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- **Module 4:** Investment Instruments
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- **Module 6:** Serving Client Needs
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Clarity
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CHAPTER 9

DEBT SECURITIES

by Lee M. Dunham, PhD, CFA, and Vijay Singal, PhD, CFA

LEARNING OUTCOMES

After completing this chapter, you should be able to do the following:

a Identify issuers of debt securities;

b Describe features of debt securities;

c Describe seniority ranking of debt securities when default occurs;

d Describe types of bonds;

e Describe bonds with embedded provisions;

f Describe securitisation and asset-backed securities;

g Define current yield;

h Describe the discounted cash flow approach to valuing debt securities;

i Describe a bond's yield to maturity;

j Explain the relationship between a bond's price and its yield to maturity;

k Define yield curve;

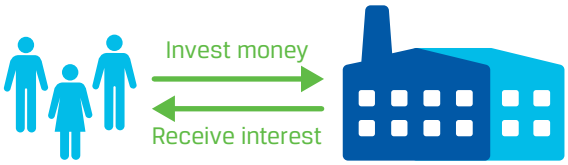
l Explain risks of investing in debt securities;

m Define a credit spread.

INTRODUCTION 1

The Canadian entrepreneur in the Investment Industry: A Top-Down View chapter initially financed her company with her own money and that of family and friends. But over time, the company needed more money to continue to grow. The company could get a loan from a bank or it could turn to investors, other than family and friends, to provide additional money.

Companies and governments raise external capital to finance their operations. Both companies and governments may raise capital by borrowing funds. As the following illustration shows, in exchange for the use of the borrowed money, the borrowing company or government promises to pay interest and to repay the borrowed money in the future.



If people invest in a company and earn interest by buying bonds, ***they are the lenders*** and ***the company is the borrower***.

The illustration has been simplified to show a company borrowing from individuals. In reality, the borrower may be a company or a government, and the investors may be individuals, companies, or governments. Companies may also raise capital by issuing (selling) equity securities, as discussed in the Equity Securities chapter.

As discussed in the Quantitative Concepts chapter, from the borrower's perspective, paying interest is the cost of having access to money that the borrower would not otherwise have. For the lender, receiving interest is compensation for opportunity cost and risk. The lender's opportunity cost is the cost of not having the loaned cash to invest, spend, or hold—that is, the cost of giving up other opportunities to use the cash. The various risks associated with lending affect the interest rates demanded by lenders.

FEATURES OF DEBT SECURITIES 2

When a large company or government borrows money, it usually does so through financial markets. The company or government issues securities that are generically called debt securities, or bonds. Debt securities represent a contractual obligation of the issuer to the holder of the debt security. Companies and governments may have more than one issue of debt securities (bonds). Each of these bond issues has different features attached to it, which affect the bond's expected return, risk, and value.

A **bond** is governed by a legal contract between the bond issuer and the bondholders. The legal contract is sometimes referred to as the bond indenture or offering circular. In the event that the issuer does not meet the contractual obligations and make the promised payments, the bondholders typically have legal recourse. The legal contract describes the key features of the bond.

A typical bond includes the following three features: **par value** (also called principal value or face value), **coupon rate**, and **maturity date**. These features define the promised cash flows of the bond and the timing of these flows.

Par value. The par (principal) value is the amount that will be paid by the issuer to the bondholders at maturity to retire the bonds.

Coupon rate. The coupon rate is the promised interest rate on the bond.

The term "coupon rate" is used because, historically, bonds were printed with coupons attached. There was one coupon for each date an interest payment was owed, and each coupon indicated the amount owed (coupon payment). Bondholders cut (clipped) the coupons off the bond and submitted them to the issuer for payment. The use of the term "coupon rate" helps prevent confusion between the interest rate promised by the bond issuer and interest rates in the market.

Coupon payments are linked to the bond's par value and the bond's coupon rate. The annual interest owed to bondholders is calculated by multiplying the bond's coupon rate by its par value. For example, if a bond's coupon rate is 6% and its par value is £100, the coupon payment will be £6. Many bonds, such as government bonds issued by the US or UK governments, make coupon payments on a semiannual basis. Therefore, the amount of annual interest is halved and paid as two coupon payments, payable every six months. Taking the previous example, bondholders would receive two coupon payments of £3. Coupon payments may also be paid annually, quarterly, or monthly. The bond contract will specify the frequency and timing of payments.

Maturity date. Debt securities are issued over a wide range of maturities, from as short as one day to as long as 100 years or more. In fact, some bonds are perpetual, with no pre-specified maturity date at all. But it is rare for new bond issues to have a maturity of longer than 30 years. The life of the bond ends on its maturity date, assuming that all promised payments have been made.

Example 1 describes the interaction of the three main features of a bond and shows the payments that the bond issuer will make to a bondholder over the life of the bond.

EXAMPLE 1. MAIN FEATURES OF A BOND

A bond has a par value of £100, a coupon rate of 6% (paid annually), and a maturity date of three years. These characteristics mean the investor receives a coupon payment of £6 for each of the three years it is held. At the end of the three years, the investor receives back the £100 par value of the bond.

Par Value = £100
Coupon Rate = 6%
Maturity = 3 Years
Coupon Payment = £6.00

Other features. Other features may be included in the bond contract to make it more attractive to bondholders. For instance, to protect bondholders' interests, it is common for the bond contract to contain **covenants**, which are legal agreements that describe actions the issuer must perform or is prohibited from performing. A bond may also give the bondholder the right, but not the obligation, to take certain actions.

Bonds may also contain features that make them more attractive to the issuer. These include giving the issuer the right, but not the obligation, to take certain actions. Rights of bondholders and issuers are discussed further in the Bonds with Embedded Provisions section.

3 SENIORITY RANKING

The bond contract gives bondholders the right to take legal action if the issuer fails to make the promised payments or fails to satisfy other terms specified in the contract. If the bond issuer fails to make the promised payments, which is referred to as **default**, the debtholders typically have legal recourse to recover the promised payments. In the event that the company is liquidated, assets are distributed following a priority of claims, or **seniority ranking**. This priority of claims can affect the amount that an investor receives upon liquidation.

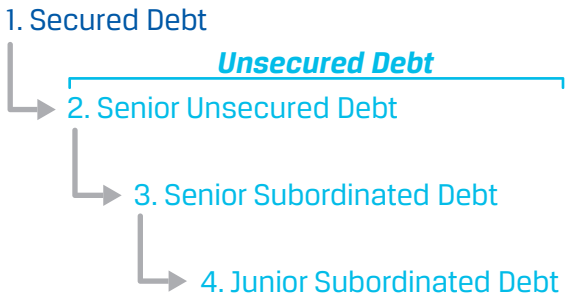
The par value (principal) of a bond plus missed interest payments represents the maximum amount a bondholder is entitled to receive upon liquidation of a company, assuming there are sufficient assets to cover the claim. Because debt represents a contractual liability of the company, debtholders have a higher claim on a company's assets than equity holders. But not all debtholders have the same priority of claim: borrowers often issue debt securities that differ with respect to seniority ranking. In general, bonds may be issued in the form of secured or unsecured debt securities.

Secured. When a borrower issues secured debt securities, it pledges certain specific assets as collateral to the bondholders. **Collateral** is generally a tangible asset, such as property, plant, or equipment, that the borrower pledges to the bondholders to secure the loan. In the event of default, the bondholders are legally entitled to take possession of the pledged assets. In essence, the collateral reduces the risk that bondholders will lose money in the event of default because the pledged assets can be sold to recover some or all of the bondholders' claim (missed coupon payments and par value).

Unsecured. Unsecured debt securities are not backed by collateral. Consequently, bondholders will typically demand a higher coupon rate on unsecured debt securities than on secured debt securities. A bond contract may also specify that an unsecured bond has a lower priority in the event of default than other unsecured bonds. A lower priority unsecured bond is called subordinated debt. Subordinated debtholders receive payment only after higher-priority debt claims are paid in full. Subordinated debt may also be ranked according to priority, from senior to junior.

Exhibit 1 shows an example of the seniority ranking of debt securities.

Exhibit 1 Seniority Ranking of Debt Securities



TYPES OF BONDS 4

Bonds, in general, can be classified by issuer type, by type of market they trade in, and by type of coupon rate.

Although the term "bond" may be used to describe any debt security, irrespective of its maturity, debt securities can also be referred to by different names based on time to maturity at issuance. Debt securities with maturities of one year or less may be referred to as bills. Debt securities with maturities from 1 to 10 years may be referred to as notes. Debt securities with maturities longer than 10 years are referred to as bonds.

Issuer. Bonds issued by companies are referred to as corporate bonds and bonds issued by central governments are sovereign or government bonds. Local and regional government bodies may also issue bonds.

In some cases, bonds issued by certain central governments carry particular names in the market. For example, bonds issued by the US government are referred to as Treasury securities or Treasuries, by the New Zealand government as Kiwi Bonds, by the UK government as gilts, by the German government as Bunds, and by the French government as OATs (obligations assimilables du Trésor).

Market. At issuance, investors buy bonds directly from an issuer in the primary market. The primary market is the market in which new securities are issued and sold to investors. The bondholders may later sell their bonds to other investors in the secondary market. In the secondary market, investors trade with other investors. When investors buy bonds in the secondary market, they are entitled to receive the bonds' remaining promised payments, including coupon payments until maturity and principal at maturity.

Coupon rates. Bonds are often categorised by their coupon rates: fixed-rate bonds, floating-rate bonds, and zero-coupon bonds. These categories of bonds are described further in the following sections.

4.1 Fixed-Rate Bonds

Fixed-rate bonds are the main type of debt securities issued by companies and governments. Because debt securities were historically issued with fixed coupon rates and paid fixed coupon payments, they may be referred to as fixed-income securities. A fixed-rate bond has a finite life that ends on the bond's maturity date, offers a coupon rate that does not change over the life of the bond, and has a par value that does not change. If interest rates in the market change or the issuer's creditworthiness changes over the life of the bond, the coupon the issuer is required to pay *does not* change. Fixed-rate bonds pay fixed periodic coupon payments during the life of the bond and a final par value payment at maturity.

Example 2 describes how Walt Disney Corporation raised capital in August 2011 by using three different fixed-rate bond issues. Notice how the bond issues with longer times to maturity have higher coupon rates.

EXAMPLE 2. FIXED-RATE BOND

On 16 August 2011, the Walt Disney Corporation, a US company, raised $1.85 billion in capital with three debt issues. It issued $750 million in 5-year fixed-rate bonds offering a coupon rate of 1.35%, $750 million in 10-year fixed-rate bonds offering a coupon rate of 2.75%, and $350 million in 30-year fixed-rate bonds offering a coupon rate of 4.375%. Coupon payments are due semiannually (twice per year) on 16 February and 16 August. The following table summarises features of these issues. On the maturity date, each bondholder will receive $1,000 per bond plus the final semiannual coupon payment.

	5-year, 1.35% Bonds	10-year, 2.75% Bonds	30-year, 4.375% Bonds
Total par value (millions)	$750	$750	$350
Number of bonds issued	750,000	750,000	350,000
Par value of one bond	$1,000	$1,000	$1,000
Coupon rate (annual)	1.35%	2.75%	4.375%

	5-year, 1.35% Bonds	10-year, 2.75% Bonds	30-year, 4.375% Bonds
Semiannual coupon payment per bond	$6.75	$13.75	$21.875
Maturity date	16 August 2016	16 August 2021	16 August 2041

4.2 Floating-Rate Bonds

Floating-rate bonds, sometimes referred to as **variable-rate bonds** or floaters, are essentially identical to fixed-rate bonds except that the coupon rate on floating-rate bonds changes over time. The coupon rate of a floating-rate bond is usually linked to a **reference rate**. The **London Interbank Offered Rate** (Libor) is a widely used reference rate.

The calculation of the floating rate reflects the reference rate and the riskiness (or creditworthiness) of the issuer at the time of issue. The floating rate is equal to the reference rate plus a percentage that depends on the borrower's (issuer's) creditworthiness and the bond's features. The percentage paid above the reference rate is called the spread and usually remains constant over the life of the bond. In other words, for an existing issue, the spread used to calculate the coupon payment does not change to reflect any change in creditworthiness that occurs after issue. But the reference rate does change over time with changes in the level of interest rates in the economy.

$$\text{Floating rate} = \text{Reference rate} + \text{Spread}$$

In bond markets, the practice is to refer to percentages in terms of basis points. One hundred basis points (or bps, pronounced bips) equal 1.0%, and one **basis point** is equal to 0.01%, or 0.0001. Therefore, rather than stating a floating rate as Libor plus 0.75%, the floating rate would be stated as Libor plus 75 bps. A floating-rate bond's coupon rate will change, or reset, at each payment date, typically every quarter. Floating-rate coupon payments are paid in arrears—that is, at the end of the period on the basis of the level of the reference rate set at the beginning of the period. On a payment date, the coupon rate is set for the next period to reflect the current level of the reference rate plus the stated spread. This new coupon rate will determine the amount of the payment at the next payment date. Example 3 is a hypothetical example illustrating the effect of changes in a reference rate on coupon rates and coupon payments.

EXAMPLE 3. FLOATING-RATE BOND

On 31 March, a UK company raises £2 million by issuing floating-rate notes with a maturity of nine months. The coupon rate is three-month Libor plus 140 bps (1.40%). Note that even though it is called three-month Libor, the rate quoted is an annual rate. It is standard practice to quote interest rates as an annual rate. Therefore, the total rate (Libor + 1.40%) must be divided by four to calculate the

quarterly coupon payment. The coupon rate is reset every quarter. The following table shows the Libor rate at the beginning of each quarter and the total coupon payment made each quarter by the company.

Floating rate = Reference rate + Spread

Date	Libor	Calculation for Coupon Payment	Coupon Payment	Principal Payment
31 March	120 bps 1.20%			
30 June	100 bps 1.00%	$\frac{(0.0120 + 0.0140)}{4} \times £2{,}000{,}000 =$	£13,000	
30 September	112 bps 1.12%	$\frac{(0.0100 + 0.0140)}{4} \times £2{,}000{,}000 =$	£12,000	
31 December		$\frac{(0.0112 + 0.0140)}{4} \times £2{,}000{,}000 =$	£12,600	£2 million

4.2.1 *Inflation-Linked Bonds*

An inflation-linked bond is a particular type of floating-rate bond. Inflation-linked bonds contain a provision that adjusts the bond's par value for inflation and thus protects the investor from inflation. Recall from the Macroeconomics chapter that inflation will typically reduce an investor's purchasing power from bond cash flows. Changes to the par value reduce the effect of inflation on the investor's purchasing power from bond cash flows. For most **inflation-linked bonds**, the par value—not the coupon rate—of the bond is adjusted at each payment date to reflect changes in inflation (which is usually measured via a consumer price index). The bond's coupon payments are adjusted for inflation because the fixed coupon rate is multiplied by the inflation-adjusted par value. Examples of inflation-linked bonds are Treasury Inflation-Protected Securities (TIPS) in the United States, index-linked gilts in the United Kingdom, and iBonds in Hong Kong.

Because of the inflation protection offered by inflation-linked bonds, the coupon rate on an inflation-linked bond is lower than the coupon rate on a similar fixed-rate bond.

4.3 Zero-Coupon Bonds

As with fixed-rate and floating-rate bonds, zero-coupon bonds have a finite life that ends on the bond's maturity date. **Zero-coupon bonds** do not, however, offer periodic interest payments during the life of the bond. The only cash flow offered by a zero-coupon bond is a single payment equal to the bond's par value that is paid on the bond's maturity date.

Zero-coupon bonds are issued at a discount to the bond's par value—that is, at an issue price that is lower than the par value. The difference between the issue price and the par value received at maturity represents the investment return earned by the bondholder over the life of the zero-coupon bond, and this return is received at maturity.

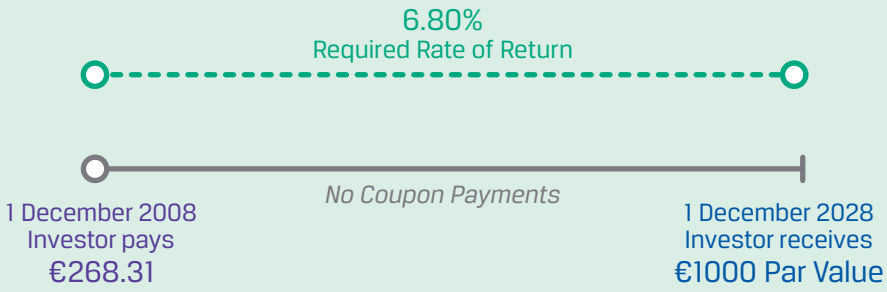
Many debt securities issued with maturities of one year or less are issued as zero-coupon debt securities. For example, Treasury bills issued by the US government are issued as zero-coupon securities. Companies and governments sometimes issue zero-coupon bonds that have maturities of longer than one year. Because of the risk involved when the only payment is the payment at maturity, investors are reluctant to buy zero-coupon bonds with long terms to maturity. If they are willing to do so, the expected return has to be relatively high compared to the interest rate on coupon-paying bonds, and many issuers are reluctant to pay such a high cost for borrowing. Also, if the buyer of a zero-coupon bond decides to sell it prior to maturity, its price could be very different because of changes in interest rates in the market and/or changes in the issuer's creditworthiness.

Example 4 describes the issue of zero-coupon notes by Vodafone on 1 December 2008. Although this issue has a 20-year term to maturity, it is termed a notes issue.

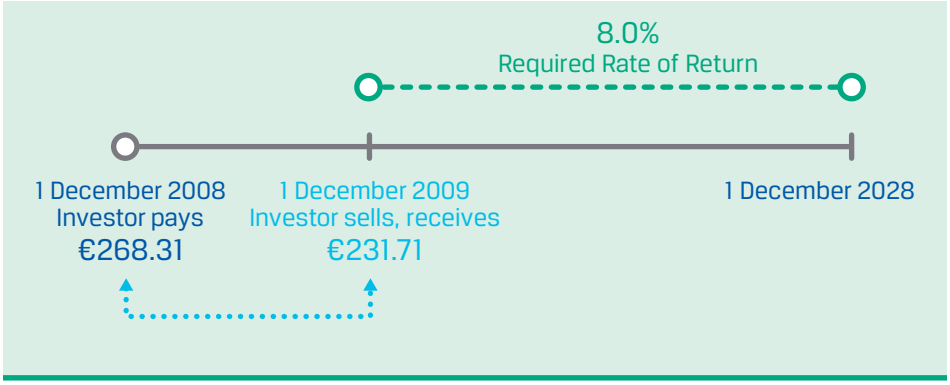
EXAMPLE 4. ZERO-COUPON BOND

On 1 December 2008, Vodafone Group, a UK company, issued zero-coupon notes with a par value of €186.35 million to mature on 1 December 2028. The notes were issued (sold) for 26.83% of par value. In other words, for every €1,000 of par value, investors paid €268.31.

1 If an investor bought the note on 1 December 2008, holds it to maturity, and receives €1,000, the annual return over the life of the bond to the investor is 6.80%. The investor will receive no cash flows before 1 December 2028 unless he or she sells the note. The annual return of 6.80% represents the investor's required rate of return.



2 To illustrate the sensitivity of zero-coupon bonds to changes in required rate of return, assume that an original buyer decides to sell the Vodafone note one year after issue. Furthermore, assume that at that time, given market conditions and the creditworthiness of Vodafone, the required rate of return on the note is 8.0%. Under these circumstances, the original buyer would receive €231.71 for every €1,000 of par value.



5 BONDS WITH EMBEDDED PROVISIONS

Many bonds include features referred to as embedded provisions. Embedded provisions give the issuer or the bondholder the right, but not the obligation, to take certain actions. Common embedded provisions include call, put, and conversion provisions.

Call, put, and conversion provisions are options, a type of derivative instrument discussed in the Derivatives chapter. The following sections describe call, put, and conversion provisions and callable, putable, and convertible bonds.

5.1 Callable Bonds

A call provision gives the issuer the right to buy back the bond issue prior to the maturity date. Bonds that contain a call provision are referred to as callable bonds.

A **callable bond** gives the issuer with the right to buy back (retire or call) the bond from bondholders prior to the maturity date at a pre-specified price, referred to as the call price. The call price typically represents the par value of the bond plus an amount referred to as the call premium. In general, bond issuers choose to include a call provision so that if interest rates fall after a bond has been issued, they can call the bond and issue new bonds at a lower interest rate. In this case, the bond issuer has the ability to retire the existing bonds with a higher coupon rate and issue bonds with a lower coupon rate. For example, consider a company that issues 10-year fixed-rate bonds that are callable starting 3 years after issuance. Suppose that three years after the bonds are issued, interest rates are much lower. The inclusion of the call provision allows the company to buy back the bonds, presumably using proceeds from the issuance of new bonds at a lower interest rate.

It is important to note that the call provision is a benefit to the issuer and is an adverse provision from the perspective of bondholders. In other words, the call provision is an advantage to the issuer and a disadvantage to the bondholder. Consequently, the coupon rate on a callable bond will generally be higher than a comparable bond without an embedded call provision to compensate the bondholder for the risk that the bond may be retired early. This risk is referred to as call risk.

A bond issuer is likely to exercise the call provision when interest rates fall. From the perspective of bondholders, this outcome is unfavourable because the bonds available for the bondholder to purchase with the proceeds from the original bonds will have lower coupon rates. For most callable bonds, the bond issuer cannot exercise the call provision until a few years after issuance. The pre-specified call price at which bonds can be bought back early may be fixed regardless of the call date, but in some cases the call price may change over time. Under a typical call schedule, the call price tends to decline and move toward the par value over time.

5.2 Putable Bonds

A put provision gives the bondholder the right to sell the bond back to the issuer prior to the maturity date. Bonds that contain a put provision are called putable bonds.

A **putable bond** gives bondholders with the right to sell (put back) their bonds to the issuer prior to the maturity date at a pre-specified price referred to as the put price. Bondholders might want to exercise this right if market interest rates rise and they can earn a higher rate by buying another bond that reflects the interest rate increase.

It is important to note that, in contrast to call provisions, put provisions are a right of the bondholder and not the issuer. The inclusion of a put provision is an advantage to the bondholder and a disadvantage to the issuer.

Consequently, the coupon rate on a putable bond will generally be lower than the coupon rate on a comparable bond without an embedded put provision. Bondholders are willing to accept a relatively lower coupon rate on a bond with a put provision because of the downside price protection provided by the put provision. The put provision protects bondholders from the loss in value because they can sell their bonds to the issuing company at the put price.

Putable bonds typically do not start providing bondholders with put protection until a few years after issuance. When a bondholder exercises the put provision, the pre-specified put price at which bonds are sold back to the issuer is typically the bond's par value.

5.3 Convertible Bonds

A conversion provision gives the bondholder the right to exchange the bond for shares of the issuing company's stock prior to the bond's maturity date. Bonds that contain a conversion provision are referred to as convertible bonds.

A **convertible bond** is a hybrid security. A hybrid security has characteristics of and relationships with both equity and debt securities. A convertible bond is a bond issued by a company that offers the bondholder the right to convert the bond into a pre-specified number of common shares of the issuing company at some point prior to the bond's maturity date. Convertible bonds are debt securities prior to conversion, but the fact that they can be converted to common shares makes their value somewhat dependant on the price of the common shares. Because the conversion feature is a benefit to bondholders, convertible bonds typically offer a coupon rate that is lower than the coupon rate on a similar bond without a conversion feature. Convertible bonds are discussed further in the Equity Securities chapter.

6 ASSET-BACKED SECURITIES

Securitisation refers to the creation and issuance of new debt securities, called **asset-backed securities**, that are backed by a pool of other debt securities. The most common type of asset-backed security is backed by a pool of mortgages. In some parts of the world, these asset-backed securities may be referred to as mortgage-backed securities.

Mortgage-backed securities are based on a pool of underlying residential mortgage loans (home loans) or on a pool of underlying commercial mortgage loans. Mortgage loans are loans to homeowners or owners of other real estate who repay the loans through monthly payments. To create mortgage-backed securities, a financial intermediary bundles a pool of mortgage loans from lenders and then issues debt securities against the pool of mortgages.

Mortgage-backed securities have the advantage that default losses and early repayments are much more predictable for a diversified portfolio of mortgages than for individual mortgages. This feature makes them less risky than individual mortgages. Mortgage-backed securities, a diversified portfolio of mortgages, may be attractive to investors who cannot service mortgages efficiently or evaluate the creditworthiness of individual mortgages. By securitising mortgage pools, mortgage banks allow investors who are not wealthy enough to buy hundreds of mortgages to gain the benefits of diversification, economies of scale in loan servicing, and professional credit screening. Other asset-backed securities are created similarly to mortgage-backed securities except that the types of underlying assets differ. For instance, the underlying assets can include credit card receivables, auto loans, and corporate bonds.

Securitisation improves liquidity in the underlying asset markets because it allows investors to indirectly buy assets that they otherwise would not or could not buy directly. Because the financial risks associated with security pools are more predictable than the risks of the individual assets, asset-backed securities are easier to price and, therefore, easier to sell when investors need to raise cash. These characteristics make the markets for asset-backed securities more liquid than the markets for the underlying assets. Because investors value liquidity, they may pay more for securitised assets than for the individual underlying assets.

Investors who buy asset-backed securities receive a portion of the pooled monthly loan payments. Unlike typical debt securities that offer coupon payments on a quarterly, semiannual, or annual basis and a single principal payment paid at the maturity date, most asset-backed securities offer monthly payments that include both an interest component and a principal component.

VALUATION OF DEBT SECURITIES

7

Valuing debt securities is relatively straightforward compared with, say, valuing equity securities (see the Equity Securities chapter) because bonds typically have a finite life and predictable cash flows. The value of a debt security is usually estimated by using a discounted cash flow (DCF) approach. The DCF valuation approach is a valuation approach that takes into account the time value of money. Recall from the discussion of the time value of money in the Quantitative Concepts chapter that the timing of a cash flow affects the cash flow's value. The DCF valuation approach estimates the value of a security as the present value of all future cash flows that the investor expects to receive from the security.

The cash flows for a debt security are typically the future coupon payments and the final principal payment. The value of a bond is the present value of the future coupon payments and the final principal payment expected from the bond. This valuation approach relies on an analysis of the investment fundamentals and characteristics of the issuer. The analysis includes an estimate of the probability of receiving the promised cash flows and an establishment of the appropriate discount rate. Once an estimate of the value of a bond is calculated, it can be compared with the current price of the bond to determine whether the bond is overvalued, undervalued, or fairly valued.

7.1 Current Yield

A bond's **current yield** is calculated as the annual coupon payment divided by the current market price. This measure is simple to calculate and is often quoted. A bond's current yield provides bondholders with an estimate of the annualised return from coupon income only, without concern for the effect of any capital gain or loss resulting from changes in the bond's value over time. The current yield should not be confused with the discount rate used to calculate the value of the bond.

7.2 Valuation of Fixed-Rate and Zero-Coupon Bonds

For fixed-rate bonds and zero-coupon bonds, the timing and promised amount of the interest payments and final principal payment are known. Thus, the value of a fixed-rate bond or zero-coupon bond can be expressed as

$$V_0 = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \ldots + \frac{CF_n}{(1+r)^n}$$

where V_0 is the current value of the bond, CF_t is the bond's cash flow (coupon payments and/or par value) at time t, r is the discount rate, and n is the number of periods until the maturity date. The bond's cash flows and the timing of the cash flows are defined in the bond contract, but the discount rate reflects market conditions as well as the riskiness of the borrower. As always, you are *not* responsible for calculations, but the presentation of formulas and illustrative calculations may enhance your understanding.

It is important to note that the expected payments may not occur if the issuer defaults. Therefore, when estimating the value of a debt security using the DCF approach, an analyst or investor must estimate and use an appropriate discount rate (r) that reflects the riskiness of the bond's cash flows. This discount rate represents the investor's required rate of return on the bond given its riskiness. The expected cash flows of bonds with higher credit risk should be discounted at relatively higher discount rates, which results in lower estimates of value.

Although you are not responsible for calculating a bond's value, Example 5 illustrates how to do so and the effect of using different discount rates. This example also serves to illustrate the effect of a change in discount rates on a bond. A change in discount rates may be the result of a change in interest rates in the market or a change in credit risk of the bond issuer.

EXAMPLE 5. BOND VALUATION USING DIFFERENT DISCOUNT RATES

Consider a three-year fixed-rate bond with a par value of $1,000 and a coupon rate of 6%, with coupon payments made semiannually. The bond will make six coupon payments of $30 (one coupon payment every six months over the life of the bond) and a final principal payment of $1,000 on the maturity date. The value of the bond can be estimated by discounting the bond's promised payments using an appropriate discount rate that reflects the riskiness of the cash flows. If an investor determines that a discount rate of 7% per year, or 3.5% semiannually, is appropriate for this bond given its risk, the value of the bond is $973.36, calculated as

$$V_0 = \frac{\$30}{(1.035)^1} + \frac{\$30}{(1.035)^2} + \frac{\$30}{(1.035)^3} + \frac{\$30}{(1.035)^4} + \frac{\$30}{(1.035)^5} + \frac{\$1{,}030}{(1.035)^6}$$

$$V_0 = \$973.36.$$

For the same bond, if an investor determines that a discount rate of 8% per year, or 4.0% semiannually, is appropriate for this bond given its risk, the value of the bond is $947.58, calculated as

$$V_0 = \frac{\$30}{(1.040)^1} + \frac{\$30}{(1.040)^2} + \frac{\$30}{(1.040)^3} + \frac{\$30}{(1.040)^4} + \frac{\$30}{(1.040)^5} + \frac{\$1{,}030}{(1.040)^6}$$

$$V_0 = \$947.58.$$

For the same bond, if an investor determines that a discount rate of 6% per year, or 3.0% semiannually, is appropriate for this bond given its risk, the value of the bond is $1,000.00, calculated as

$$V_0 = \frac{\$30}{(1.030)^1} + \frac{\$30}{(1.030)^2} + \frac{\$30}{(1.030)^3} + \frac{\$30}{(1.030)^4} + \frac{\$30}{(1.030)^5} + \frac{\$1{,}030}{(1.030)^6}$$

$$V_0 = \$1{,}000.00.$$

For the same bond, if an investor determines that a discount rate of 5% per year, or 2.5% semiannually, is appropriate for this bond given its risk, the value of the bond is $1,027.54, calculated as

$$V_0 = \frac{\$30}{(1.025)^1} + \frac{\$30}{(1.025)^2} + \frac{\$30}{(1.025)^3} + \frac{\$30}{(1.025)^4} + \frac{\$30}{(1.025)^5} + \frac{\$1{,}030}{(1.025)^6}$$
$$V_0 = \$1{,}027.54.$$

Example 5 also illustrates how the relationship between the coupon rate and the discount rate (required rate of return) affects the bond's value relative to the par value. To explain this relationship further,

- if the bond's coupon rate and the required rate of return are the same, the bond's value is its par value. Thus, the bond should trade at par value.
- if the bond's coupon rate is lower than the required rate of return, the bond's value is less than its par value. Thus, the bond should trade at a discount (trade at less than par value).
- if the bond's coupon rate is higher than the required rate of return, the bond's value is greater than its par value. Thus, the bond should trade at a premium (trade at more than par value).

In the case of a zero-coupon bond, the only promised payment is the par value on the maturity date. To estimate the value of a zero-coupon bond, the single promised payment equal to the bond's par value is discounted to its present value by using an appropriate discount rate that reflects the riskiness of the bond.

7.3 Yield to Maturity

Investors can also use the DCF approach to estimate the discount rate implied by a bond's market price. The discount rate that equates the present value of a bond's promised cash flows to its market price is the bond's **yield to maturity**, or yield. An investor can compare this yield to maturity with the required rate of return on the bond given its riskiness to decide whether to purchase it.

A bond's yield to maturity can be expressed as

$$P_0 = \frac{CF_1}{(1 + r_{ytm})^1} + \frac{CF_2}{(1 + r_{ytm})^2} + \frac{CF_3}{(1 + r_{ytm})^3} + \ldots + \frac{CF_n}{(1 + r_{ytm})^n}$$

where P_0 represents the current market price of the bond, and r_{ytm} represents the bond's yield to maturity.

Many investors use a bond's yield to maturity to approximate the annualised return from buying the bond at the current market price and holding it until maturity, assuming that all promised payments are made on time and in full. When a bond's payments are known, as in the case of fixed-rate bonds and zero-coupon bonds, the yield to maturity can be inferred by using the current market price. Example 6 shows the calculation of yield to maturity. Again, you are *not* responsible for knowing how to do the calculation.

EXAMPLE 6. YIELD TO MATURITY

Consider a fixed-rate bond with exactly five years remaining until maturity, a par value of $1,000 per unit, and a coupon rate of 4% with semiannual payments. The bond is currently trading at a price of $914.70. With this information, the bond's yield to maturity can be found by solving for r_{ytm}:

$$\$914.70 = \frac{\$20}{\left(1 + r_{ytm}\right)^{1}} + \frac{\$20}{\left(1 + r_{ytm}\right)^{2}} + \frac{\$20}{\left(1 + r_{ytm}\right)^{3}} + \ldots + \frac{\$1{,}020}{\left(1 + r_{ytm}\right)^{10}}.$$

The bond's yield to maturity is the discount rate that makes the present value of the bond's promised cash flows equal to its market price. The bond's future cash flows consist of 10 semiannual coupon payments of $20 occurring every 6 months and a final principal payment of $1,000 on the maturity date in 5 years, or 10 semiannual periods. In this case, r_{ytm} is 3% on a semiannual basis, or 6% annualised. Thus, at a price of $914.70, the bond's yield to maturity is 6%.

The current yield is calculated as $40/$914.70 = 4.37%. You can see that the current yield and the yield to maturity differ.

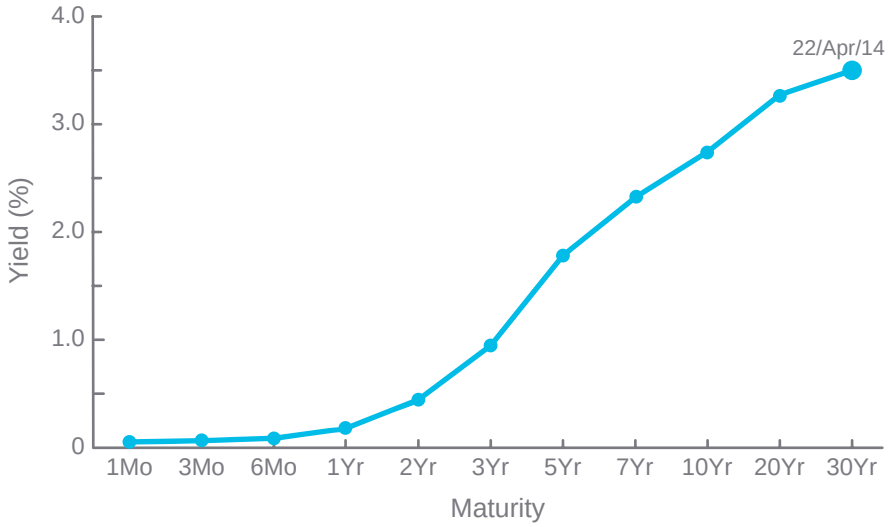
It is important to understand that bond prices and bond yields to maturity are inversely related. That is, as bond prices fall, their yields to maturity increase, and as bond prices rise, their yields to maturity decrease.

7.4 Yield Curve

When investors try to determine the appropriate discount rate (yield to maturity or required rate of return) for a particular bond, they often begin by looking at the yields to maturity offered by government bonds. The **term structure of interest rates**, often referred to simply as the term structure, shows how interest rates on government bonds vary with maturity. The term structure is often presented in graphical form, referred to as the **yield curve**. The yield curve graphs the yield to maturity of government bonds (y-axis) against the maturity of these bonds (x-axis). It is important when developing a yield curve to ensure that bonds have identical features other than their maturity, such as identical coupon rates. In other words, the bonds considered should only differ in maturity.

A yield curve applied by investors to US debt securities is the US Treasury yield curve, which graphs yields on US government bonds by maturity. Exhibit 2 illustrates the US Treasury yield curve as of 22 April 2014. In this case, the yield curve is upward sloping, indicating that longer-maturity bonds offer higher yields to maturity than shorter-maturity bonds. For example, the yield to maturity on a 30-year Treasury bond is 3.50%, but the yield to maturity on a 1-year Treasury bill is only 0.11%.

Exhibit 2 US Treasury Yield Curve, 22 April 2014



Source: Based on data from the US Department of the Treasury (www.treasury.gov).

Although an upward-sloping curve is the norm, there are times when the yield curve may be flat, meaning that the yield to maturity of US Treasury bonds is the same no matter what the maturity date is. There are also times when the yield curve is downward sloping, or inverted, which can happen if interest rates are expected to decline in the future.

The term structure for government bonds, such as Treasury bonds, provides investors with a base yield to maturity, which serves as a reference to compare yields to maturity offered by riskier bonds. Relative to Treasury bonds, riskier bonds should offer higher yields to maturity to compensate investors for the higher credit or default risk.

RISKS OF INVESTING IN DEBT SECURITIES 8

Investing in debt securities is generally considered less risky than investing in equity securities, but bondholders still face a number of risks. These risks include credit risk, interest rate risk, inflation risk, liquidity risk, reinvestment risk, and call risk. A change in a bond's risk will affect its required rate of return and its price. The required rate of return can be thought of as the yield to maturity required by an investor. Riskier bonds typically have higher yields to maturity, reflecting the higher required rate of return.

8.1 Credit Risk

Credit risk, sometimes referred to as default risk, is the risk of loss if the borrower, or bond issuer, fails to make full and timely payments of interest and/or principal. Debt securities represent legal obligations, but the issuer may face financial hardship and consequently not have the money available to make the promised interest and/or principal payments. In this case, bondholders may lose a substantial amount of their invested capital.

It is important to note that credit risk can affect bondholders even when the company does not actually default on its payments. For example, if market participants suspect that a particular bond issuer will not be able to make its promised bond payments because of adverse business or general economic conditions, the probability of future default will increase and the bond price will likely fall in the market. Consequently, investors holding that particular bond will be exposed to a price decline and a potential loss of money if they want to sell the bond.

8.1.1 *Credit Rating*

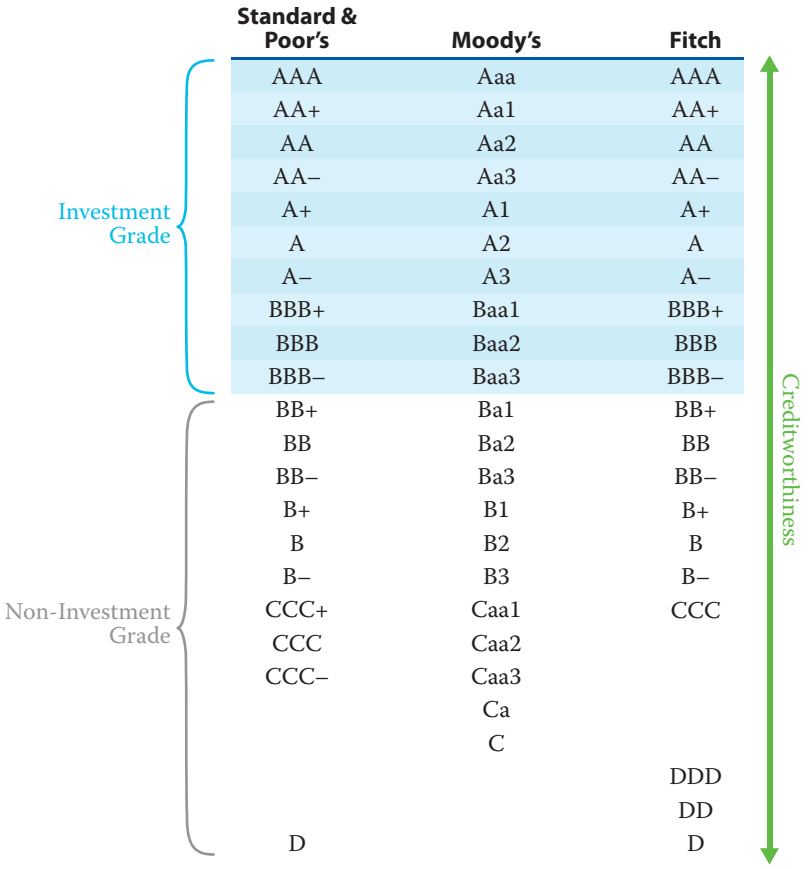
Investors may be able to assess the credit risk of a bond by reviewing its **credit rating**. Independent credit rating agencies assess the credit quality of particular bonds and assign them ratings based on the creditworthiness of the issuer. Exhibit 3 presents the credit ratings systems of Standard & Poor's, Moody's Investors Service, and Fitch Ratings.

Bonds are classified based on credit risk as **investment-grade bonds** (those in the shaded area of Exhibit 3) or **non-investment-grade bonds** (those in the non-shaded area of Exhibit 3). The term investment-grade bonds comes from the fact that regulators often specify that certain investors, such as insurance companies and pension funds, must restrict their investments to or largely hold bonds with a high degree of creditworthiness (low risk of default).

Non-investment-grade bonds are commonly referred to as **high-yield bonds** or **junk bonds**. They are called junk bonds because they are less creditworthy and have a greater probability of default. Investors in these bonds prefer the term high-yield bonds, which acknowledges the higher yields (expected returns) on these bonds because of the higher level of risk. Recall that the riskier the borrower—or the less certain the borrower's apparent ability to repay the loan—the higher the level of interest demanded by the lender.

Although both individual and institutional investors tend to own investment-grade bonds, investors with a willingness to take on greater risk in exchange for higher expected returns dominate the high-yield bond market.

Exhibit 3 Rating Systems Used by Major Credit Rating Agencies



Credit rating agencies assign a bond rating at the time of issue, but they also review the rating and may change a bond's credit rating over time depending on the issuer's perceived creditworthiness. An improvement in credit rating is referred to as an upgrade, and a reduction in credit rating is referred to as a downgrade. A high credit rating gives a bond issuer two major benefits: the ability to issue debt securities at a lower interest rate and the ability to access a larger pool of investors. The larger pool of investors will include institutional investors that must hold significant portions of their investment assets in investment-grade bonds.

8.1.2 *Credit Spreads*

US Treasuries and government bonds of some developed and emerging countries are considered very safe securities that carry minimal default risk. Consequently, relative to these government bonds, yields on other bonds are typically higher. Investors commonly refer to the difference between a risky bond's yield to maturity and the yield to maturity on a government bond with the same maturity as the risky bond's **credit spread**. The credit spread tells the investor how much extra yield is being offered for investing in a bond that has a higher probability of default. Example 7 shows the credit spread for a bond issue by Caterpillar Inc.

EXAMPLE 7. CREDIT SPREADS

Caterpillar, a US company, has a bond outstanding with a maturity date of 27 May 2041. The bond's coupon rate is 5.2%. On 13 April 2012, the bond was trading at a price of $1,185.32, representing a yield to maturity of 4.10%. The bond has approximately 29 years remaining until maturity as of 13 April 2012. On that same date, 30-year Treasury bonds are yielding 3.22%.

The bond's credit spread over a 30-year Treasury is 4.10% – 3.22% = 0.88%, or 88 bps. The extra yield, or credit spread, being offered by the Caterpillar bond serves as compensation to the investor for taking a higher risk relative to the Treasury bond.

Higher-risk bonds, such as junk bonds, trade at wider credit spreads because of their higher default risk. Similarly, lower-risk bonds trade at narrower credit spreads relative to high-risk bonds. Credit spreads enable investors to compare yield differences across bonds of different credit quality. If a bond is perceived to have become more risky, its price will fall and its yield will rise, which will likely result in a widening of the bond's credit spread relative to a government bond with the same maturity. Similarly, a bond perceived to have experienced an improvement in credit quality will see its price rise and its yield fall, likely resulting in a narrower credit spread relative to a comparable government bond.

8.2 Interest Rate Risk

Interest rate risk is the risk that interest rates will change. Interest rate risk usually refers to the risk associated with decreases in bond prices resulting from increases in interest rates. This risk is particularly relevant to fixed-rate bonds and zero-coupon bonds. Bond prices and interest rates are inversely related; that is, bond prices increase as interest rates decrease and bond prices decrease as interest rates increase. Example 4, in the zero-coupon bond section, illustrates the effect of an interest rate change on a zero-coupon bond.

Prices of zero-coupon and fixed-rate bonds can decline significantly in an environment of rising interest rates. However, because coupon rates on floating-rate bonds are reset to current market interest rates at each payment date, floating-rate bonds exhibit less interest rate risk with respect to rising interest rates. But a floating-rate bond may exhibit interest rate risk in an environment of declining interest rates because bondholders receive less coupon income when the bond's coupon rate is reset to a lower rate.

8.3 Inflation Risk

Nearly all debt securities expose investors to **inflation risk** because the promised interest payments and final principal payment from most debt securities are nominal amounts—that is, the amounts do not change with inflation. Unfortunately, as inflation makes products and services more expensive over time, the purchasing power of the coupon payments and the final principal payment on most bonds declines.

Floating-rate bonds partially protect against inflation because the coupon rate adjusts. They provide no protection, however, against the loss of purchasing power of the principal payment. Investors who are concerned about inflation and want protection against it may prefer to invest in inflation-linked bonds, which adjust the principal (par) value for inflation. Because the coupon payment is based on the par value, the coupon payment also changes with inflation.

8.4 Other Risks

In addition to credit risk, interest rate risk, and inflation risk, investors in debt securities also face a number of other risks, including liquidity risk, reinvestment risk, and call risk.

Liquidity risk refers to the risk of being unable to sell a bond prior to the maturity date without having to accept a significant discount to market value. Bonds that do not trade very frequently exhibit high liquidity risk. Investors who want to sell their relatively illiquid bonds face higher liquidity risk than investors in bonds that trade more frequently.

Reinvestment risk refers to the fact that in a period of falling interest rates, the coupon payments received during the life of a bond and/or the principal payment received from a bond that is called early must be reinvested at a lower interest rate than the bond's original coupon rate. If market interest rates fall after a bond is issued, bondholders will most likely have to reinvest the income received on the bond (the coupon payment) at the current lower interest rates.

Call risk, sometimes referred to as prepayment risk, refers to the risk that the issuer will buy back (redeem or call) the bond issue prior to maturity through the exercise of a call provision. If interest rates fall, issuers may exercise the call provision, so bondholders will have to reinvest the proceeds in bonds offering lower coupon rates. Callable bonds, and most mortgage-backed securities based on loans that allow the borrowers to make loan prepayments in advance of their maturity date, are subject to prepayment risk.

How do the risks of a bond affect its price in the market? The yield to maturity on a bond is a function of its maturity and risk. In general, two bonds with the same maturity and risk should trade at prices that offer approximately the same yield to maturity. For example, two five-year bonds with the same liquidity and a BBB rating will trade at approximately equal yields to maturity.

Low-risk bonds, such as many government bonds, trade at relatively lower yields to maturity, which imply relatively higher prices. Similarly, high-risk bonds, such as junk bonds, trade at relatively higher yields to maturity, which imply relatively lower prices. Relative to secured debt, subordinated debt securities offer higher yields to maturity, which reflect their higher default risk.

SUMMARY

As the Canadian entrepreneur found out, debt securities are an alternative to bank loans for raising capital and financing growth. But debt securities generally have more features than bank loans and must be understood before they are used. Both issuers and investors need to fully understand the key features and risks of financing with debt securities. The financial consequences of not doing so can be substantial.

The following points recap what you have learned in this chapter about debt securities:

- Debt security or bond issuers are typically companies and governments.
- A typical debt security is characterised by three features: par value, coupon rate, and maturity date.
- Coupon and principal payments must be made on scheduled dates. If the issuer fails to make the promised payments, it is in default and bondholders may be able to take legal action to attempt to recover their investment.
- Debt securities are classified as either secured debt securities (secured by collateral) or unsecured debt securities (not secured by collateral). Debtholders have a higher priority claim than equityholders if a company liquidates, but priority of claims or seniority ranking can vary among debtholders.
- Bonds may pay fixed-rate, floating-rate, or zero coupon payments.
- Fixed-rate bonds are the most common bonds. They offer fixed coupon payments based on an interest (or coupon) rate that does not change over time. These coupon payments are typically paid semiannually.
- Floating-rate bonds typically offer coupon payments based on a reference rate that changes over time plus a fixed spread; the reference interest rate is reset on each coupon payment date to reflect current market rates.
- The only cash flow offered by a zero-coupon bond is a single payment equal to the bond's par value to be paid on the bond's maturity date.
- Many bonds come with embedded provisions that provide the issuer or the bondholder with particular rights, such as to call, put, or convert the bond.
- Securitisation is a process that creates new debt securities backed by a pool of other debt securities. These new debt securities are called asset-backed securities. Most asset-backed securities generate monthly payments that include both interest and principal components.
- A bond's current yield is calculated as the annual coupon payments divided by the current market price. It provides an estimate of return from coupon income only.
- The value of a typical debt security is usually estimated by using a discounted cash flow approach, which estimates the value of a debt security as the present value of all future cash flows (interest and principal payments) that are expected

from the debt security. The discount rate used to estimate present value represents the required rate of return on the debt security based on market conditions and riskiness.

- The discount rate that equates the present value of a bond's promised cash flows to its market price is called the yield to maturity, or yield. Investors use a bond's yield to approximate the annualised return from buying the bond at the current market price and holding the bond until maturity.
- The term structure of interest rates depicts the relationship between government bond yields and maturities and is often presented in graphical form as the yield curve.
- The primary risks of investing in debt securities are credit or default risk, interest rate risk, inflation risk, liquidity risk, reinvestment risk, and call risk.
- The credit spread is the difference in the yields of two bonds with the same maturity but different credit quality. Investors commonly assess the credit spread of risky corporate bonds relative to government bonds, such as US Treasury bonds.