougher but are equally effective. In this case the risk-free interest rate in question, the OIS rate, generates operational problems. In addition, it can easily be noted from the graph how at the current state, the effect of this rate is very low since it is reaching values very close to zero.

Therefore we wonder if it is possible to devise a simpler indicator, perhaps approximate, which nonetheless provides the same type of information to the market participants, and that could be used for every country, Germany included.

With this aim in mind, let's define the cash synthetic basis (see Figure 1.57).

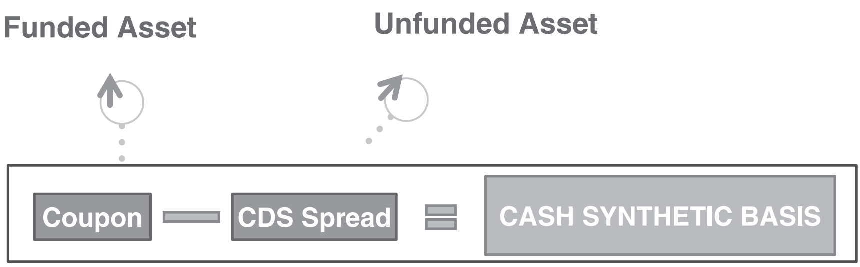

FIGURE 1.57 Definition of the cash synthetic basis

As can be noted, compared to the basis, we have resolved the problem of the risk-free interest rate in a draconian way, eliminating it. Obviously, the concept that the rate of yields on bonds compensates not only the credit risk but also the cost of funding remains, as previously argued. Figure 1.58 summarises these considerations for our benefit.

How does this new indicator that we have built behave, compared to the classic one of the basis?

In the case of a negative basis, the yield of the government bond is definitely higher compared to the CDS spread; consequently the cash synthetic basis is always positive and of entities more significant compared to the magnitude of the basis. So we can say that high positive values of the cash synthetic basis can be associated with market phases at negative basis, that is, in conditions of market stress (see Figure 1.59).

Let's check with a historical graph if the relationship between the cash synthetic basis (positive) and basis (negative) that we have identified supports this. Figure 1.60 represents the trend of the basis during the period of January 2011 – July 2014, and the cash synthetic basis of Italy on the same graph, with the evidence of significant financial events that may have influenced the performance of these indicators. It is noticeable that until June 2011, the basis remained weakly positive, while the cash synthetic basis was strongly positive, at its highest around April 2011. From August 2011, with the intensification of the sovereign debt crisis, the basis of Italy crumbles, until reaching a negative value during November 2011, to then settle on weakly positive values, but with a significantly higher variability. Since the launch of the OMT in September 2012, the variability of the basis tends to decrease, while in absolute terms it seems to settle around neutrality. This phenomenon is due to the substantial reduction of the perceived risk on peripheral bonds, which are now protected by the OMT from speculative phenomena. The cash synthetic basis has had sudden reductions corresponding to the most significant

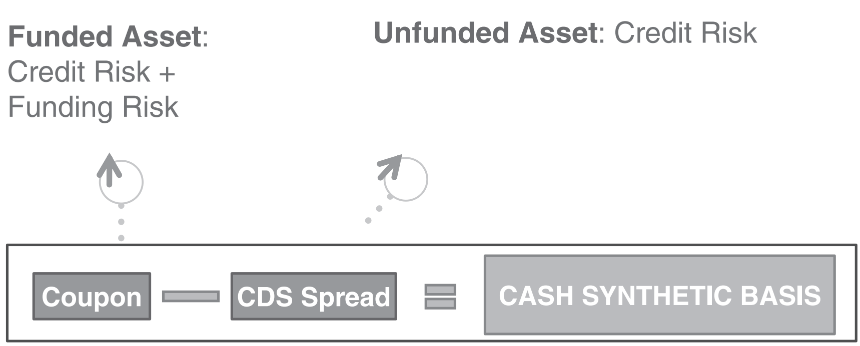

FIGURE 1.58 Types of risks considered in the definition of the cash synthetic basis

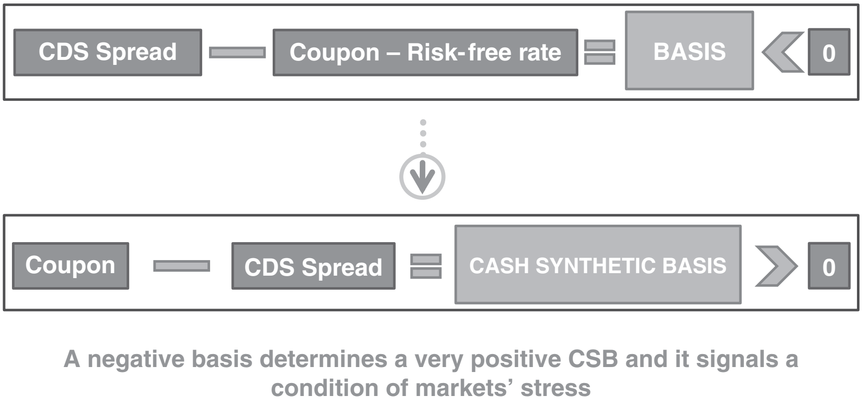

FIGURE 1.59 Relation between negative basis and cash synthetic basis

events (increase in interest rates, LTRO, the crisis of the Spanish banking system), to then move into the post-OMT phase on weakly positive values.

By trial and error, we can thus confirm the connection between our two quantities and say that a very positive cash synthetic basis can be an indicator of conditions of market stress.

Let's examine what happens in the case of positive basis. In this case the CDS spread is often (but not always) higher in yields than government bonds. As a result, the cash synthetic basis ends to assume negative values. Now, it is interesting to ask what is happening from the financial point of view of when the CDS spread is systematically always higher than the yields of the bonds. This is the typical case for Germany, but the phenomenon has been observed on and off even on French and Danish government

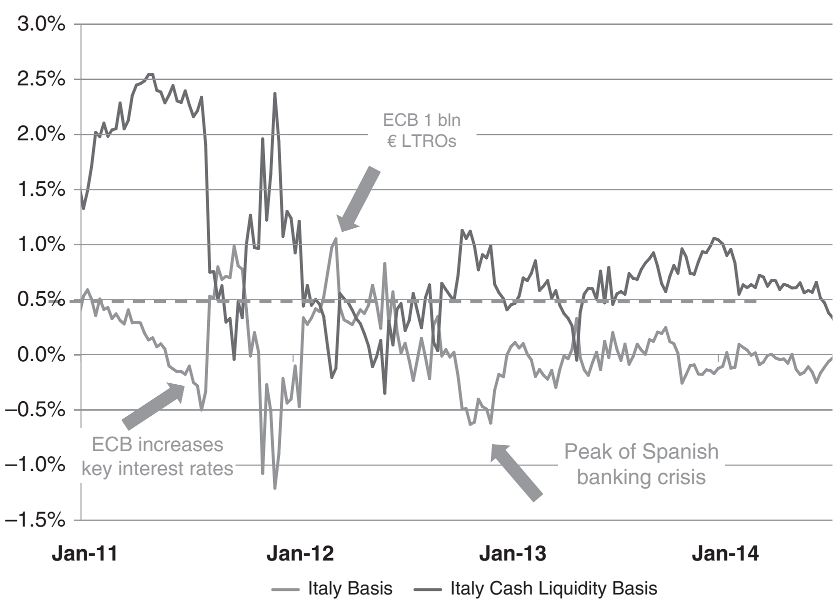

FIGURE 1.60 Trend of the basis and of the cash synthetic basis for Italy
Source: Calculations on Bloomberg Data

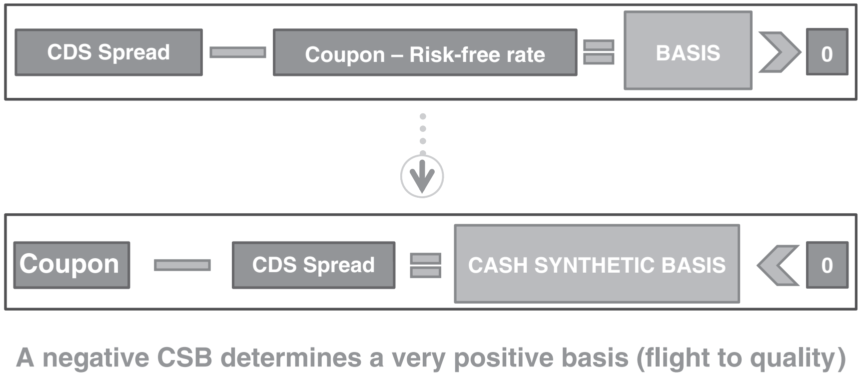

FIGURE 1.61 Relation between positive basis and cash synthetic basis

bonds. In essence, there is a strong demand for such bonds to keep returns very low; this demand can be linked to the phenomena of so-called *flight to quality*, that is, the search of low-risk loans in which to hold cash safe during times of market turmoil, but also for the necessity of high-quality collateral to support the operations in the European interbank market.

Figure 1.61 summarises this reasoning.

Let's carry out the usual empirical test by studying the performance of the cash synthetic basis of the basis relative to Germany. Figure 1.62 represents the performance of the basis during the period January 2011 – July 2014 and the cash synthetic basis of Germany on the same graph, with the evidence of significant financial events that may have influenced the performance of these indicators. It is noticeable that until August 2011, the basis remains weakly positive, while the cash synthetic basis

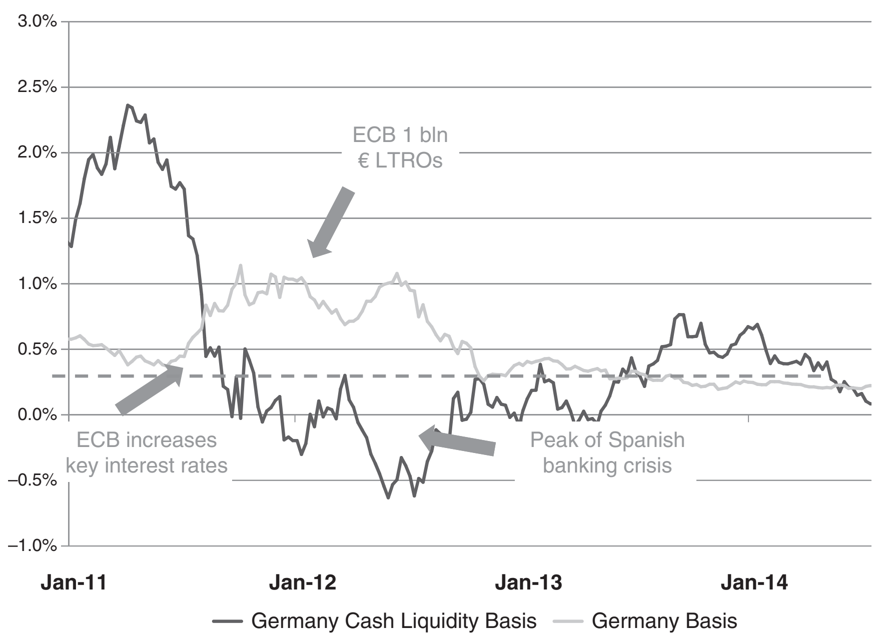

FIGURE 1.62 Trend of the basis and of the cash synthetic basis for Germany
Source: Calculations on Bloomberg Data

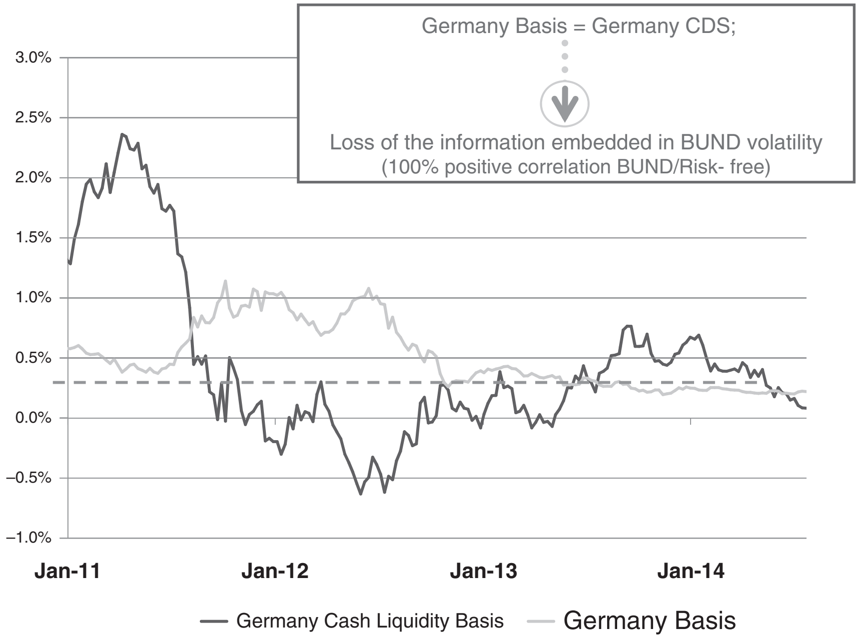

FIGURE 1.63 Distinctive trait of the Germany basis
Source: Calculations on Bloomberg Data

was strongly positive, at its highest around March 2011. From August 2011, with the intensification of the sovereign debt crisis, the basis of Germany has moderately appreciated, while the cash synthetic basis has significantly declined, until reaching negative values at the peak of the Spanish banking crisis during summer of 2012. The OMT in September 2012 then has a normalising effect on the cash synthetic basis which stays either neutral or weakly positive, with limited variability.

The graph definitely confirms the predictive value of the cash synthetic basis, which assumes negative values at times of high market stress, while the basis seems not to be particularly reactive. This is explained by the fact that in this case, the basis is simply the CDS spread of Germany, and is overlooking the construction of contained information in the performance of the Bund; so it can be said that the simplified indicator in this case works even better compared to the traditional measure of the basis (see Figure 1.63).

With the analysis of the basic concepts of the cash synthetic basis, we have concluded our overview on the building blocks forming the financial system of the Eurozone.

Until now we have studied the various individual elements, i.e. interbank interest rates, monetary policy instruments and addresses, and the indicators of credit risk, giving only some sporadic insights into the interactions between the various components of the system. Now we will prepare to abandon this level of detail of analysis to study the behaviour of the system as a whole, and its architecture in the next chapter.