

Chapter 25

BONDS

Or “rendering what is fixed, volatile, and what is volatile, fixed”

A debt security is a financial instrument representing the borrower’s obligation to the lender from whom he has received funds. This obligation provides for a schedule of cash flows defining the terms of repayment of the funds and the lender’s remuneration in the interval. The remuneration may be fixed during the life of the debt or floating if it is linked to a benchmark or index.

The reader should recognise the basic differences between debt and equity.

- **Debt:**
 - has a remuneration which is independent of the company’s results and is contractually set in advance. Except in some extreme cases (a missed payment, or bankruptcy), the lender will receive the interest due to him regardless of whether the company’s results are excellent, average or poor;
 - always has a repayment date, however far off, that is also set contractually. For the moment, we will set aside the rare case of perpetual debt;
 - is paid off ahead of equity when the company is liquidated and its assets sold off. The proceeds will first be used to pay off creditors, and only when they have been fully repaid will any surplus be paid to shareholders.
- **Equity:**
 - has a remuneration which depends on company earnings. If those earnings are bad, there is no dividend or capital gain;
 - carries no guarantee of repayment at any date, however far into the future. The only “way out” for an equity investor is to sell to another equity investor, who thus takes over ownership;
 - is remunerated last, in the event of bankruptcy, only after the creditors have been paid off. As you know, in most cases, the liquidation of assets is not enough to fully pay off creditors. Shareholders then have no recourse, as the company is no longer solvent and equity is negative!

In other words, shareholders are fully exposed to company risk, as creditors have the first claim on revenue streams generated by operating assets (free cash flow) and only once they have been paid what is owed to them will the rest be paid to shareholders.

In light of the above, it is natural that shareholders alone should have voting rights and thus the right to appoint management. They have a very direct interest in the operating

assets being managed as efficiently as possible, i.e. in having cash flow be as high as possible, so that there is something left over after the creditors have been paid off (interest and principal).

Voting rights are not a fourth difference between debt and equity. Rather, they are the logical continuation of the three differences listed above. **Shareholders come after creditors in their claim on cash flow and are thus exposed to company risk. They therefore have voting rights.**

Hence, the higher the enterprise value, the higher the equity value. As debt is not exposed to company risk (except in the event of bankruptcy), its value will be much less sensitive to variations in enterprise value.

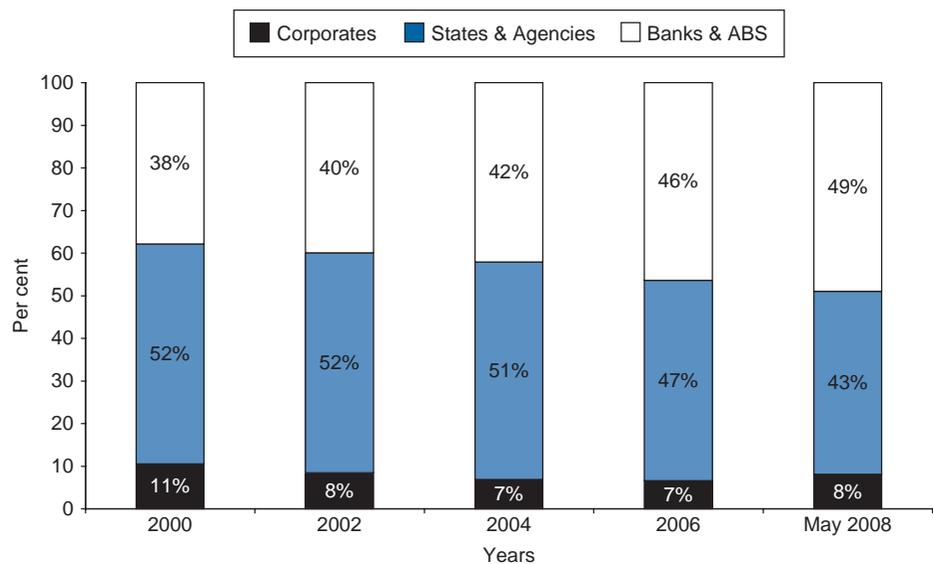
Most debt securities started out as regular loans or credits, but evolved into **bonds** with the development of financial markets and **disintermediation** in the 1960s.

Unlike conventional bank loans, debt securities can be traded on secondary markets (stock exchanges, money markets, mortgage markets and interbank markets). Debt securities are bonds, commercial papers, treasury bills and notes, certificates of deposit and mortgage-backed bonds or mortgage bonds. Furthermore, the current trend is to securitise loans to make them negotiable.

Disintermediation was not the only factor fuelling the growth of bond markets. The increasing difficulty of obtaining bank loans was another, as banks realised that the interest margin on such loans did not offer sufficient return on equity. This pushed companies to turn to bond markets to raise the funds banks had become reluctant to advance.

The Directorate-General for Economic and Financial Affairs of the European Union produces a monthly note on developments in the euro-denominated bond markets (http://ec.europa.eu/economy_finance/publications/publ_page8701_en.htm). This graph shows the recent evolution of this market by the type of issuer:

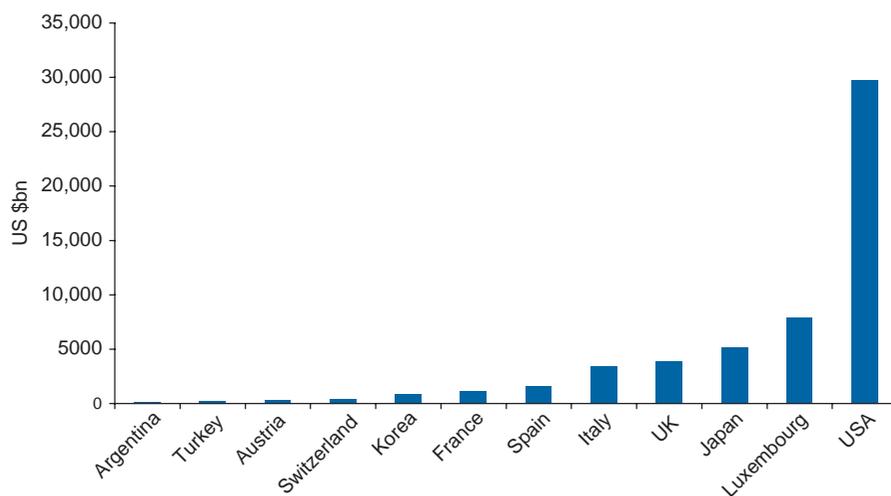
Companies accounted for 8% of euro-denominated bond issues in May 2008.



Source: European Union.

Lastly, investors have welcomed the emergence of corporate bonds offering higher yields than government bonds. Of course, these higher returns came at the cost of higher risks.

The following graph illustrates the market value of bonds listed at the end of 2007.¹



¹ The graph includes only markets with the highest market value for which a breakdown for the typology of issuer (private, public, foreign) was available.

Source: FIBV Annual Stats 2007 (Fixed Income – Value of bonds listed), Eurnext-Nyse, SIFMA.

Many of the explanations and examples offered in this chapter deal with bonds, but they can easily be applied to all kinds of debt instruments. We shall take the example of the Lafarge May 2008 bond issue with the following features.

LAFARGE – 6.125% MAY 2008–MAY 2015 BOND ISSUE

Amount:	€750,000,000
Denomination:	€50,000
Issue price:	99.529% or €49,764.5 per bond, payable in one instalment on the settlement date.
Date of issue:	28 May 2008.
Settlement date:	28 May 2008.
Maturity:	7 years.
Annual coupon:	6.125%, i.e. €3,062.50 per bond payable in one instalment on 28 May of each year, with the first payment on 28 May 2009.
Yield to maturity for the subscriber:	On the settlement date.
Average life:	7 years.
Normal redemption date:	The bonds will be redeemed in full on 28 May 2015 at par value.
Guarantee:	no guaranty.
Further issues (fungibility):	The issuer may, without prior permission from the bondholders, create and issue new bonds with the same features as the present bonds with the exception of the issue price and the first coupon payment date. The present bonds could thus be exchanged with the new bonds.
Rating:	Baa2 (Moody's), BBB (Standard & Poor's)
Listing:	Luxemburg Stock Market.

Section 25.1

BASIC CONCEPTS

1/ THE PRINCIPAL

(a) Nominal or face value

Loans that can be publicly traded are divided into a certain number of units giving the same rights for the same fraction of the debt. This is the nominal, face or par value, which for bonds is generally €1000 but is €50,000 in the Lafarge case.

The nominal value is used to calculate the interest payments. In the simplest cases, it equals the amount of money the issuer received for each bond and that the issuer will repay upon redemption.

(b) Issue price

The issue price is the price at which the bonds are issued, that is, the price investors pay for each bond. *The Lafarge bond was issued on 28 May 2008 at a price of €49,764.50, i.e. 99.529% of its face value.*

Depending on the characteristics of the issue, the issue price may be higher than the face value (issued at a premium), lower than the face value (issued at a discount), or equal to the face value (at par).

(c) Redemption

When a loan is amortised, it is said to be redeemed. In Chapter 17 we looked at the various ways a loan can be repaid:

- redemption at maturity, or on a bullet repayment basis. *This is the case of the Lafarge issue;*
- redemption in equal slices (or series), or constant amortisation;
- redemption in fixed instalments.

Other methods exist, such as determining which bonds are redeemed by lottery. . . there is no end to financial creativity!

A **deferred redemption period** is a grace period, generally at the beginning of the bond's life, during which the issuer does not have to repay the principal.

The terms of the issue may also include provisions for **early redemption** (call options) or retraction (put options). A call option gives the issuer the right to buy back all or part of the issue prior to the maturity date, while a put option allows the bondholder to demand early repayment.

No such options are included in the Lafarge issue.

(d) Maturity of the bond

The life of a bond extends from its issue date to its final redemption date. Where the bond is redeemed in several instalments, the **average maturity** of the bond corresponds to the average of each of the repayment periods.

$$\text{Average maturity} = \text{Average life} = \frac{\sum_{t=1}^N t \times \text{Number of bonds redeemed during year } t}{\text{Total number of shares to be redeemed}}$$

where t is the variable for the year and N the total number of periods.

The Lafarge bonds have a maturity of 7 years.

(e) Guarantees

Repayment of the principal (and interest) on a bond borrowing can be guaranteed by the issuer, the parent company, collaterals, pledges or warranties. Bonds are rarely secured, while commercial paper and certificates of deposit can in theory be secured but in fact never are.

The bonds issued by Lafarge are not guaranteed.

2/ INCOME

(a) Issue date

The issue date is the date on which interest begins to accrue. It may or may not coincide with the **settlement date**, when investors actually pay for the bonds purchased.

Interest on the Lafarge bond begins to accrue on the settlement date.

(b) Interest rate

The coupon or nominal rate is used to calculate the interest (or coupon in the case of a bond) payable to the lenders. Interest is calculated by multiplying the nominal rate with the nominal or par value of the bond.

On the Lafarge issue, the coupon rate is 6.125% and the coupon payment €3062.50.

In addition to coupon payments, investors may also gain an additional remuneration if the issue price is lower than the par value. *On the Lafarge issue, investors paid €49,765.04 for each bond, whereas interest was based on a par value of €50,000 and the bond will be redeemed at €50,000.* In this case, the bond sold at a **discount**.

When the issue price is higher than the par value, the bond is said to sell at a **premium**.

A **redemption premium or discount** arises where the redemption value is higher or lower than the nominal value.

(c) Periodic coupon payments

Coupon payments can be made every year, half-year, quarter, month or even more frequently. On certain borrowings, the interval is even longer, since the total compounded interest earned is paid only upon redemption. Such bonds are called **zero coupon bonds**.

In some cases, the interest is **prepaid**, that is, the company pays the interest at the beginning of the period to which it relates. In general, however, the **accrued** interest is paid at the end of the period to which it relates.

The Lafarge issue pays accrued interest on an annual basis.

Section 25.2

THE YIELD TO MATURITY

The actual return on an investment (or the cost of a loan for the borrower) depends on a number of factors: the difference between the settlement date and the issue date; the issue premium/discount, the redemption premium/discount, the deferred redemption period and the coupon payment interval. As a result, the nominal rate is not very meaningful.

We have seen that the **yield to maturity** (see Chapter 24), cancels out the bond's present net value, that is, the difference between the issue price and the present value of future flows on the bond. **Note that for bonds, the yield to maturity (y) and the internal rate of return are identical.** This yield is calculated on the settlement date when investors pay for their bonds, and is always indicated in the prospectus for bond issues. The yield to maturity takes into account any timing differences between the right to receive income and the actual cash payment.

In the case of the Lafarge bond issue:

$$99.529\% - \left(\sum_{i=1}^7 \frac{6.125\%}{(1+y)^i} + \frac{100\%}{(1+y)^7} \right) = 0 \quad \text{i.e. } y = 6.120\%$$

The yield to maturity, before taxation and intermediaries' fees, represents:

- **for investors**, the rate of return they would receive by holding the bonds until maturity, assuming that the interest payments are reinvested at the same yield to maturity, which is a very strong assumption.
- **for the issuer**, the pre-tax actuarial cost of the loan.

From the point of view of the investor, the bond schedule must take into account intermediation costs and the tax status of the income earned. For the issuer, the gross cost to maturity is higher because of the commissions paid to intermediaries. This increases the actuarial cost of the borrowing. In addition, the issuer pays the intermediaries (**paying agents**) in charge of paying the interest and reimbursing the principal. Lastly, the issuer can deduct the coupon payments from its corporate income tax, thus reducing the actual cost of the loan.

The yield to maturity on a security is the *ex ante* **promised rate** at a moment in time. The lender will obtain this rate if he keeps the security until the maturity *and the security doesn't default*. Thus, the promised rate is not necessarily the rate *actually* realised if the bond is held to maturity. The **realised rate** is the rate of discount that equates all payments actually received by investors, including the final principal payment, with the market price of the security at the time it was purchased. The difference between the two rates is known as the **loss rate** attributable to default. If default probability is a positive number, the **expected yield** on a security will be less than that promised.

1/SPREADS

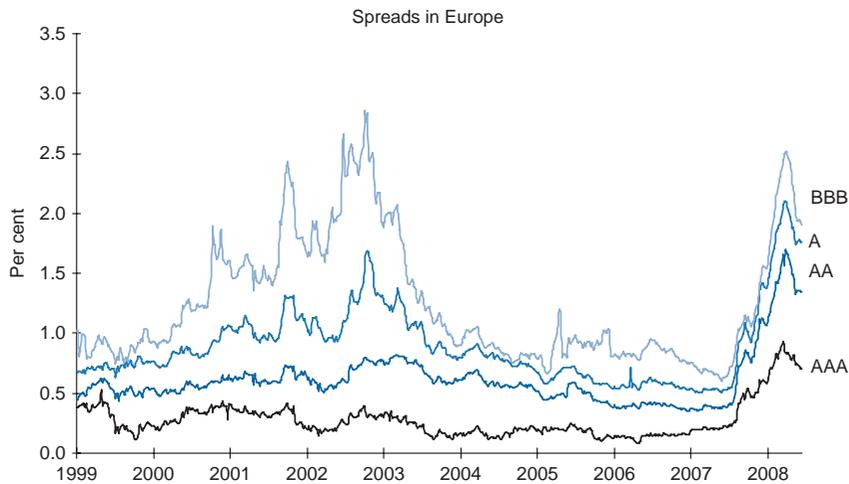
The spread is the difference between the rate of return on a bond and that on a benchmark used by the market. In the euro area, the benchmark can be:

- a short-term rate, the 3- or 6-month Euribor, for variable rate debt;
- the Interest Rate Swap (IRS) rate or government bond yields for long-term debt.

The Lafarge bond was issued with a spread of 206 basis points (2.06%), meaning that Lafarge had to pay 2.06% more than German government bond yields per year to raise funds.

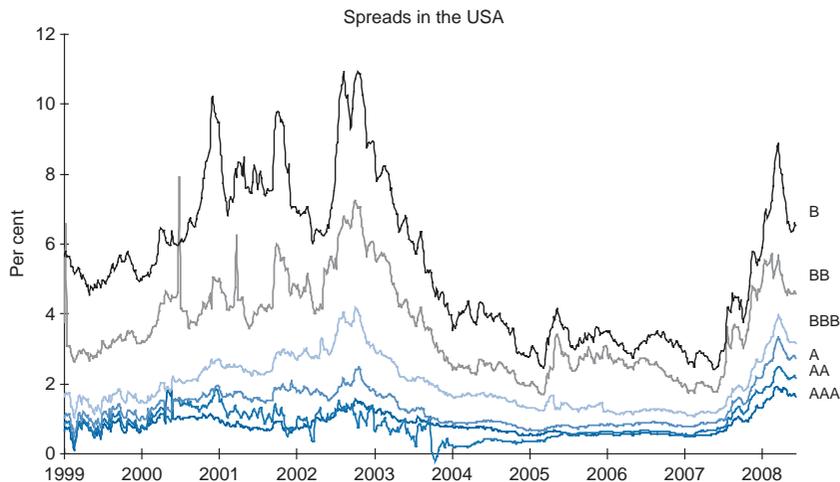
The spread is a key parameter for valuing bonds, particularly at the time of issue. It depends on the perceived credit quality of the issuer and the maturity of the issue, which are reflected in the credit rating and the guarantees given. Spreads are, of course, a relative concept, depending on the bonds being compared. The stronger the creditworthiness of the issuer and the market's appetite for risk, the lower the margin will be.²

² An interesting study on yield spreads in major financial areas is periodically published by the International Monetary Fund and can be freely obtained at www.imf.org.



Source: Datastream.

Spreads tend to widen markedly during a crisis (like in late 2007 and early 2008), both in absolute terms and relative to each other.



Source: Datastream.

Spreads are so important that they have become the key criteria for both issuers and investors when they want to issue, sell or buy bonds.

2/ THE SECONDARY MARKET

Once the subscription period is over, the price at which the bonds were sold (their issue price) becomes a thing of the past. The value of the instrument begins to fluctuate on the secondary market. Consequently, the yield to maturity published in the prospectus applies only at the time of issue; after that, it fluctuates in step with the value of the bond.

Theoretically, changes in the bond's yield to maturity on the secondary market do not directly concern the borrower, since the cost of the debt was fixed when it was contracted.

For the borrower, the yield on the secondary market is merely an **opportunity cost**, that is, the **cost of refunding** for issuing new bonds. It represents the "real" cost of debt, but is not shown in the company accounts where the debt is written at its historical cost, regardless of any fluctuations in its value on the secondary market.

3/ LISTING TECHNIQUES

The price of bonds listed on stock markets is expressed as a percentage of the nominal value. In fact, they are treated as though the nominal value of each bond were €100. Thus, a bond with a nominal value of €50,000 will not be listed at €49,500 but at 99% ($49,500/50,000 \times 100$). Similarly, a bond with a nominal value of €10,000 will be listed at 99%, rather than €9900.

This makes it easier to compare bond prices.

For the comparison to be relevant, the prices must not include the fraction of annual interest already accrued. Otherwise, the price of a bond with a 15% coupon would be 115 just before its coupon payment date and 100 just after. This is why bonds are quoted **net of accrued interest**. Bond tables thus show both the price expressed as a percentage of the nominal value and the fraction of accrued interest, which is also given as a percentage of the nominal value.

The table below indicates that on 12 June 2008, the Lafarge bond traded at 96.782% with an accrued interest of 0.221%. This means that at that date the bond costs €48,501.59, i.e.: $€50,000 \times (96.782\% + 0.221\%)$.

Price	Bond ticker	Gross YTM	Maturity	Maturity date	Duration	Accrued interest	Next coupon payment
96.782%	XSo365901734	6.718%	6.96 years	28/05/15	5.47	5.84	0.221%

Certain debt securities, mainly fixed-rate Treasury notes with annual interest payments, are quoted at their yield to maturity. The two listing methods are rigorously equivalent and only require a simple calculation to switch from one to the other.

By now, you have probably realised that the price of a bond does not reflect its actual cost. A bond trading at 105% may be more or less expensive than a bond trading at 96%. **The yield to maturity is the most important criteria, allowing investors to evaluate various investment opportunities according to the degree of risk they are willing to accept and the length of their investment.** However, it merely offers a temporary estimate of the **promised** return; this may be different from the **expected** return which incorporates the probability of default of the bond.

4/ FURTHER ISSUES AND ASSIMILATION

Having made one bond issue, the same company can later issue other bonds with the same features (time to maturity, coupon rate, coupon payment schedule, redemption price and guarantees, etc.) so that they are interchangeable. This enables the various issues to be grouped as one, for a larger total amount. This offers two advantages:

- administrative expenses are reduced, since there is just one issue;
- more importantly, the bonds are more liquid and therefore more easily traded on the secondary market. Their price is accordingly lower, as investors are willing to accept slightly lower interest rates on securities that are more liquid.

Bonds assimilated are issued with the same features as the bonds with which they are interchangeable. The only difference is in the issue price,³ which is shaped by market conditions that are very likely to have changed since the original issue.

The Lafarge bond provides for further (future fungible) issues.

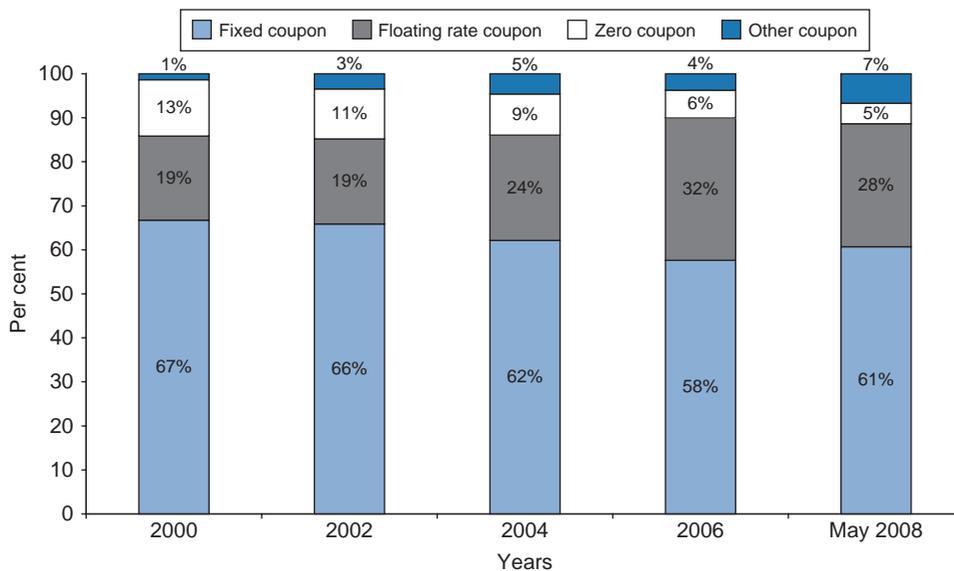
³ In some cases, the first coupon payment is different while the issue price is identical: the bonds only become fungible after the first coupon payment.

Section 25.3

FLOATING-RATE BONDS

So far we have looked only at fixed-income debt securities. The cash flow schedule for these securities is laid down clearly when they are issued, whereas the securities that we will be describing in this section give rise to cash flows that are not totally fixed from the very outset, but follow preset rules.

EURO-DENOMINATED ISSUES BY TYPE OF COUPON



1/THE MECHANICS OF THE COUPON

The coupon of a floating-rate bond is not fixed, but is indexed to an observable market rate, generally a short-term rate, such as a 6-month Euribor. In other words, the coupon rate is periodically reset based on some reference rate plus a spread. When each coupon is presented for payment, its value is calculated as a function of the market rate, based on the formula:

$$\text{Coupon}_t = (\text{Market rate}_t + \text{Spread}) \times \text{Par value}$$

This cancels out the interest rate risk since the issuer of the security is certain of paying interest at exactly the market rate at all times. Likewise, the investor is assured at all times of receiving a return in line with the market rate. Consequently, there is no reason for the price of a variable-rate bond to move very far from its par value unless the issuer's solvency becomes a concern.

Let's take the simple example of a fixed-rate bond indexed to the 1-year rate that pays interest annually. On the day following payment of the coupon and in the year prior to its maturity date, the price of the bond can be calculated as follows (as a percentage of par value):

$$V = \frac{100 + r_1 \times 100}{1 + r_1} = 100$$

where r_1 is the 1-year rate.

Here the price of the bond is 100% since the discount rate is the same as the rate used to calculate the coupon. Likewise, we could demonstrate that the price of the bond is 100% on each coupon payment date. The price of the bond will fluctuate in the same way as a short-term instrument in between coupon payment dates.

If the reference rate covers a period which is not the same as the interval between two coupon payments, the situation becomes slightly more complex. This said, since there is rarely a big difference between short-term rates, the price of the bond will clearly not fluctuate much over time.

The main factor that can push the price of a variable-rate bond well below its par value is a deterioration in the solvency of the issuer.

Consequently, floating-rate bonds are not highly volatile securities, even though their value is not always exactly 100%.

Three final points about the mechanics of the coupon of floating-rate securities:

- There is a distinction between a floating-rate security and what is sometimes referred to as a **variable-rate (or adjustable-rate) security** and the *frequency* at which the coupon rate is reset and the *reference rate*. A floating-rate security resets more than once a year, and the reference rate is a short-term rate. In contrast, a variable-rate security does not reset more than once a year, and the reference rate is a long-term interest rate.
- There are some issues whose coupon rate moves in the *opposite direction* of the interest-rate change. They are called **inverse floaters**.
- There are some securities whose coupon rate is equal to the reference rate as long as the reference rate is within a contractually specified range. If, at the reset rate, the reference rate is outside this range, the coupon rate is zero for that single period. These securities are called **range notes**.

2/ THE SPREAD

Like those issuing fixed-rate securities, companies issuing floating-rate securities need to pay investors a return that covers the counterparty (credit) risk. Consequently, a fixed margin (**spread**) is added to the variable percentage when the coupon is calculated. For instance, a company may issue a bond at 3-month Euribor + 0.45% (or 45 basis point). The size of this margin basically depends on the company's financial creditworthiness.

The spread is set once and for all when the bond is issued, but of course the company's risk profile may vary over time. This factor, which does not depend on interest rate trends, slightly increases the volatility of variable-debt securities.

The issue of credit risk is the same for a fixed-rate security as for a variable-income security.

3/ INDEX-LINKED SECURITIES

Floating rates, as described in the first paragraph of this section, are indexed to a market interest rate. Broadly speaking, however, a bond's coupons may be indexed to any index or price provided that it is clearly defined from a contractual standpoint. Such securities are known as **index-linked securities**.

For instance, most European countries have issued bonds indexed to inflation. The coupon paid each year, as well as the redemption price, are reset to take into account the rise in the price index since the bond was launched. As a result, the investor benefits from complete protection against inflation. With the advent of the euro, for example, the UK government issued a bond indexed to the rate of inflation in the United Kingdom. Likewise, Mexican companies have brought to market bonds linked to oil prices, while other companies have issued bonds indexed to their own share price.

To value this type of security, projections need to be made about the future value of the underlying index, which is never an easy task.

The following table shows the main reference rates in Europe.

REFERENCE RATES IN EUROPE

Reference rate	Definition
EONIA (Euro Overnight Index Average)	European money-market rate. This is an average rate weighted by overnight transactions reported by a representative sample of 64 European banks. Computed by the European Central Bank and published by Reuters.
EURIBOR (European Interbank Offered Rate)	European money-market rate corresponding to the arithmetic mean of offered rates on the European banking market for a given maturity (between 1 week and 12 months). Sponsored by the European Banking Federation and published by Reuters, it is based on daily quotes provided by 64 European banks.
LIBOR (London Interbank Offered Rate)	Money-market rate observed in London corresponding to the arithmetic mean of offered rates on the London banking market for a given maturity (between 1 and 12 months) and given currency (euro, sterling, dollar, etc.).
Interest Rate Swap (IRS)	The Interest Rate Swap (IRS) rate indicates the fixed interest rate that will equate the present value of the fixed-rate payments with the present value of the floating-rate payments in an interest-rate swap contract. The convention in the market is for the swap market makers to set the floating leg – normally at Euribor – and then quote the fixed rate that is payable for that maturity.

Section 25.4

MEDIUM TERM NOTES

A medium term note (MTN) is essentially a plain vanilla debt security (generally) with a fixed coupon and maturity date. MTNs are generally *noncallable, unsecured, senior debt securities* with *investment-grade* ratings. Notes can be issued either as bearer or registered securities.

There are two important differences between MTNs and corporate bonds:

- the distribution process: MTNs are normally sold *on a best-efforts basis* by financial intermediaries. Therefore the borrowing company is not guaranteed to place all its paper;⁴
- MTNs are usually sold in relatively small amounts on a *continuous basis*. This is a unique characteristic of MTNs: they are offered to investors continually over a period of time as part of an *MTN programme*.

⁴ Certain MTN issues are underwritten by investment banks, making them indistinguishable from conventional corporate bonds.

Companies with MTN programmes have great flexibility in the types of securities they may issue. This flexibility concerns the coupon (fixed vs. floating), the embedded options and the maturities.

Despite their denomination, MTNs are not necessarily medium term. The single bonds issued in a programme can in fact range in maturity from 9 months to 30 years or more.

The total amount of debt issued in a MTN programme generally ranges from €100 million to €1 billion. The single issue size can be rather small and some issues have been for as little as €5 million!

(a) Reasons for issuing MTNs

An MTN programme is a series of issues over time, matching the issuer's funding requirement, and therefore should be preferred over a "traditional" bond by companies that do not need all the funding at once, nor for the full duration of the programme.

However, corporate bonds continue to be preferred when:

- funds are required immediately;
- issuers expect interest rates to rise in the near future and want to lock in a fixed rate for all the funding required;
- issuers want to minimise the cost of the issue. The all-in cost of a straight bond issue is generally lower than the all-in cost of an MTN programme. This reflects the economies of scale that may be achieved when issuing big amounts at once, as well as the greater secondary market liquidity of larger-sized issues. The liquidity premium associated with large volume issues is not known with certainty, but is estimated at around 5 to 10 basis points (Kitter, 1999).

Three major advantages can be reached through MTN programmes:

- 1 A high financial flexibility. This is often the most important reason behind the corporate treasury's decision to use this funding instrument, notwithstanding the interest cost advantage of straight bonds. The major flexibility is with regards to the term to maturity of the issues. It is not rare to see issues with unconventional maturities, like 15 months, 4.5 years and so on. This makes the MTNs the preferred instrument when the primary need of the issuer is to **match exactly the duration of assets with the duration of liabilities**.
- 2 A fast issue process of single issues, often less than a day.
- 3 Avoiding publicity, since often the distribution method is private placement. This characteristic is particularly relevant in times of turbulent markets, high volatility and financial distress of the company.

5 Rule 415 (March 1982) permits delayed or continuous issuance of so-called shelf-registered corporate securities. Issuers register securities that may be sold for two years after the effective date of the registration without the requirement of another registration statement each time new offerings are made. Thus shelf registration enables issuers to take advantage of brief periods of low interest rates by selling previously registered securities on a moment's notice.

COMPARATIVE CHARACTERISTICS OF BOND ISSUES IN THE INTERNATIONAL BOND MARKET

	Domestic markets	US market (Yankee bonds)	Eurobond market
Regulatory bodies	Official agency approval	SEC	Minimum regulatory control
Disclosure requirements	Variable	More detailed: <ul style="list-style-type: none"> • High initial and ongoing expense • Onerous to non-US firms 	Determined by market prices
Issuing costs	Variable up to 4%	0.75% – 1.00%	0.2 – 0.5%
Rating requirements	Usually not	Yes	No, but commonly done
Exchange listing	Listing is usual	Listing is usual	Listing is usual
Queuing	Queuing is common	Queuing is not common	No formal process
Currency of denomination restrictions	Part of queuing (many countries have in the past or now restrict use of currency)	US does not restrict the use of US\$	No restrictions
Speed of issuance	Variable	Relatively slow until Rule 415 shelf registration ⁵	Usually fast (bought deal leads to fast issuance)

COMPARATIVE CHARACTERISTICS OF BOND ISSUES IN THE INTERNATIONAL BOND MARKET (cont.)

	Pros	Cons	Pros	Cons	Pros	Cons
Issuer incentives	+ Local visibility, diversification of funding sources	– Market may be small, queuing may prevail	+ Large market, great depth	– Disclosure is costly to foreigners, speed	+ Lower annual interest expenses, speed of placement	– Cannot sell issue in US until seasoned
Lender incentives	+ Diversified currency portfolio	– Reporting to tax authorities, withholding tax may apply	+ Great depth and liquidity, appeal of standardised information	– Reporting to tax authorities	+ Diversified currency portfolio, bearer bonds, no withholding tax	– Less liquidity and information disclosures

Section 25.5

THE VOLATILITY OF DEBT SECURITIES

The holder of a debt security may have regarded himself as protected having chosen this type of security, but he actually faces three types of risk:

- **interest rate risk** and **coupon reinvestment risk**, which affect almost solely fixed-rate securities;
- **credit risk**, which affects fixed-rate and variable-rate securities alike. We will consider this at greater length in the following section.

1/ CHANGES IN THE PRICE OF A FIXED-RATE BOND CAUSED BY INTEREST-RATE FLUCTUATIONS

(a) Definition

What would happen if, at the end of the subscription period for the Lafarge 6.125% bond, the market interest rate rose to 7.125% (scenario 1) or fell to 5.125% (scenario 2)? In the first scenario, the bondholder would obviously attempt to sell the Lafarge bond to buy securities yielding 7.125%. The price of the bond will fall such that the bond offers its buyer a yield to maturity of 7.125%. Conversely, if the market rate falls to 5.125%, holders of the Lafarge bond will hold onto their bonds. Other investors will attempt to buy them, and the price of the bond will rise to a level at which the bond offers its buyer a yield to maturity of 5.125%.

An upward (or downward) change in interest rates therefore leads to a fall (or rise) in the present value of a fixed-rate bond, irrespective of the issuer's financial condition.

The value of a fixed-rate debt instrument is not fixed. It varies inversely with market rates: if interest rates rise, its value declines; if interest rates fall, its value appreciates.

As we have seen, if the yield on our Lafarge bond rises to 6.210%, its price will move to 99.529.

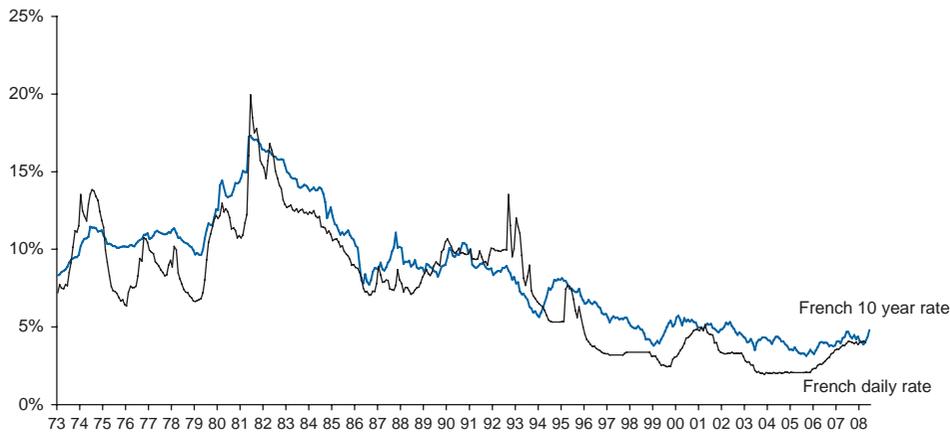
But if its yield to maturity rises to 6.710 % (a 0.5 point increase), its price will change to:

$$V = \sum_{i=1}^7 \frac{6.125\%}{(1 + 6.710\%)^i} + \frac{100\%}{(1 + 6.710\%)^7} = 96.82\% \quad \text{i.e. a decrease of 2.73\%}$$

which is a value close to the actual market value as of 12 June 2007.

This shows that holders of bonds face a risk to their capital, and this risk is by no means merely theoretical given the fluctuations in interest rates over the medium term:

FRANCE: LONG- AND SHORT-TERM INTEREST RATES SINCE 1973 TO MID-JUNE 2008



Source: Datastream.

(b) Measures: modified duration and convexity

The modified duration of a bond measures the percentage change in its price for a given change in interest rates. The price of a bond with a modified duration of 4 will increase by 4% when interest rates fall from 7% to 6%, while the price of another bond with a modified duration of 3 will increase by just 3%.

From a mathematical standpoint, modified duration can be defined as the absolute value of the first derivative of a bond's price with respect to interest rates, divided by the price:

$$\text{Modified duration} = \frac{1}{V} \times \sum_{t=1}^N \frac{t \times F_t}{(1+r)^{t+1}}$$

where r is the market rate and F_t the cash flows generated by the bond.

Turning back to the example of the Lafarge bond at its issuance date, we arrive at the following:

$$\begin{aligned} \text{Modified duration} = \frac{1}{99.529\%} \times & \left[\frac{1 \times 6.125\%}{(1 + 6.210\%)^2} + \frac{2 \times 6.125\%}{(1 + 6.210\%)^3} \right. \\ & \left. + \frac{3 \times 6.125\%}{(1 + 6.210\%)^4} + \dots + \frac{7 \times 106.125\%}{(1 + 6.210\%)^8} \right] = 5.550 \end{aligned}$$

Modified duration is therefore a way of calculating the percentage change in the price of a bond for a given change in interest rates. It simply involves multiplying the change in interest rates by the bond's modified duration. A rise in interest rates from 6.210% to 6.710% therefore leads to a price decrease of $0.5\% \times 5.550 = 2.78\%$, i.e. from 99.529% to $99.863 \times (1 - 2.78\%) = 96.77\%$.

We note a discrepancy of 0.05% with the price calculated previously (96.82%). Modified duration is valid solely at the point where it is calculated (i.e. 6.210% here). The further we move away from this point, the more skewed it becomes. For instance, at a yield of 6.710% it is 5.508 rather than 5.550. This will skew calculation of the new price of the bond, but the distortion will be small if the fluctuation in interest rates is also limited in size. From a geometrical standpoint, the modified duration is the first derivative of price with respect to interest rates and it reflects the slope of the tangent to the price/yield curve. Since this forms part of a hyperbolic curve, the slope of the tangent is not constant and moves in line with interest rates.

(c) Parameters influencing modified duration

Let's consider the following three bonds:

Bond	A	B	C
Coupon	5%	5%	0%
Price	100	100	100
Yield to maturity	5%	5%	5%
Redemption price	100	100	432.2
Residual life	5 years	15 years	30 years

How much are these bonds worth in the event of interest rate fluctuations?

Market interest rates (%)	A	B	C
1	119.4	155.5	320.7
5	100	100	100
10	81.0	62.0	24.8
15	66.5	41.5	6.5

Note that **the longer the maturity of a bond, the greater its sensitivity to a change in interest rates.**

Modified duration is primarily a function of the maturity date. **The closer a bond gets to its maturity date, the closer its price moves towards its redemption value and the more its sensitivity to interest rates decreases.** Conversely, the longer it is until the bond matures, the greater its sensitivity to interest rate fluctuations.

Modified duration also depends on two other parameters, which are nonetheless of secondary importance to the time to maturity factor:

- **the bond's coupon rate:** the lower the coupon rate, the higher its modified duration;
- **market rates:** the lower the level of market rates, the higher a bond's modified duration.

Modified duration represents an investment tool used systematically by fixed-income portfolio managers. If they anticipate a decline in interest rates, they opt for bonds with a higher modified duration, i.e. a longer time to maturity and a very low coupon rate, or even zero coupon bonds, to maximise their capital gains.

Conversely, if portfolio managers expect a rise in interest rates, they focus on bonds with a low modified duration (i.e. due to mature shortly and carrying a high coupon) in order to minimise their capital losses.

Convexity is the second derivative of price with respect to interest rates. **It measures the relative change in a bond's modified duration for a small fluctuation in interest rates.** Convexity expresses the speed of appreciation or the sluggishness of depreciation in the price of the bond if interest rates decline or rise.

2/ COUPON REINVESTMENT RISK

As we have seen, the holder of a bond does not know at what rate its coupons will be reinvested throughout the bond's. Only zero coupon bonds afford protection against this risk, simply because they do not carry any coupons!

First of all, note that this risk factor is the mirror image of the previous one. If interest rates rise, the investor suffers a capital loss, but is able to reinvest coupon payments at a higher rate than the initial yield to maturity. Conversely, a fall in interest rates leads to a loss on the reinvestment of coupons and to a capital gain.

Intuitively, it seems clear that for any fixed-income debt portfolio or security, there is a period over which:

- the loss on the reinvestment of coupons will be offset by the capital gain on the sale of the bond if interest rates decline;
- the gain on the reinvestment of coupons will be offset by the capital loss on the sale of the bond if interest rates rise.

All in all, once this period ends, the overall value of the portfolio (i.e. bonds plus reinvested coupons) is the same, and the investors will have achieved a return on investment identical to the yield to maturity indicated when the bond was issued.

In such circumstances, the portfolio is said to be **immunised**, i.e. it is protected against the risk of fluctuations in interest rates (capital risk and coupon reinvestment risk).

This time period is known as the **duration** of a bond. It may be calculated at any time, either at issue or throughout the whole life of the bond.

For instance, an investor who wants to be assured of achieving a certain return on investment over a period of three years will choose a portfolio of debt securities with a duration of three years.

Note that the duration of a zero-coupon bond is equal to its remaining life.

In mathematical terms, duration is calculated as follows:

$$\text{Duration} = \frac{\sum_{t=1}^N \frac{t \times F_t}{(1+r)^t}}{\sum_{t=1}^N \frac{F_t}{(1+r)^t}}$$

Duration can be regarded as being akin to the discounted average life of all the cash flows of a bond (i.e. interest and capital). The numerator comprises the discounted cash flows weighted by the number of years to maturity, while the denominator reflects the present value of the debt.

The Lafarge bond has a duration of 5.89 years at issue.

Duration is linked to modified duration by a very simple equation, since:

$$\text{Duration} = (1 + r) \times \text{Modified duration}$$

We can see that $5.550 \times (1 + 6.210\%) = 5.89$ years.

Turning our attention back to modified duration, we can say that it is explained by the duration of a bond, which brings together in a single concept the various determinants of modified duration, i.e. time to maturity, coupon rate and market rates.

Note, however, that duration is **barely used in practice** owing to the constant fluctuations in market rates and the constant shifts in investors' investment horizons.

Section 25.6

DEFAULT RISK AND THE ROLE OF RATING

1/ RATING AND DEFAULT RISK

Default risk can be measured on the basis of a traditional financial analysis of the borrower's situation or by using credit scoring, as we saw in Chapter 8. Specialised agencies, which analyse the risk of default, issue ratings which reflect the quality of the borrower's signature. There are three agencies that dominate the market – Standard & Poor's (www.standardandpoors.com), Moody's (www.moodys.com) and Fitch (www.tch.com).

A number of scholars have investigated the main determinants of rating opinions. For corporate debt, higher ratings are generally associated with:

6 Overall, these studies were able to explain from 60% to 90% of the ratings assigned by the rating agencies.

- 1 lower debt ratios;
- 2 higher ROA;
- 3 lower variation in earnings;
- 4 larger companies;
- 5 higher interest coverage ratios;
- 6 lack of subordination.⁶

Although rating services have existed in the USA since the beginning of the 20th century, they are a more recent development in Europe (1980s and 1990s) and are expected to increase even more quickly with the new Basel 2 banks' capital requirements (see www.bri.org).

Rating agencies provide ratings for companies, banks, sovereign states and municipalities. They can decide to rate a specific issue or to give an absolute rating for the issuer (rating given to first-ranking debt). Rating agencies also distinguish between short-and long-term prospects.

Some examples of long-term debt ratings:

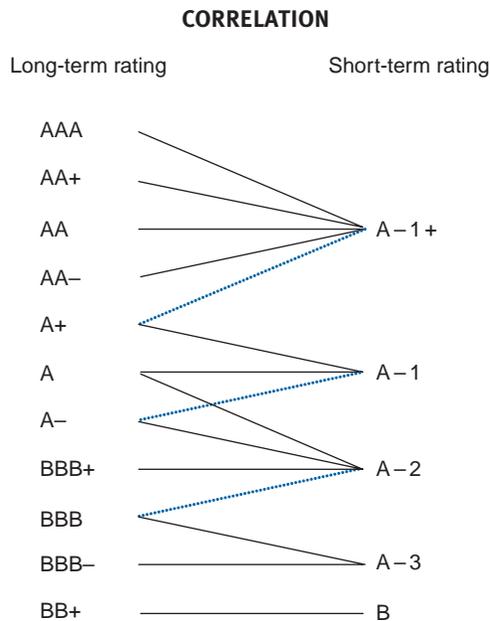
Moody's	Standard & Poor's and Fitch	Definition	Examples (June 2008)
Aaa	AAA	Best quality, lowest risk	La Poste, Germany, Pfizer, Spain, GE, Rabobank, France
Aa	AA	High quality. Very strong ability to meet payment obligations	Total, EDF, city of Milan, BASF, BNP Paribas, Sanofi-Aventis, Italy
A	A	Upper-medium grade obligations. Issuer has strong capacity to meet its obligations	Carrefour, France Télécom, Daimler, University of Lancaster, Botswana, Poland, city of Lille
Baa	BBB	Medium grade. Issuer has satisfactory capacity to meet its obligations	Pernod Ricard, Vivendi, Sodexho, Réunion (French island), Morocco
Ba	BB	Speculative. Uncertainty of issuer's capacity to meet its obligations	Rémy Cointreau, Piaggio, Eutelsat, Egypt, Alcatel Lucent, Rhodia, Attijariwafa Bank, Tereos
B	B	Issuer has poor capacity to meet its obligations	Cambodia, Bolivia, Toys 'R' Us, US Airways, M-Real
Caa	CCC	Poor standing. Danger with respect to payment of interest and return of principal	Cuba, Nicaragua
Ca	CC	Highly speculative Often in default	
C	C	Close to insolvency	
	D or SD	Insolvent!	Quebecor

 [download](#)

Short-term debts:

Moody's	Standard & Poor's and Fitch	Definition	Examples (June 2008)
Prime 1	A-1	Superior ability to meet obligations	Air Liquide, AXA, Intesa SanPaolo, Diageo
Prime 2	A-2	Strong ability to repay obligations	Telefónica, Lafarge, Edison, Mattel, Henkel
Prime 3	A-3	Acceptable ability to repay obligations	PPR, Wendel, Morocco, Hyundai Motor
Not Prime	B	Speculative	Sequana, Eutelsat, Attijariwafa Bank, Severstal
	C	Vulnerable	Bolivia, Doral Financial
	D	Insolvent	

Short-term rating is not independent from long-term rating, as seen in the diagram below:



Source: Standard & Poor's.

Rating services also add an **outlook** to the rating they give – stable, positive or negative – which indicates the likely trend of the rating over the two to three years ahead.

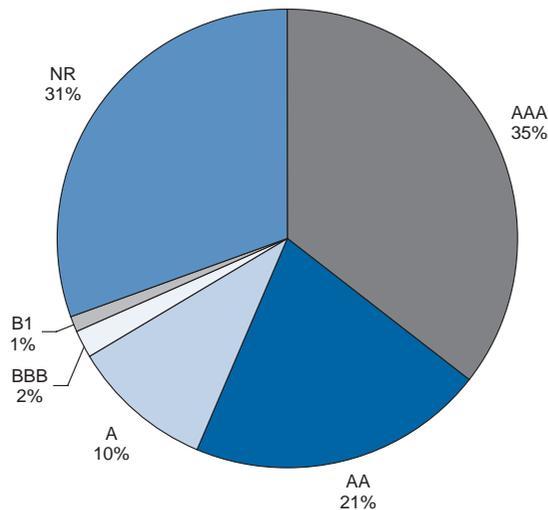
Short- and medium-term ratings may be modified by a + or – or a numerical modifier, which indicates the position of the company within its generic rating category.

The **watchlist** alerts investors that an event such as an acquisition, disposal, merger, once it has been weighed into the analysis, is likely to lead to a change in the rating. The company on the watchlist is likely to be upgraded when the expected outcome is positive, downgraded when the expected outcome is negative and, when the agency is unable to determine the outcome, it indicates an unknown change.

During the last two decades, the number of downgrades of corporate bond ratings has exceeded the number of upgrades. Blume et al. (1998) have demonstrated that this is mainly the effect of ever more stringent standards used by agencies in assigning ratings.

Ratings between AAA and BBB are referred to as **Investment Grade**, and those between BB and D as **Speculative Grade** (or *Non Investment Grade*). The distinction between these two types of risk is important to investors, especially institutional investors, which often are not permitted to buy the risky speculative grade bonds!

RATINGS OF EURO BOND ISSUES MAY 2007–APRIL 2008

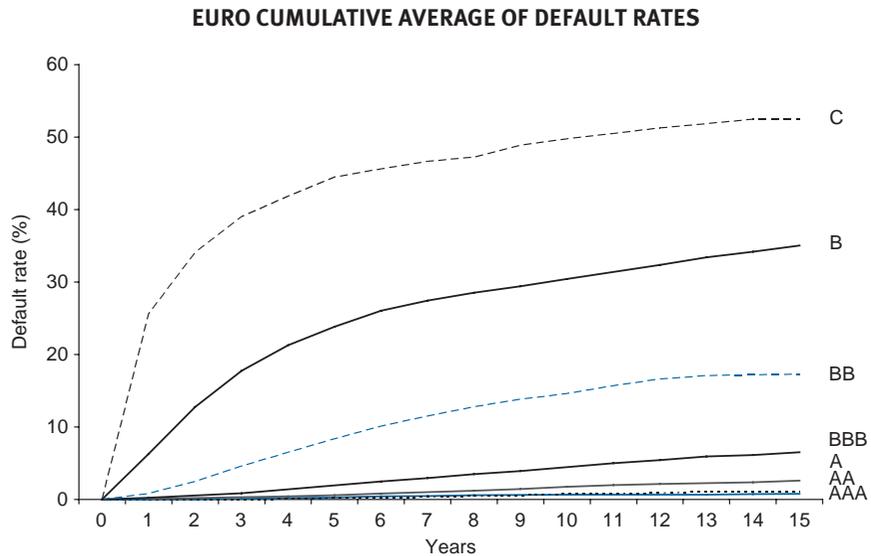


Source: European Commission.

The reader should avoid considering speculative grade bonds as a synonym of “junk bonds”. The term “junk” originated in the mid-1970s to describe those corporate securities that lost their investment grade status due to a fundamental deterioration in the quality of their operating and financial performance (so called “fallen angels”).

Since the late 1970s, this market began to include more newly issued or original issues that represented a source of capital for emerging or continuing growth companies, and those other companies which previously relied on private placements.

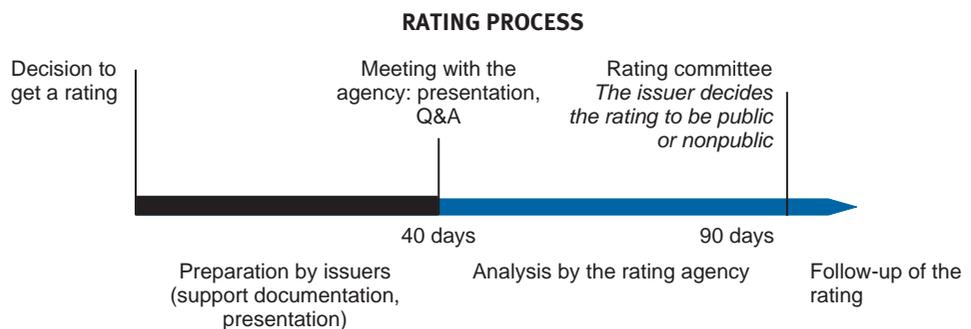
From the sample of international issuers rated by Standard & Poor's over 15 years, 0.8% of issuers rated AAA failed to pay an instalment on a loan, while 35% of issuers rated B defaulted.



Source: Standard & Poor's 2007.

In Europe, financial rating agencies generally rate companies at their request, which enables them to access privileged information (medium-term plans, contacts with management). Rating agencies very rarely rate companies without management cooperation. When they do, the accuracy of the rating depends on the quality of the information about the company available on the market. If the company does not require a public rating immediately, it may ask to keep it **confidential**, and it is then referred to as a *shadow rating*.

Because the rating agencies work independently, they sometimes attach different ratings to a bond issue; this phenomenon is known as a **split rating**. The yield on a split-rated bond tends to be an average of yields for the higher and lower rating categories.



With the disappearance of exchange fluctuation exposure in Europe thanks to the introduction of the euro, investors no longer shy away from bonds issued in other eurozone countries, making it easier for them to diversify their portfolios. However, given that they are relatively less well-informed about the financial situation of these new investment

targets, investors now rely on rating agencies much more than they did before the advent of the euro.

Moreover, the current opening up of the bond market to new issuers that are smaller and more of an unknown quantity, has led to an increase in this trend. This has long been established practice in the USA, where the spectre of issuers' ratings looms large.

The rating given to a company has a direct impact on the cost of the debt it has to pay. On average, in April 2006, compared with risk-free rates (government bond rates or swap curves), a bank rated AAA would have to pay 0.14% more to issue a 1-year bond and 0.90% for a 30-year bond, while an issuer rated BBB would have to pay between 0.65% and 1.77% more, depending on the maturity date.

A final comment. Academic research demonstrates that bond ratings can be predicted with a high degree of accuracy with publicly available data, leading some to question what value the agencies add beyond certification. However, it is true that bond yields are more and more associated with ratings than publicly available data alone, implying that the agencies seem to provide additional information, perhaps as a result of their contacts with management.

2/ EXPLAINING THE SPREAD ON CORPORATE BONDS

Is the relation between rating and corporate spread so strongly influenced by the default probability signalled by the class of rating of companies? The evidence is not so unanimous. An article by Elton et al. (2001) has explored the relative importance of the following factors in explaining corporate spreads in the USA:

- 1 expected default loss, because investors require a higher promised payment to compensate for the expected loss from defaults;
- 2 tax premium, because interest payments on corporate bonds are taxed in the USA at the state level whereas interest payments on government bonds are not;
- 3 risk premium, because a portion of the risk on corporate bonds is systematic rather than diversifiable.

These factors seem almost entirely to explain the spreads and expected default accounts for a surprisingly small fraction of the premium of corporate rates. A substantial portion of the spread is closely related to state taxes and – above all – to risk premiums for common stock.

Why should a systematic risk exist also for bonds? There are basically two reasons, as the authors point out:

- If expected default loss were to move with equity prices – while stock prices rise default risk goes down and vice versa – it would introduce a systematic factor. However, the relationship between the economic cycle and yield spread is not always the same, depending on the sector to which the issuer belongs. Athanassakos and Carayannopoulos (2002) have demonstrated that while in the industrial and transportation sectors bond premia are generally higher during recessionary periods, the opposite is true for utilities. This may be the result of investors decreasing their demand for bonds in highly cyclical industries, while at the same time increasing the demand for instruments less affected by general economic conditions such as bonds issued by utilities.

- The compensation for risk required in capital markets changes over time. If changes in the required compensation for risk affect both corporate bonds and equities, then this would introduce a systematic factor.

SUMMARY



A debt security is a financial instrument representing the borrower's obligation to the lender from whom he has received funds. This obligation provides for a schedule of financial flows defining the terms of repayment of the funds and the lender's remuneration in the interval.

The price of a bond does not reflect its actual cost. The yield to maturity (which cancels out the bond's NPV – that is the difference between the issue price and the present value of future flows) – is the only criterion allowing investors to evaluate the various investment opportunities, (according to risk and length of investment). On the secondary market, the yield to maturity is merely an opportunity cost for the issuer, i.e. the cost of refunding today.

The basic parameters for bonds are as follows:

- Nominal or face value.
- Issue price, with a possible premium on the nominal value.
- Redemption: redemption at maturity (known as a bullet repayment), constant amortisation or fixed instalments. The terms of the issue may also include provisions for early redemption (call options) or retraction (put options).
- Average life of bond: where the bond is redeemed in several instalments, the average life of the bond corresponds to the average of each of the repayment periods.
- Nominal rate: also known as the coupon rate and used to calculate interest payable.
- Issue/redemption premium/discount: the difference between the issue premium/discount and the nominal value and the difference between the redemption premium/discount and the nominal value.
- Periodic coupon payments: frequency at which coupon payments are made. We talk of zero coupon bonds when total compounded interest earned is paid only upon redemption.

The diversity of these parameters explains why the yield to maturity may differ from the coupon rate.

Floating-rate debt securities are exposed to the risk of interest rate fluctuations: the value of a fixed rate debt security increases when interest rates fall, and vice versa. This fluctuation is measured by:

- the modified duration, which measures the percentage change in the price of a bond for a small change in interest rates. Modified duration is a function of the maturity date, the nominal rate and the market rate;
- convexity, the second derivative of price with respect to interest rates, which expresses the speed of appreciation or the sluggishness of depreciation in the price of the bond if interest rates decline or rise;

- coupon reinvestment risk. There is a time period over which the portfolio is said to be immunised, i.e. it is protected against the risk of fluctuations in interest rates (capital risk and coupon reinvestment risk). This period is known as the duration of the bond, and is equal to the ratio of the discounted cash flows weighted by the number of years to maturity and the present value of the debt.

Fixed-rate securities have a coupon that is not fixed but indexed to an observable market rate (with a fixed margin that is added to the variable rate when the coupon is calculated). Variable-rate bonds are not very volatile securities, even though their value is not always exactly 100% of the nominal.

All debt securities are exposed to default risk that are assessed by rating agencies on the basis of ratings (AAA, AA, A, BBB, etc.) which depend on the volatility of the economic assets and the financial structure of the issuer. The result is a *spread* which is the difference between the bond's yield to maturity and that of a no-risk loan over an identical period. Obviously, the better the perceived solvency of the issuer, the lower the spread.

Questions

- 1/Why is the bond rating important?
- 2/What is the default risk?
- 3/What is the “character” of a bond issuer?
- 4/What should a credit analyst consider as the basic of credit risk?

- 1/*Because bonds with lower ratings tend to have higher interest costs.*
- 2/*Default risk is the risk that the issuer will fail to meet its obligation to make timely payment of interest and principal.*
- 3/*Character relates to the ethical reputation as well as the business qualifications and operating record of the board of directors, management and others responsible for the use of the borrowed funds.*
- 4/*A credit analyst should consider the “four Cs of credit”: character, capacity, collateral and covenants.*

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QUESTIONS

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 quiz

ANSWERS

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