International Business and Finance Seminar 2

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19 Jul 2023

Time Value of Money

- Let's do some money talk...
  - If your friend wants to borrow £1000 from you, and promise to pay back £1000 in five years, will you be happy to do that?
  - Time is valuable! Inflation, risk-free assets, etc.
  - The value of time, in the simplest form, is the rate of return, r
  - Therefore, for every amount of money in the future, if we want to make meaningful comparisons, we would like to use a common benchmark — usually the present value of that amount

Compounding

- Compounding is the process whereby interest is credited to an existing principal amount as well as to interest already paid.
- Compounding thus can be construed as ***interest on interest***—the effect of which is to magnify returns to interest over time, the so-called "miracle of compounding."
  - Albert Einstein once said: "Compound interest is the eighth wonder of the world. He who understands it, earns it; he who doesn't, pays it".
  - Compounding has always been one of Warren Buffet's investment principle: "My wealth has come from a combination of living in America, some lucky genes, and compound interest."

$$PV = FV \frac{1}{(1+r)^n}$$

PV = present value

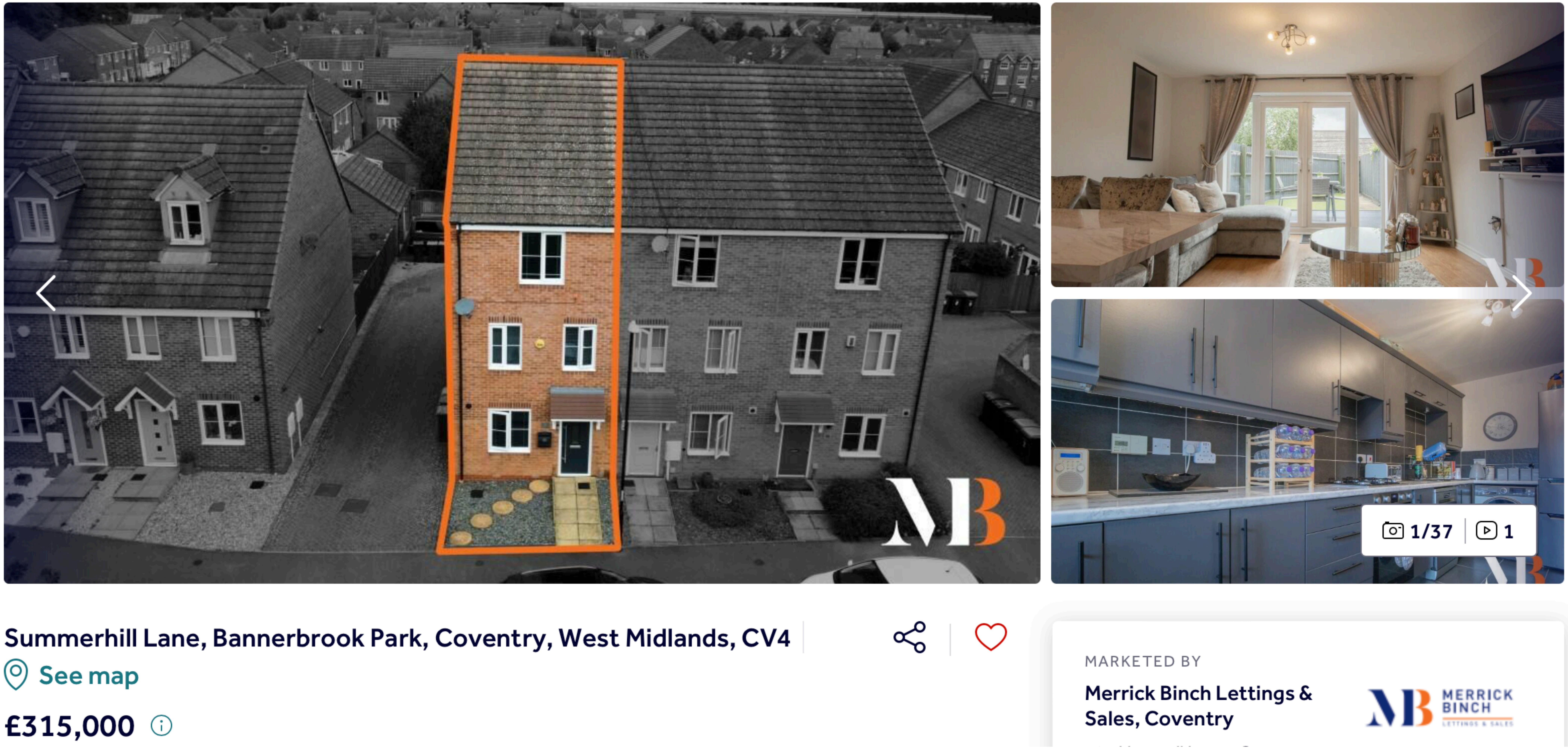
FV = future value

r = rate of return

n = number of periods

Buying a House?

- If I take out a loan of 300,000 GBP, with interest rate of 6.5%, how much will I pay back in total after 10 years if interests rates are accrued annually? monthly? daily? What about paying back after 20 years? 30 years?



Buying a House?

- Suppose interest is accrued annually:
  - 10 years: A=300,000$(1.065)^{10}$ $A \approx$ 519,874
  - 20 years: A=300,000$(1.065)^{20}$ $A \approx$ 905,727
  - 30 years: A=300,000$(1.065)3^0$ $A \approx$ 1,580,367

- Suppose you plan to pay back in 30 years:
  - Interest accrued annually: A=300,000$(1.065)^{30}$ $A \approx$ 1,580,367
  - Interest accrued monthly: A=300,000$(1.065)^{360}$ $A \approx$ 1,607,643
  - Interest accrued daily: A=300,000$(1.065)^{10,950}$ $A \approx$ 1,611,956

Quiz Question

Question 2: Two thousand British Pound are invested for **10** years at **10%** paid semi-annually for the first **3** years, then at **8%** paid quarterly for another **4** years and finally at **9%** paid monthly for the last **3** years. Find the accumulated value after all these **10** years.

Accumulated value after the first 3 years = $2000\left(1+\frac{0.1}{2}\right)^{2\times 3} = £2680.19$

Accumulated value after 7 years = $2680.19\left(1+\frac{0.08}{4}\right)^{4\times 4} = £3679.33$

Accumulated value after 10 years = $3679.33\left(1+\frac{0.09}{12}\right)^{12\times 3} = £4814.94$

This could also be calculated as:

$$2000(1.05)^{6}(1.02)^{16}(1.0075)^{36} = £4814.94$$

Quiz Question

Question 3: A pensioner could save **£15,000** in **Dec. 31, 2000**. During all these years she kept her money in a saving account, giving her **2%** interest compounding yearly.

a. How much will be her saving in **Dec. 31, 2020**, if we assume, she has not touched or will not touch her saving.
b. Calculate the amount of increase in the year **2018**.

Question 3:

a. Estimated saving on Dec. 31, 2020 will be = $15{,}000(1+0.02)^{20} \approx £22{,}289$
b. Estimated saving on Dec. 31, 2017 is =$15{,}000(1+0.02)^{17} \approx £21{,}004$ and considering 2% increase yearly, the estimated increase will be: $0.02 \times £21{,}004 = £420$

Quiz Question

Question 4: A man stipulates in his will that **£50,000** from his estate is to be placed in a fund from which his three daughters are each to receive the same amount when aged **21**. When the man dies, the girls are aged **19**, **15**, and **13**. How much will each receive, if the fund earns interest at **12%** compounded semi-annually?

Question 4: Let X be the required payment. The 19-year-old will receive £X in 2 years, the 15-year-old in 6 years, and 13-year-old in 8 years. Therefore, whatever they receive in future should be discounted and the summation should be £50,000, i.e.:

$$X(1.06)^{-4} + X(1.06)^{-12} + X(1.06)^{-16} = \text{£}50{,}000$$

So,

$$1.682709311\, X = 50{,}000 \Longrightarrow X = \text{£}29713{,}99$$

Quiz Question

Question 5: In March **2012**, the French bank, RCI Banque, issued an **18**-month bond with a face value of **€10,000**, and an annual coupon rate of **2%**, paid quarterly. The issue price was **€9,984.50**. What was it yield to maturity (YTM)?

Question 5: Quarterly coupon interest rate = 0.02/4 = 0.005, so:

$$€9{,}984.50 \ = \ €50\,.\,A^{6}_{R/4} + \frac{10{,}000}{(1 + R/4)^{6}}$$

We can assume $R/4 = X$ and use the Binomial expansion of $(1+X)^6$, we have:

$$(1+X)^6 = 1 + 6X + 15X^2 + 20X^3 + \cdots + X^6$$

As

$$|X| < 1 \Longrightarrow (1+X)^6 \approx 1 + 6X$$

So,

$$9{,}984.50 = 50\left[\frac{1}{X} - \frac{1}{X(1+X)^6}\right] + \frac{10{,}000}{(1+X)^6}$$

Changes to:

$$9{,}984.50 = \frac{300 + 10{,}000}{1 + 6X} \Longrightarrow X = 0.0052 \Longrightarrow R = 0.02106 = 2.106\%$$

$$YTM = \sqrt{\frac{FaceValue}{CurrentPrice}} - 1$$

where:

$n =$ Number of periods to maturity

$Face\ Value =$ Bond's maturity value or par value

$Current\ Price =$ Bond's price today

Quiz Question

Question 6: In **2019**, Daimler Chrysler had just paid a dividend of **€2** per share on its equity. The dividends are expected to grow at a constant rate of **5%** per year indefinitely. If investors require an **11%** return on the company's equity:

a. What is the current price?
b. What will be the price in 2022?
c. What will be the price in 2034?

Question 6:

a. Current price at a constant growth of 5 per cent per year indefinitely

$P = Div_1 / (R - g)$, whereas $Div_1 = D_0 (1+g)$ i.e. $Div_1 = €2\ (1.05) = €2.1$
$P = €2.1 / (0.11 - 0.05) = €35$

b. Price in 3 years: $P = P_0(1+g)^3 = €35(1.05)^3 = €40.52$

c. Price in 15 years: $P = P_0(1+g)^{15} = €35(1.05)^{15} = €72.76$

Concept Questions

Question 1: Fill the gaps with suitable word(s):

a. The sole proprietorship does not have to share ------- or ------- with others.
b. A partnership is dissolved upon the ------- or ------- of any one of the -------.
c. A corporation is a(n) ------- that exists separately from its owners, better known as -------.
d. Commercial banks and credit unions are two examples of -------.
e. Modern financial theory assumes that the primary goal of the firm is the maximisation of stockholders' -------, which translates into maximising the ------- of the firm's common stock.
f. ------- is a short-term goal. It can be achieved at the expense of the firm and its stockholders.
g. ------- is the ability of a company to meet its current liabilities out of current assets.
h. The ratio of total liabilities to ------- is used to determine the degree of debt in the capital structure.
i. ------- equals current assets less current liabilities.
j. The process of determining present value is often called ------- and is the reverse of the ------- process.
k. The ------- is the annual deposit (or payment) of an amount that is necessary to accumulate a specified future sum.
l. If a loan is to be repaid in equal periodic amounts, it is said to be a(n) -------.

Concept Questions

Question 1:

a. Profits, control
b. Withdrawal, death, partners
c. Legal entity, stockholders
d. Financial institutions or intermediaries
e. Wealth, market price
f. Profit maximisation
g. Liquidity
h. Stockholders' equity
i. Net working capital
j. Discounting, compounding
k. Sinking fund
l. Amortised loan