Variations in Bond Structure

Overview

In this module we introduce the key features which define the structure of a bond and hence the cash flows that it generates over its life. We also discuss some of the risks associated with bond investments.

Learning Objectives

By the end of this chapter, you should be able to:

- Define the four key structural components of a bond
- Distinguish between a bond's par value and its market value
- Define some of the investment risks associated with various bond structures, in particular price risk, reinvestment risk and pre-payment risk

Estimated Completion Time: 20 minutes

If you are already familiar with these topics you may skip this document and go straight into the analysis sections in the training package.

You can read this chapter on-line but you may find it easier to read it from hard copy by printing it out first.

Keywords

- Principal / face value / par value
- Market price
- Price tick
- Premium / discount to par

- Coupon / coupon amount
- Paying Agent
- Floating rate notes / floaters
- LIBOR
- Zero-coupon bonds / zeros

- Maturity
- Callable bonds
- Putable bonds
- Sinking funds / sinkers
- Amortisation

- Interest rate risk / market risk / price risk
- Reinvestment risk
- Pre-payment risk

The Four Basic Components

The figure on the next page shows a certificate of a five-year Eurobond which was issued in 1986. Highlighted in the picture are the four fundamental components of the bond:

- **Issuer -** in this case Xerox Credit Corporation. Clearly the issuer's name and its type of business has a bearing on the market liquidity and credit risk that might be associated with the paper.
- **Principal -** USD 5,000 in this case
- **Coupon** - this bond pays 8 $^{5}/_{8}$% for five years
- **Maturity date** - in this case 1991

The issuer is the legal entity which undertakes to comply with all the terms and conditions of the bonds.

Also known as: borrower, obligor, debtor.

The small print on the face and reverse side of the certificate details other terms and conditions of the loan - e.g. where the payments are to be made and by whom, procedures in the event of non-payment, etc.

Many governments who issue domestic bonds regularly and in vast amounts, represent their bonds in **book entry** form. In such cases the bonds have no physical existence and ownership is recorded on computer. However, the same four components must also be present.

Sample Corporate Eurobond Certificate
Source: Xerox Credit Corporation

Principal

The principal is the face value of the bond. It is the amount which the borrower will repay at maturity. The bond certificate also states the currency in which payment will be made.

The principal is the basis on which coupon interest is calculated.

Also known as: nominal value, par value, face value, redemption amount.

The principal amount shown on an individual bond certificate may only be a small portion of the total raised in the issue. Eurobonds are initially in the form of a single **global certificate** which is eventually replaced by **definitive** bond certificates in smaller denominations. For example, if the issue size is GBP 200 million and the lead manager proposes creating 200,000 certificates, each certificate will be for a principal amount of GBP 1,000.

Publicly issued eurobond certificates are typically offered in denominations of USD 1000, 5000, 10 000 and only occasionally in larger amounts. This allows the management syndicate to sell to a broad spectrum of investors including individuals and this greatly improves secondary market liquidity. Other issues - for example those offered through private placement to one or more selected institutional investors - are typically in larger denominations.

Par Value vs. Market Price

A bond's principal amount and market value are not necessarily the same. The principal amount as printed on the bond certificate is fixed; the price at which that certificate trades in the market may be higher or lower than the principal amount, depending on current market rates of interest and the changing credit standing of the issuer.

Because the same issue may trade in different denominations, the market quotes bond prices as a percentage of face value, rather than in currency units.

A bond which trades:

- **at a price equal to its principal value (i.e. price = 100.00) is said to be trading at par**
- **at a price which is lower than its principal value (e.g. 95.00) is said to be trading below par, or at a discount**
- **at a price which is higher than its principal value (e.g. 107.25) is said to be trading above par, or at a premium**

Example

If a 5.50% German government bond maturing in 2001 is offered at 102.53 this means that:

- A DEM 1,000 certificate would cost DEM 1,025.30
- A DEM 5,000 certificate would cost DEM 5,126.50 (102.53 / 100 x 5,000), and so on.

The buyer may also have to add “accrued interest” to this price (this represents interest which has accumulated since the last coupon payment date).

On the other hand, when trading bonds the convention is to specify the principal amount bought or sold, rather than its market value. A typical order might be “buy DEM 5,000 of the 5.50% Bund of 2001, at 102.53”.

Minimum Tick Size

A tick is the smallest amount by which a bond price may change. Each bond market sector has its own traditional minimum tick size.

For example, German government bonds are quoted to the nearest 0.01%, as in our example. But US Treasuries are quoted to the nearest 1/32% - sometimes 1/64% - of face value. Thus, in the US Treasury bond market a price quoted as “102.14” (or “102-14”) means that a USD 1,000,000 trade would cost:

$$\frac{(102 + 14/32)}{100} \times 1{,}000{,}000 = \text{USD } 1{,}024{,}375.00$$

A price quoted as “102.14+” means the price is half of 1/32nd (i.e. 1/64th) higher than 102.14, so a USD 1,000,000 trade would cost:

$$\frac{(102 + 14.5/32)}{100} \times 1{,}000{,}000 = \text{USD } 1{,}024{,}531.25$$

The figure on the next page lists the price quoting conventions that apply in some selected markets. Not all markets price bonds as a percentage of face value. In some markets prices are quoted on a yield basis - that is, on the basis of the return they offer to the investor.

Sector	Price Quoted	Price Tick
US Treasuries	% face value	1/32 or 1/64
Japanese government bonds ("JGBs")	"	0.01
German government bonds (*Bundesobligationen* or "Bunds")	"	0.01
UK government gilt-edged securities ("Gilts")	"	1/32
Eurobonds	"	1/8

Bond Price Quoting Conventions in Selected Market Sectors

The 5 1/2% Motorola Finance Eurobonds maturing in 2006 are offered at 98 7/8. What is the cost of a USD 7,500,000 trade (ignoring accrued interest)?

Answer

$\frac{(98 + 7/8)}{100} \times 7{,}500{,}000 = \text{USD } 7{,}415{,}625.00$

Coupon

The coupon is the rate of interest on a debt security that the borrower promises to pay the holder. It is expressed as an annual percentage of the face value.

Annual coupon amount = $\frac{\text{Coupon}}{100} \times$ Principal amount

The word coupon derives from the French *couper*, meaning to cut off or clip. You saw that attached to a traditional bond certificate is a collection of sequentially-numbered coupons, which represent the bondholders claim to specified amounts of interest falling due on specified dates.

The coupons are detached from the bond certificate in the correct order and presented for payment to a Paying Agent. This is a bank appointed by the borrower to assist in servicing the bond issue.

Fixed Coupons

The simplest and most common type of bonds pay fixed coupons which do not vary over the life of the bond. For example, a DEM 10,000 certificate on a ten-year **straight** paying an *annual* coupon of 7 1/2 % will have ten coupons attached, each representing a claim for DEM 750.00 in interest. The final coupon will be due on the same date that the bond matures, so at maturity the investor receives a total of DEM 10,750.

Although the coupon is always expressed as an annual rate, the actual coupon payment may be made in one or more instalments throughout the year, depending on the market.

Thus, a ten-year straight with a *semi-annual* coupon of 7 1/2% will have 20 coupons attached, each paying DEM 375.00 every six months, for DEM 10,000 of principal. Again, the final coupon is payable on the maturity of the bond, so at maturity the investor receives a total of DEM 10,375.00.

Coupons are typically payable on the anniversary of the bond's maturity date. For example, a semi-annual bond maturing on 5 September 2005 will pay 1/2 of the annual coupon on 5 September and 5 March every year. If a coupon date falls on a week-end or public holiday in the country of the bond's currency, the payment date is rolled forward to the next business day and the amount payable is adjusted accordingly.

Depending upon the market in which a bond is issued, coupons may be payable annually, semi-annually, quarterly or monthly.

$$\text{Coupon amount} = \frac{\text{Coupon}}{100} \times \frac{\text{Principal amount}}{\text{No. coupons per year}}.$$

Other Coupon Structures

Fixed coupon bonds have the advantage that the investor knows precisely what interest income he will earn during the life of the loan. But the structure suffers from two major uncertainties:

1. Having purchased a straight bond, the investor is 'stuck' with a fixed set of coupons; if market rates of interest subsequently rise the investor cannot benefit from the higher rates available unless he first sells his bonds. Faced with the opportunity of investing at higher rates, the market will of course pay less for these bonds, so the investor suffers a loss in the price of the bond.

2. The total return to a bond investor includes not only the coupon income but also any additional income that the investor may earn from reinvesting those coupons, when these are received. The straight bond fixes the coupon income but not any reinvestment income, which will depend on market rates of interest prevailing in the future.

Interest rate risk: the risk of capital loss on a fixed-income security investment as a result of a general rise in market rates of interest.

Also known as: Market risk, Price risk.

Reinvestment risk the risk of loss of reinvestment income to an investor as a result of future interest rates falling.

Other coupon structures exist which address one or other of these problems inherent in straight bonds:

- **Floating Rate Notes (FRNs): floaters** pay a coupon which is reset periodically by the issuer's Fiscal Agent, in line with a specified money market rate of interest such as **LIBOR**. These investments are attractive to commercial banks which fund themselves on a LIBOR basis, or to investors who fear that interest rates may rise.

- **Zero coupon bonds: zeros** pay no coupons at all but are purchased at a discount to par, so the total return to the investor holding these bonds to maturity is the difference between the price paid for the bonds and their par value. This return is established at the time of purchase and does not depend on future reinvestment rates.

These are just two of the most common variances in coupon structure; we shall discuss these and other variations in later chapters.

LIBOR is a benchmark rate of interest established daily in the London interbank market for the purpose of providing a basis for calculation of interest on floating rate instruments. LIBORs are typically established for three month and six month periods.

The Mortgage Bank and Financial Administration Agency of the Kingdom of Denmark
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Guaranteed Floating Rate Notes due
unconditionally and irrevocably guaranteed

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For the six month Interest Period 1st December, 1995 to 3rd 1996 the Notes will carry a rate of Interest of 5.39531 per cent. annum, with Coupon Amounts of U.S. $138.63 and U.S. per U.S. $5,000 and U.S. $100,000 Notes respectively. relevant Interest Payment Date will be 3rd June,

Bankers Trust Company, London **Agent Bank**

Example of Payment Notification for an FRN

For settlement on 18 August 1996 the 2.20% JGB maturing on 18 August 1997 is offered at 98.50. You buy a nominal JPY 100 million of this issue and hold it to maturity.

(a) How much would an investor have to pay for the bond: .....

(b) What is the total coupon interest received: .....

(c) What is the coupon interest received as a percentage of the amount invested: .....

(d) On what date(s) would you expect to receive this interest: .....

(e) How much would you receive on each coupon date: .....

(f) By August 1997, would the total return on your investment be higher or lower than that calculated in (c)? Briefly explain your reasoning.

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Answers

(a) Amount invested $= \frac{98.50}{100} \times 100{,}000{,}000$

$= \text{JPY } 98{,}500{,}000$

(b) Total coupon income $= \frac{2.20}{100} \times 100{,}000{,}000$

$= \text{JPY } 2{,}200{,}000$

(c) Coupon income as a percentage of the amount invested:

$$= \frac{2{,}200{,}000}{98{,}000{,}000} \times 100$$

$= 2.24\%$, rounded.

(d) Interest is payable on 18 February and 18 August 1997, both of which are working days in Tokyo.

(e) Coupon amount $= \frac{2.20 \times 100{,}000{,}000}{100 \times 2}$

$= \text{JPY } 1{,}100{,}000.$

(f) The total return on the investment will be higher than 2.24% because:

(i) Reinvestment income will be earned from the JPY 1,100,000 coupon received on 18 February 1997 and reinvested for six months.

(ii) There will be a capital gain on the investment, having spent JPY 98.5 million on the bond to receive JPY 100 million in principal at maturity.

Maturity

The maturity date is the final date by which bondholders receive all the principal due, as well as the interest.

Also known as: redemption date.

The maturity date marks the end of the borrower's obligations under the terms and conditions of the bonds. The maturity set on a bond issue depends on the funding needs of the borrower as well as on prevailing investor sentiment. The bond's maturity may also affect the coupon the issuer may have to pay in order to sell his bonds: the cost of 5-year money may not be the same as the cost of 10- or 11-year money.

More importantly, the investor's exposure to price risk on a straight bond will be a function of the bond's maturity. The longer the bond's maturity:

- the longer the period over which the investor is committed to receiving a fixed coupon

- the greater the opportunity loss if market rates subsequently rise and hence the greater the fall in the bond's market price

During the volatile 1970s there was a marked trend towards shorter maturities among corporate bonds, as both issuers and investors grew wary of committing for long terms. Even today most straight corporate bonds tend to be issued in the 4-7 year area, although some issuers are able to get away with much longer maturities: one of the longest issues in recent times was a 100-year bond issued by the Walt Disney Corporation. However, such super-longs are extremely rare.

The most common maturity structure is the **bullet** form bond, where the entire principal is repaid on the same date, but other variations have been developed which address some of the concerns of investors (or issuers) about long maturities.

For example:

- **Callable bonds** - which give the issuer the option to redeem the bond on one or more specified dates before their scheduled maturity. This facility permits the issuer to repay the bond early if market interest rates fall, and to refinance its borrowing more cheaply through a new bond issue carrying a lower coupon. Because the buyer of a callable bond faces the possibility of having to reinvest the proceeds at lower rates (though not necessarily with the same borrower), callable bonds typically pay higher coupons than comparable straights.

- **Putable bonds** - which give the investor the option to sell the bond back to the issuer at par or some other specified price, ahead of the bond's scheduled maturity. With putable bonds it is the investor that has the reinvestment option, which will be exercised if interest rates rise or if there are doubts about the continuing creditworthiness of the original borrower. Because of this "sweetener", putable bonds tend to pay lower coupons than comparable straights and can therefore be a more cost-effective financing route for some issuers, at least in the short run. They can, however, be a double-edged sword: when interest rates rise investors put the bonds back to the issuer, forcing it to refinance by issuing new bonds with higher coupons.

- **Sinking fund bonds** - **sinkers** - the issuer has the obligation to redeem a certain fixed nominal amount of the bonds each year according to a specified schedule. Normally there is an interval of several years before the first sinking fund instalment is due. This means that only bonds with final maturities of seven years or more with generally have sinkers.

  If the bonds can be purchased at less than par (their redemption value) the issuer will instruct a market maker to buy bonds in the secondary market. These bonds will be retired from circulation and will be credited towards the next sinking fund instalment. The balance of the sinking fund instalment will be satisfied by a computer program operated by the issuer's fiscal agent which will randomly select serial numbers of those bonds which will be called for redemption. Bonds selected this way are redeemed at their face value.

Both callable bonds and "sinkers" expose the investor to pre-payment risk, although the nature of the risks is very different. With a callable bond the pre-payment risk increases when interest rates fall. With a sinker the pre-payment risk is random: it is very high for the holder of a single bond certificate, but by the law of large numbers it diminishes significantly for the larger investors. These and other maturity structures will be discussed in greater detail later.

Prepayment risk: the risk of loss of interest on a bond that may occur if the investor is repaid ahead of the scheduled maturity date, when market interest rates are lower.

Early in 1996 your broker calls to inform you that he has found some old 6% World Bank Swiss franc bonds (your favourite issuer) maturing in January 1999. You know that in the current market a new 4-year World Bank bond issued at par would have to bear a coupon of around 5 1/2%.

Would you expect to be offered the 6% of 1999 at a premium or a discount to par? Briefly explain your answer.

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Answers

If the market currently pays par for a 5 1/2% coupon, then you can be certain that the 6% bonds from the same issuer will be offered at a premium to par. This ensures that both securities, with the same credit risk and maturity, yield comparable returns:

- An investor buying a new issue at par and holding the bonds to maturity receives a 5 1/2% coupon and no capital gain or loss on the principal.
- An investor buying the 6% bonds at a premium and holding to them to maturity will suffer a capital loss on the principal: the difference between the price paid and par. When set against the higher coupon earned on these bonds, the net return should also be approximately 5 1/2%.

Summary

In this chapter we looked at the four key components which define the investment structure of a bond: borrower, principal, coupon and maturity. We also noted the difference between face value and market value.

We saw that while the straight bullet bonds are the simplest and most common structures, even these bonds carry certain risks which may be unacceptable to some investors - specifically, price risk and reinvestment risk. Other bond structures have been developed to address those risks, and these are discussed later in the programme.

Clearly, anyone interested in a specific issue has to be quite certain about its structural components, therefore its risk characteristics. The vital information about a specific issue is : the issuer name, coupon and maturity, as well as any call dates, put dates, or other early redemption features. Already in this discussion we have alluded to two fundamental laws of the fixed income markets:

- **When interest rates rise bond prices fall, and vice versa**
- **Other things being equal, the longer the bond's maturity the higher is its price risk.**

We shall explore these relationships in detail in the analysis sections of this course.