FitchLearning

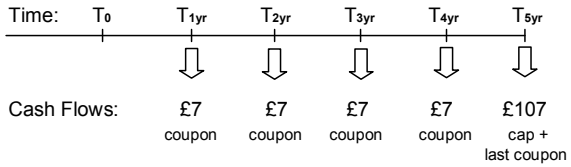
# Chapter 7
Debt Valuation

4-6 questions

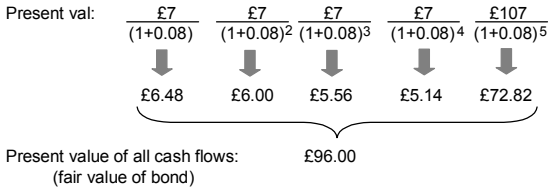
## 2. Debt Valuation

**Bond calculations**

A bond is a series of cash flows:




Its value is calculated as the present value of the cash flows discounted at a required return, e.g. 8%:






## Keeping on target

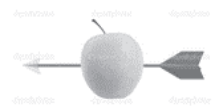
A 2 year annual coupon bond redeems at $100 and pays a coupon of 6%. If yields are 7% p.a., what is the price of the bond closest to?

A. $98.192

B. $101.833

C. $97.192

D. $100.833



## 2. Debt Valuation

**Bond calculations**

An alternative is to use the annuity formula to take care of the coupons and simply add the capital present value afterwards:

$$£7 \times \frac{1}{0.08}\left[1 - \frac{1}{(1+0.08)^5}\right] + \left[\frac{£100}{(1+0.08)^5}\right]$$

$$\left(£7 \times \frac{1}{0.08} \times 0.3194\right) + \left[\frac{£100}{(1+0.08)^5}\right]$$

$$\left(\frac{£7}{0.08} \times 0.3194\right) + £68.06$$

£27.94 + £68.06

£96.00



## Keeping on target

X Ltd has an 8 year bond in issue, coupon 6%, nominal value £1000. Calculate the price of the bond if the yield is 4% p.a.

A. £746.22

B. £1,134.65

C. £1,163.88

D. £1,212.54

**Answers to the questions on the previous slide:**

A

$\$6 / 1.07 + \$106 / 1.07^2 = \$98.19$

## 2. Debt Valuation

**Credit ratings**

| | Standard & Poor's | Moody's |
|---|---|---|
| Investment grade | AAA | Aaa |
| | AA | Aa |
| | A | A |
| | BBB | Baa |
| Speculative grade | BB | Ba |
| | B | B |
| | CCC | Caa |
| | CC | Ca |
| | C | C |
| | D | D |



# Further information

The three most prominent credit rating agencies that provide these ratings are Standard & Poor's, Moody's and Fitch.

Fitch ratings are not shown in this table as they use a similar system to Standard & Poor's.

The rating is defined by the business risk and financial risk of the issuer.

When conducting a credit rating assessment, rating agencies typically focus on a number of key factors, including:

- Financial statements
- Macro-economic forecasts
- Industry trends
- Regulatory developments
- Management quality
- The bond's covenant
- Financial ratios

**Answer to question on previous slide**

B

£60 x 1 / 0.04 x (1 – 1 / $1.04^8$) + £1000 / $1.04^8$ = £1,134.65

## 3. Prices and Yields

**Bond yield calculations**

Flat yield:

$$\text{Flat yield} = \frac{\text{Gross annual coupon}}{\text{Market price}} \text{ x } 100\%$$

## 3. Prices and Yields

Gross redemption yield

$$\text{Bond price} = £\text{coupon} \times \frac{1}{r} \times \left[1 - \frac{1}{(1+r)^n}\right] + \frac{CAP}{(1+r)^n}$$

Which one of the following is the best approximation of the gross redemption yield of an annual 8% two year gilt with a current price of £103?

A. 6.3%

B. 7.1%

C. 9.2%

D. 10.7%



## Further information

The **yield to maturity** (YTM) is also known as the **gross redemption yield** (GRY), it represents the **internal rate of return (IRR)**, expressed as an annualised percentage rate, if one was to hold on to the bond until maturity. One key assumption of the YTM calculation, is that one is able to reinvest all the interest payments received at the same yield throughout.

The **net redemption yield** can be calculated as the **internal rate of return** (IRR) of:

- The dirty price paid to buy the bond
- The net coupons received to redemption (net of the appropriate rate of tax)
- The final redemption proceeds which are paid gross

## Keeping on target

Which one of the following is the best approximation of the gross redemption yield of an 5% two year annual gilt with a current price of £98.17?

A. 2.99%

B. 3.00%

C. 5.98%

D. 6.00%

## Keeping on target

Which one of the following is the best approximation of the gross redemption yield of an 5% two year semi-annual gilt with a current price of £98.17?

A. 2.99%

B. 3.00%

C. 5.98%

D. 6.00%

## 3. Prices and Yields

Net redemption yield

$$\text{Bond price} = \text{£coupon}\ (1-t)\ x\ \frac{1}{r}\ x\left[1-\frac{1}{(1+r)^n}\right]+\frac{CAP}{(1+r)^n}$$

Which one of the following is the best approximation of the net redemption yield of an annual 8% two year gilt with a current price of £103, for a 20% taxpayer?

A. 3.7%

B. 4.8%

C. 5.9%

D. 7.0%



## Keeping on target

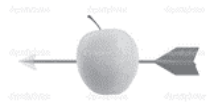
If the higher rate of tax is 40%, which **one** of the following is the best approximation of the net redemption yield of an annual 6% five year gilt with a current price of £98?

A. 4.05%

B. 4.99%

C. 6.27%

D. 8.42%



## Further information

*Decomposing bond returns*

Bond returns can be attributed to:

- **Yield to maturity effect**: the yield expected if all things remain the same
- **Interest rate effect**: the impact a change in the interest rates had on the yield
- **Sector/quality effect**: the impact a change in credit rating or sector performance had on the yield
- **Residual effect**: the effect of all remaining factors

**Answers to the questions on the previous slide:**

D

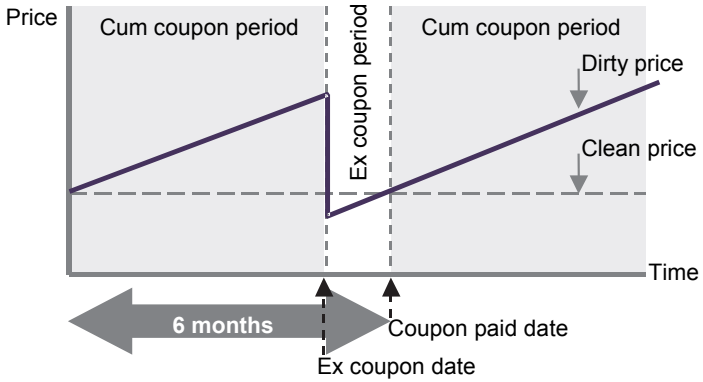
$5 \times 1 / 0.06 \times (1 - 1 / 1.06^2) + 100 / 1.06^2 = £98.17$

C

$2.5 \times 1 / 0.0299 \times (1 - 1 / 1.0299^4) + 100 / 1.0299^4 = £98.18$

## 3. Prices and Yields

**Clean vs. dirty prices**






## Hints

The ex-coupon period for gilt is typically seven business days.

Bearer bonds generally do not have ex-coupon periods

The IMC exam assumes that a semi-annual coupon period is 182.5 days.

**Answers to the question on the previous slide:**

A

$6 \times 0.6 \times 1 / 0.0405 \times (1 - 1 / 1.0405^5) + 100 / 1.0405^5 = £98$

## 3. Prices and Yields

**Clean vs. dirty prices**

**Example**:
You buy £10,000 nominal of an 8% Gilt on 5 July for a clean price of £105. Coupon dates are 1 April and 1 October. Calculate the dirty price payable on settlement:

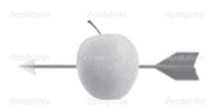
A. £10,690
B. £10,700
C. £10,710
D. £10,720



## Keeping on target

A 3% Gilt is quoted at £98.00, 66 days after its last half-yearly coupon payment, how much would it cost to buy the bond?

A. £98.00
B. £98.54
C. £99.08
D. £100.00



## Keeping on target

A 7% Gilt is quoted at £101.78, 179 days after its last half-yearly coupon payment, how much accrued interest will be added to the purchase price if the gilt is sold today?

A. £105.21
B. £3.43
C. £0.00
D. £6.87

## 4. Factors Affecting Bond Prices

**Bond prices**

Interest rates determine the return required from the bond. Bond prices have an **inverse** relationship with interest rates. A rise in interest rates will lead to a rise in the bond's required yield (YTM) and its price will fall. The **sensitivity** of the bond's reaction to an interest rate move is determined by:

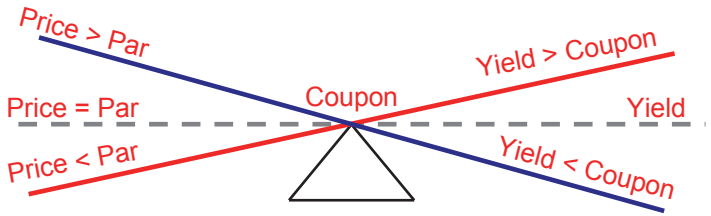
- Remaining life
  - Longer
  - Shorter
- Coupon size
  - High
  - Low
- Yield
  - High
  - Low



## Further information

**Interest rate sensitivity** – if the required yield from a bond rises its price will fall. If the required yield from a bond falls its price will rise.

Bond prices have an inverse relationship with their yields:




**Inflation risk –** is linked to interest rate risk, as interest rates have to rise to compensate bondholders for declines in the purchasing power of money.

**Answers to the questions on the previous slide:**

B

$$Dirty\,Price = £98 + \frac{66}{182.5} x £1.50$$

$$= £98.54$$

C

The bond is trading in its ex-coupon period (7 business days before the coupon paid date). No accrued interest will be added. In fact £0.07 will be deducted.

## 4. Factors Affecting Bond Prices

**Duration**

Macaulay duration:

- A relative measure of a bond's sensitivity:

$$\text{Duration} = \frac{\sum(\text{Present val of cash flow x time to cash flow})}{\sum \text{Present value of cash flow}}$$

i.e. the bond's price



## Keeping on target

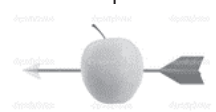
A 2-year 4% bond is priced at £98.14. What is the Macaulay duration if the yield is 5% p.a.?

A. 1.37 years

B. 1.88 years

C. 1.88%

D. 1.96 years



## Keeping on target

A 4-year zero coupon bond is priced at £92.40. What is the Macaulay duration if the yield is 2% p.a.?

A. 2 years

B. 3 years

C. 4 years

D. 5 years

## 4. Factors Affecting Bond Prices

**Duration**

Modified duration

- The approximate percentage change in a bond's price for a 1% change in yield:

$$\text{Modified Duration} = \frac{D}{(1+r)}$$

Where D is the bond's duration and r is its present yield.



## Keeping on target

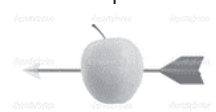
A bond is priced at £104 and has a yield of 4% p.a. and a Macaulay duration of 5 years. The modified duration is:

A. 4.8%

B. 4.8 years

C. 3.8 years

D. 125%



## Keeping on target

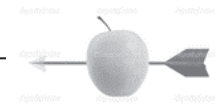
A bond is priced at £113.75 and has a modified duration of 3.45. If yields rise by 0.5% p.a., what will the new price of the bond be?

A. £94.15

B. £111.79

C. £115.71

D. £133.35



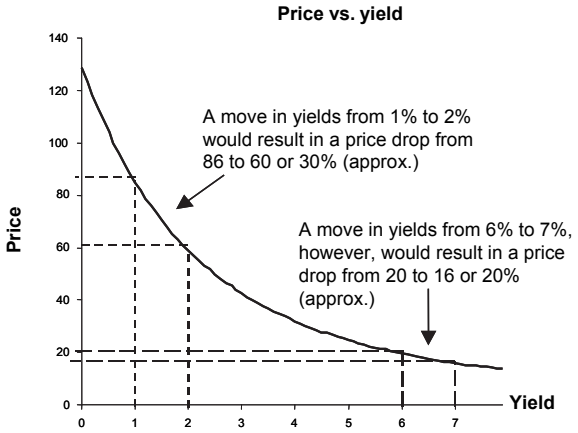
**Answer to the questions on the previous slide:**

| Cashflow | Present Value of Cashflow | Present value of cashflow x time | |
|---|---|---|---|
| 4 | 4 / 1.05 = 3.81 | 3.80 x 1 = 3.81 | |
| 104 | 104 / $1.05^2$ = 94.33 | 94.33 x 2 = 188.66 | |
| Total | 98.14 | 192.46 | |
| | | | |
| | 192.46 /98.14 = 1.96 Years | | |

**C** The Macaulay duration of a zero coupon bond is equal to its maturity

## 4. Factors Affecting Bond Prices

**Convexity**






# Hints

**Convexity**

An adjustment to modified duration

At low yields modified duration underestimates the price increase when yields fall, and overestimates the price decrease when the yield rises.

**Answer to the questions on the previous slide:**

A

5 / 1.04 = 4.80%

B

Modified duration can be used to predict the change in bond price for a given change in yield as follows:

Change in bond price = - Modified duration x Change in yield x Price

Price change = -3.45 x 0.005 x £113.75

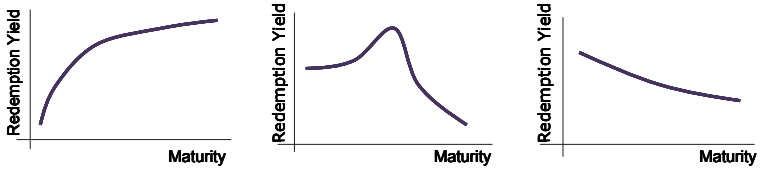
Price change = £1.96

New price = £113.75 - £1.96 = £111.79

.

## 5. Yield Curves

Types of yield curve:




Yield curve theories:

- Liquidity preference theory
- Market segmentation theory
- Pure expectations theory



## Hints

**Yield Curves**

For an upward sloping yield curve, where the bonds are not zero coupon, the following relationship holds:

Forwards > spots > yield

The reverse is true for a downward sloping yield curve.

## Keeping on target

A 1 year bond has a yield of 4% p.a. A 2 year bond has a yield of 6% p.a. What is the implied rate for a 1 year bond one year from now?

A. 8.04%

B. 7.69%

C. 7.28%

D. 6.96%

## Keeping on target

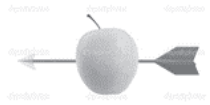
A 1 year bond has a yield of 9% p.a. and the rate for a 1 year bond one year from now is 6% p.a. What is the 2 year bond rate?

A. 5.00%

B. 6.79%

C. 7.49%

D. 8.68%



**Answer to the questions on the previous slide:**

A

(1.06 x 1.06) / 1.04 = 1.0804

1.0804 – 1 = 8.04%

C

$$\sqrt{1.09x1.06} - 1 = 0.07489 \text{ (or } 7.49\%)$$