International Business and Finance
Seminar 2

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Time value of money

- Let's do some money talk…
  - If your friend wants to borrow £1,000 from you, and promise to pay back £1,000 next year, will you be happy to do that?
  - Time is valuable! Eg. Inflation, interest rate, etc.
  - The time value of money: difference in value between money today and money in the future
  - 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.
- Example: £100 with the interest rate of r

Year 1 $100 + 100 \times r = 100(1 + r)$

Year 2 $100(1 + r) + 100(1 + r) \times r = 100(1 + r)(1 + r) = 100(1 + r)^2$

Year 3 $100(1 + r)^2 + 100(1 + r)^2 \times r = 100(1 + r)^2(1 + r) = 100(1 + r)^3$

Year n $100(1 + r)^n$

- Calculation of the present value
  - In general, the future value (FV) of C_0 after n periods will be:

$$FV = C_0 \times (1 + r)^n,$$

r: interest rate

  - Thus, the present value (PV) of that amount is:

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

PV = present value

FV = future value

r = rate of return

n = number of periods

Buying a house?

- Q1) If I take out a loan of £300,000, with interest rate of 6.5%, how much will I pay back in total after 10 years if interests are accrued annually? monthly? What about paying back after 20 years? 30 years?

Summerhill Lane, Bannerbrook Park, Coventry, West Midlands, CV4

See map

£315,000

MARKETED BY

Merrick Binch Lettings & Sales, Coventry

MERRICK BINCH

Buying a house?

- What we have:
  - C_0: £300,000
  - r: 6.5% (yearly interest rate)
- 1-1) Suppose interest is accrued annually:
  - 10 years:

    $FV = 300{,}000(1.065)^{10}$ $FV \approx$ £563,141
  - 20 years:

    $FV = 300{,}000(1.065)^{20}$ $FV \approx$ £1,057,093
  - 30 years:

    $FV = 300{,}000(1.065)^{30}$ $FV \approx$ £1,984,310
- 1-2) Suppose you plan to pay back in 30 years:
  - Interest accrued annually:

    $FV = 300{,}000(1.065)^{30}$ $FV \approx$ £1,984,310
  - Interest accrued monthly:

    $FV = 300{,}000(1+0.065/12)^{360}$ $FV \approx$ £2,097,539

Questions

2) Suppose £2,000 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.

3) A pensioner could save £15,000 on 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 on Dec. 31, 2020, if she has not touched her saving?

b. Calculate the amount of increase in the year 2018.

4) A man leaves £50,000 in his will to be shared equally among his three daughters when each turns 21. At the time of his death, the daughters are 19, 15, and 13 years old. If the money is invested at 12% interest, compounded semi-annually, how much will each daughter receive when she turns 21?

Questions

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:

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

Questions

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: $0.02 \times £21{,}004 = £420$

Questions

Question 4: A man leaves **£50,000** in his will to be **shared equally among his three daughters when each turns 21**. At the time of his death, the daughters are **19, 15, and 13** years old. If the money is invested at **12%** interest, compounded **semi-annually**, how much will each daughter receive when she turns 21?

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.:

$$X\frac{1}{\left(1+\frac{0.12}{2}\right)^{2\times 2}}+X\frac{1}{\left(1+\frac{0.12}{2}\right)^{2\times 6}}+X\frac{1}{\left(1+\frac{0.12}{2}\right)^{2\times 8}}=£50{,}000$$

$$X\left[\frac{1}{(1.06)^4}+\frac{1}{(1.06)^{12}}+\frac{1}{(1.06)^{16}}\right]=£50{,}000$$

$$1.6827X=£50{,}000$$

Thus,

$$X\approx £29{,}714$$