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Financial Investment

Class 4: Fixed-income markets

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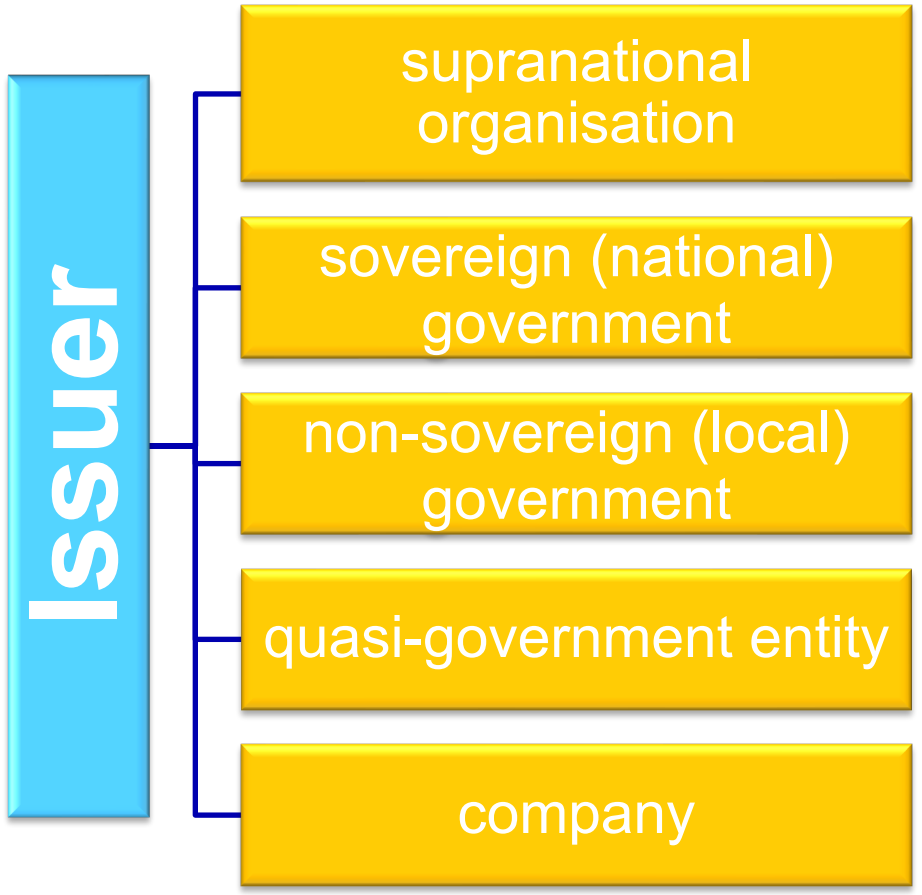
Basic features of a Bond

Creditworthiness

- investment-grade bonds
- non-investment-grade bonds



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Basic features of a Bond

Maturity

- The maturity date is the date when the issuer is obligated to redeem the bond.
- The tenor, also known as term to maturity, is the time remaining until the bond's maturity date.
  - Money market securities are fixed-income securities with maturity up to one year.
  - Capital market securities are fixed-income securities with maturity longer than one year.

Par value (principal) of a bond

- The par value of a bond is the amount the issuer agrees to repay the bondholders on the maturity date.

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Basic features of a Bond

Coupon rate and frequency

- The coupon or nominal rate (yield) of a bond is the interest rate that the issuer agrees to pay each year until the maturity date.
- The coupon is the annual amount of interest payments and is determined by multiplying the coupon rate by the par value of the bond.
  - Plain vanilla bonds pay a fixed rate of interest.
  - Floating-rate notes (FRNs) or floaters pay a floating rate: a reference rate plus a spread.
  - Bonds that do not pay interest are called “zero-coupon bonds.”

Basic features of a Bond

Currency denomination

- Bonds can be issued in any currency, mostly US dollars and euros.
- Dual-currency bonds make coupon payments in one currency and pay the par value at maturity in another currency.
- Currency option bonds are a combination of a single currency bond plus a foreign currency option.

Bond indenture

- The trust deed is the legal contract that describes the form of the bond, the obligations of the issuer, and the rights of the bondholders.
- This legal contract is often called the “bond indenture.”
- The indenture is written in the name of the issuer and references features of the bond issue, such as par value, coupon rate and frequency, maturity date, and the funding sources for the interest and principal repayments, as well as any collaterals, covenants, and credit enhancements.

Bond indenture

Legal identity of the bond issuer and its legal form

- The legal obligation to make the contractual payments is assigned to the bond issuer. The issuer is identified in the indenture by its legal name.

For sovereign bonds	• The issuer is usually the office responsible for the national budget.
For corporate bonds	• The issuer might be a holding company or a subsidiary.
For securitised bonds	• The legal obligation usually lies with special purpose vehicles.

Bond indenture

Sources of repayment proceeds

Sovereign bonds

- Sovereign bonds are backed by the “full faith and credit” of the national government and thus by that government’s ability to raise tax revenues and print money.

Non-sovereign government bonds

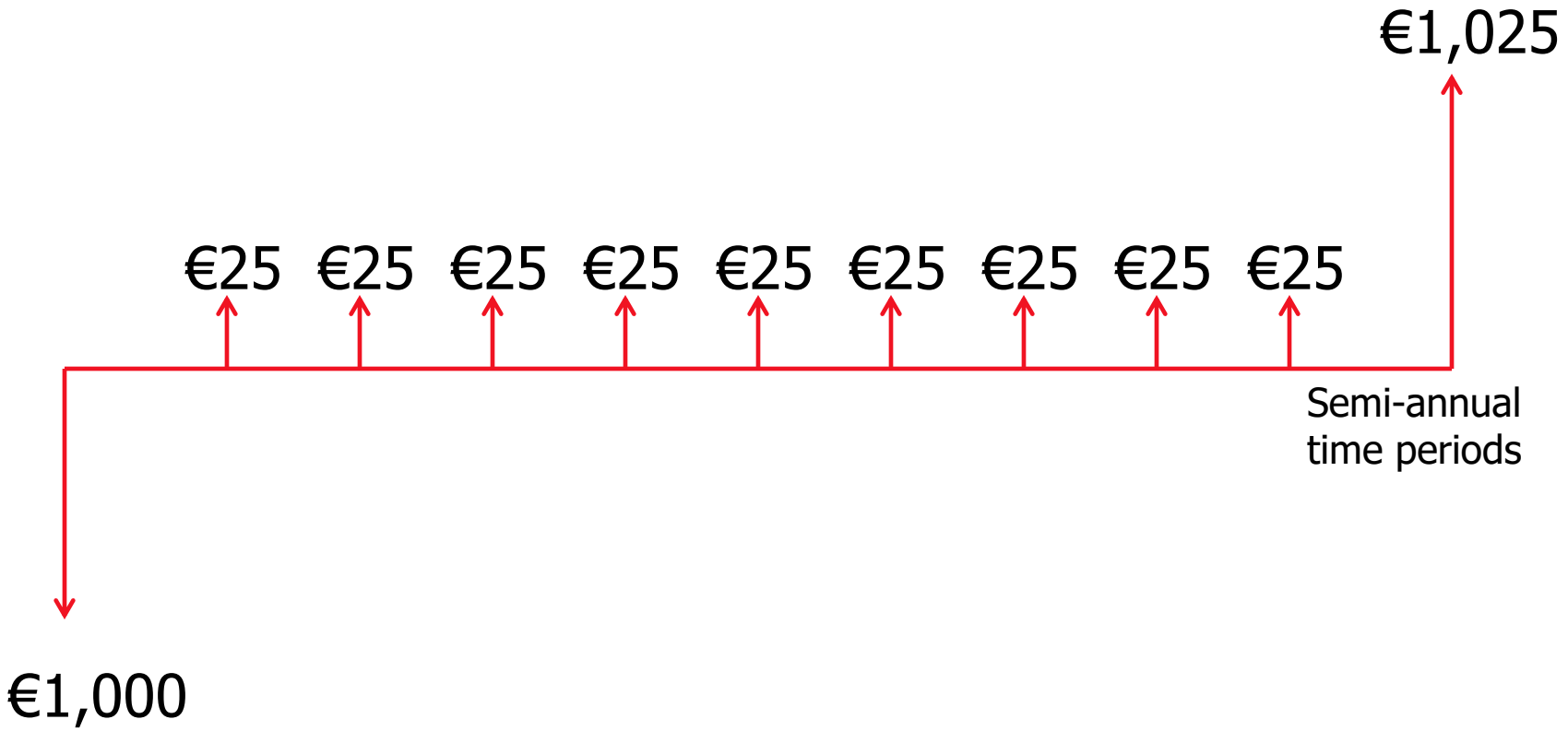
- The major sources for repayment include the general taxing authority of the issuer, the cash flows of the project the bond issue is financing, and special taxes or fees established specifically for the purpose of funding the payments of interest and principal.

Corporate bonds

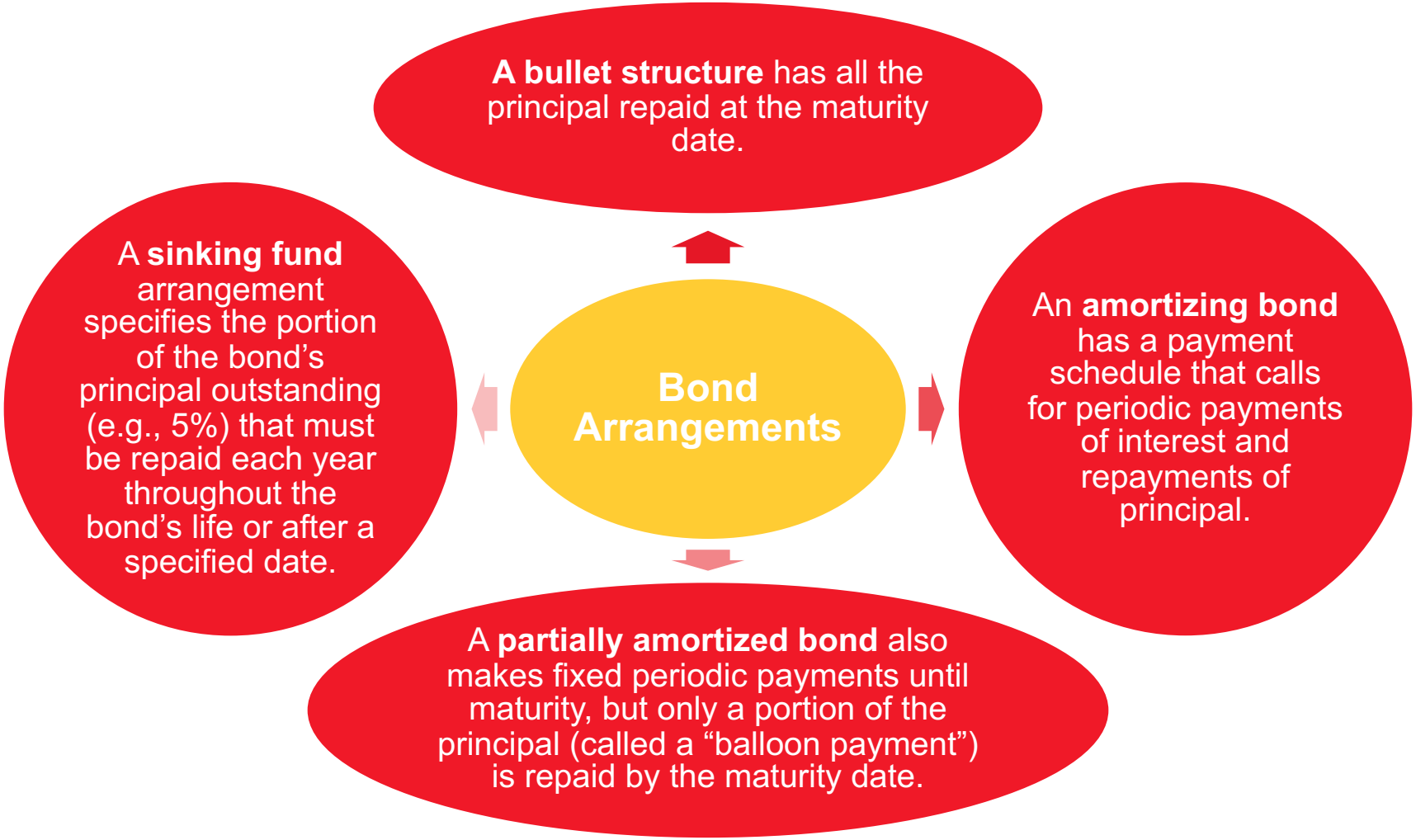
- The source of payment for corporate bonds is the issuer’s ability to generate cash flows, primarily through its operations

Structure of a bond's cash flows

- The most common payment structure by far is that of a plain vanilla bond, as depicted below.



Principal repayment structures



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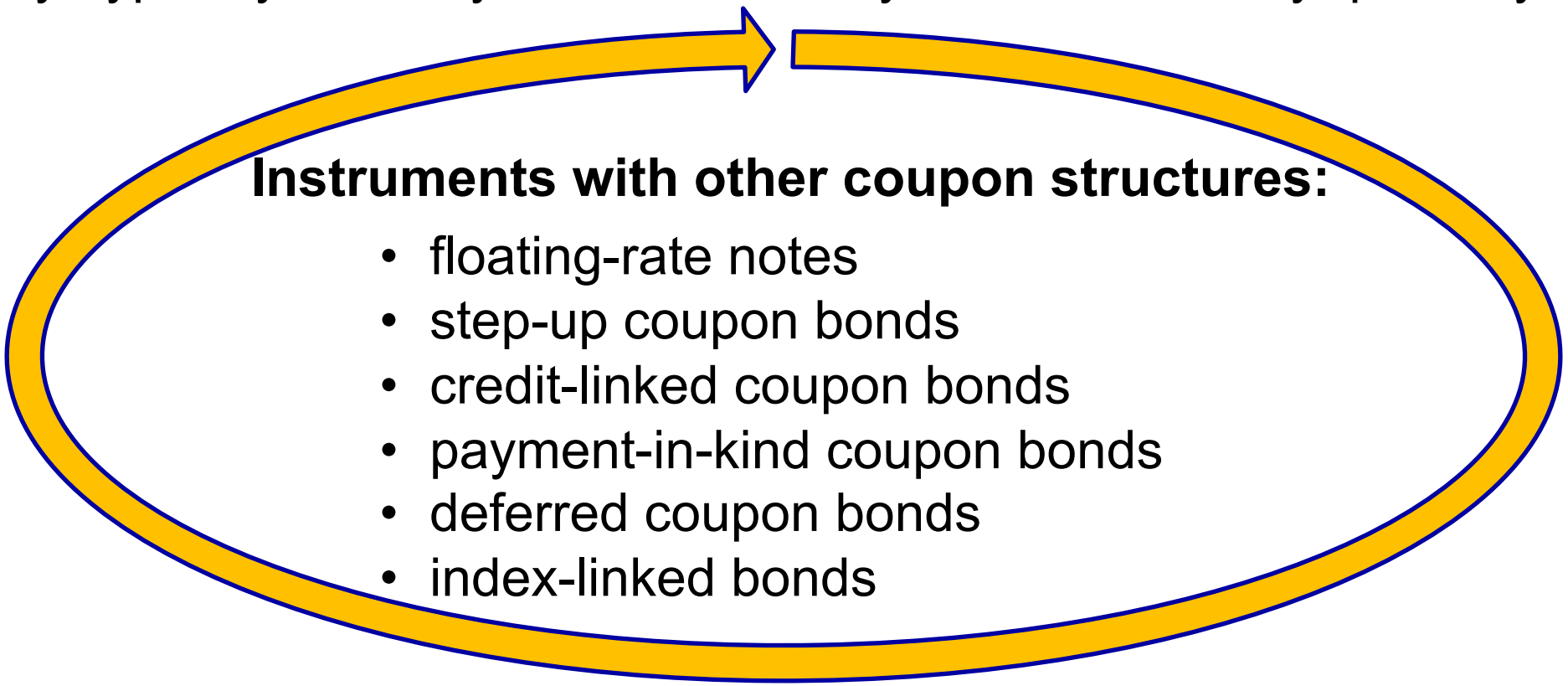
Coupon payment structures

- Conventional bonds pay a fixed periodic coupon over a specified time to maturity, typically annually or semi-annually and occasionally quarterly.



Coupon payment structures

- FRNs typically pay a quarterly coupon.
- The coupon is determined by the formula

FRNs	are usually less affected by changes in interest rates.
FRNs	may have additional features, such as a floor or a cap.
Inverse FRNs	(inverse floaters) are bonds whose coupon rates have an inverse relationship to the reference rate.

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Coupon payment structures

Step-up coupon bonds

- have a fixed or floating coupon, which increases by specified margins at specified dates
- offer bondholders some protection against rising interest rates and may be an important feature for callable bonds

Credit-linked coupon bonds

- have a coupon that changes when the bond's credit rating changes
- Are attractive to investors who are concerned about the future creditworthiness of the issuer

Coupon payment structures

Payment-in-kind (PIK) bonds

- Typically allow the issuer to pay interest in the form of additional amounts of the bond issue rather than a cash payment
- Typically, are favored by issuers who are concerned that the issuer may face potential cash flow problems in the future

Deferred coupon (i.e., split coupon) bonds

- Pay no coupon for the first few years but then pay a higher coupon than they otherwise normally would for the remainder of their life
- They are also common in project financing when the assets being developed do not generate any income during the development phase

Coupon payment structures

Index-linked bonds

have their coupon payments and/or principal repayment linked to a specified index

- Bonds can potentially be linked to any published economic and financial variable/index.
- Bonds linked to a rate of inflation are called “inflation-linked bonds” (e.g., Treasury inflation-protected securities, or TIPS, in the United States.

- Cash flows of the index-linked bond can be linked to the specified index by linking the interest payments (interest-indexed bonds), the principal repayment (zero-coupon bonds), or both (capital-indexed bonds and indexed annuity bonds).

- An equity-linked note (ELN) is a fixed-income security that differs from a conventional bond in that the final payment is based on the return of an equity index.

Bonds with contingency provisions

- A contingency provision is a clause in a legal document that allows for some action if the event or circumstance does occur (i.e., embedded option).
- Some common types of bonds with embedded options include callable bonds, putable bonds, and convertible bonds.

Bonds with contingency provisions

Callable bonds

- Callable bonds give the issuer the right to redeem all or part of the bond before the specified maturity date.
- The primary reason why issuers choose to issue callable bonds rather than non-callable bonds is to protect themselves against a decline in interest rates.

Putable bonds

- The bondholder has the right to sell the bond back to the issuer at a pre-determined price on specified dates.
- Putable bonds are beneficial for the bondholder by guaranteeing a pre-specified selling price at the redemption dates.

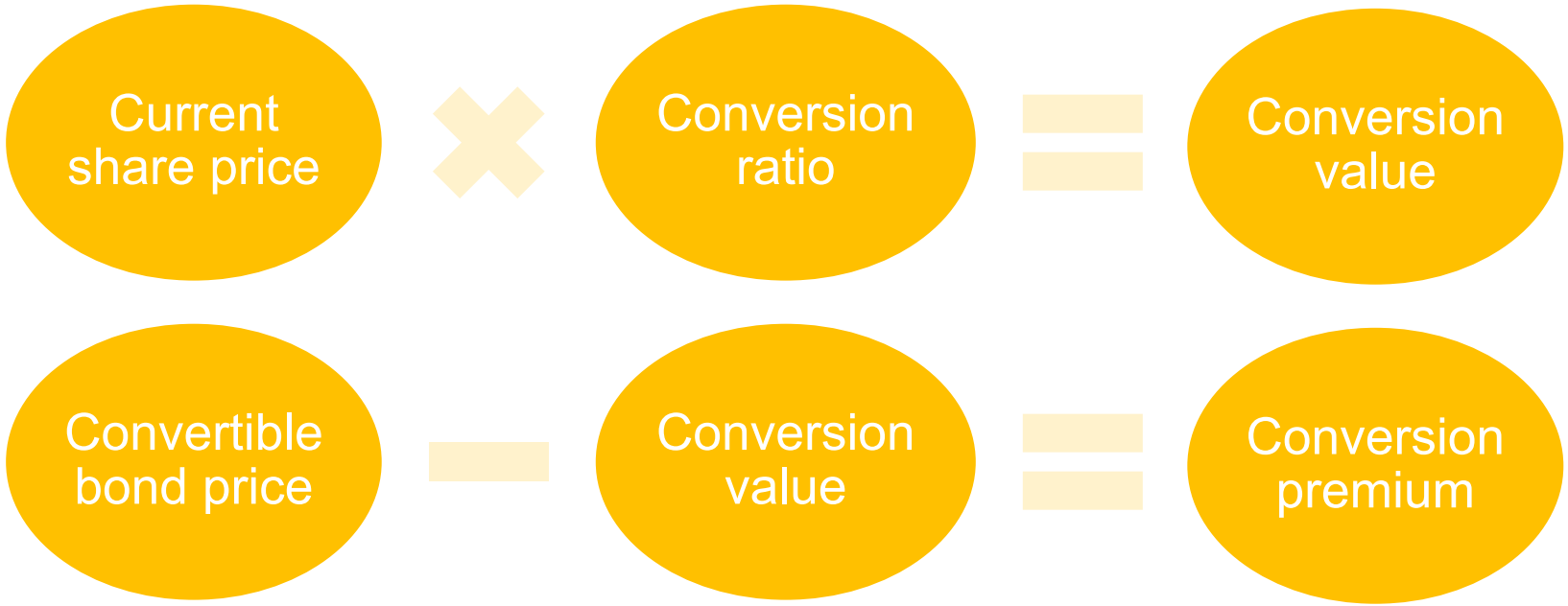
Bonds with contingency provisions

Convertible bonds

- They are a hybrid security with both debt and equity features.
- The bondholder has the right to exchange the bond for a specified number of common shares in the issuing company.
- They are beneficial to bondholders.
- The bondholder has the ability to convert bonds into equity in case of share price appreciation and thus participate in the equity up side.
- At the same time, the bondholder receives downside protection; if the share price does not appreciate, the convertible bond offers the comfort of regular coupon payments and the promise of principal repayment at maturity.

Bonds with contingency provisions

- The conversion price is the price per share at which the convertible bond can be converted into shares.
- The conversion ratio is the number of common shares that each bond can be converted into.



Bond valuation

- Bond pricing is an application of discounted cash flow analysis.
  - **Bond price** should be equal to the value of all discounted future cash flows.
- On an option-free fixed-rate bond, the promised future cash flows are a series of coupon interest payments and repayment of the full principal at maturity.
- The market discount rate is used to obtain the present value.
  - The **market discount rate** is the rate of return required by investors given the risk of the investment in the bond.

Formula for calculating the bond price given the market discount rate:

$$\mathrm{PV} = \frac{\mathrm{PMT}}{(1+r)^1} + \frac{\mathrm{PMT}}{(1+r)^2} + \cdots + \frac{\mathrm{PMT}+\mathrm{FV}}{(1+r)^N}$$

where

PV	is the present value (price) of the bond
PMT	is the coupon payment per period
FV	is the future value paid at maturity, or the bond's par value
r	is the required rate of return per period
N	is the number of evenly spaced periods to maturity

- The price of a fixed-rate bond, relative to par value, depends on the relationship of the coupon rate to the market discount rate.

If the bond price is higher than par value, the bond is said to be traded **at a premium.**	• This happens when the coupon rate is greater than the market discount rate.
If the bond price is lower than par value, the bond is said to be traded **at a discount.**	• This happens when the coupon rate is less than the market discount rate.
If the bond price is equal to par value, the bond is said to be traded **at par.**	• This happens when the coupon rate is equal to the market discount rate.

The **yield-to-maturity** is the internal rate of return on a bond's cash flows. It is the implied market discount rate.

The **yield-to-maturity (YTM)** is the rate of return on the bond to an investor provided three conditions are met:

- The investor holds the bond to maturity.
- The issuer does not default on coupon or principal payments.
- The investor is able to reinvest coupon payments at that same yield.

Therefore, the yield-to-maturity is the promised yield.

- Because the market discount rates for the cash flows with different maturities are rarely the same, it is fundamentally better to calculate the price of a bond by using a sequence of market discount rates that correspond to the cash flow dates.

General formula for calculating a bond price given the sequence of spot rates:

$$\mathrm{PV} = \frac{\mathrm{PMT}}{(1+Z_1)^1} + \frac{\mathrm{PMT}}{(1+Z_2)^2} + \cdots + \frac{\mathrm{PMT}+\mathrm{FV}}{(1+Z_N)^N}$$

where Z_1, Z_2, *and* Z_N are spot rates for period 1, 2, and N, respectively.

Example. Suppose that the one-year spot rate is 2%, the two-year spot rate is 3%, and the three-year spot rate is 4%. Calculate the price of a three-year 5% annual coupon paying bond:

$$\frac{5}{(1.02)^1} + \frac{5}{(1.03)^2} + \frac{105}{(1.04)^3} =$$

$$4.902 + 4.713 + 93.345 = \mathbf{102.960}$$

The bond price is 102.960.

• The present values of the individual cash flows discounted using spot rates differ from those using yield-to-maturity, but the sum of the present values is the same. Thus, the same price is obtained using either approach.