# FNCE10002 Principles of Finance – Detailed Notes


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**How to read the notes**

- Each lecture opens with the summary box from the notes, shown as a key-points table. The numbered sections after it give the full detail.
- Formulas are retyped as formula blocks, and figures are described in words.

## Subject overview

FNCE10002 Principles of Finance studies how individuals and businesses acquire, spend and manage financial resources, in two branches.

| Branch | Question it answers | Topics |
|---|---|---|
| Investment analysis | Where to invest and how to finance these investments. | Valuation of bonds, equities and derivatives; modern portfolio theory; asset pricing and market efficiency. |
| Corporate finance | The decisions of companies and their management. | Capital budgeting (what investments to make); capital structure (how to finance these investments); payout policy (what to pay out to shareholders). |

# Lecture 1: Overview of Principles of Finance and Introduction to Financial Maths I

The goal of a firm's managers is to maximise the market value of its equity, and the time value of money supplies the tools (compounding, discounting and NPV) for judging whether an investment adds to that value.

## 1.1 Key points

- The main goal of firms and managers is to maximise the market value of a company's equity. This satisfies shareholders, as their share prices increase.
- According to Capital Market Efficiency, the share price of a company should reflect all relevant information available to the market at a point in time.
- The time value of money is the difference between the value of money today and the value of money in the future.
- We can earn interest to turn a PV cash flow into a higher FV cash flow, or pay interest to exchange a FV cash flow for a PV cash flow.
- Simple interest calculates the value of a cash flow based purely on the principal. Compound interest calculates it on both the principal and accrued (earned) interest.
- To compare cash flows we must consider them at the same point in time. We turn a PV into a FV by compounding it, and a FV into a PV by discounting it.
- PV and FV depend on the time period, the interest rate and the compounding periods.
- The value additivity principle states that the PV (or FV) of a series of cash flows equals the sum of the PVs (or FVs) of each cash flow.
- If the NPV is above 0, we should accept the investment.

## 1.2 The main goals of firms and managers

A company is controlled by a board of directors and managed by senior management and the CEO. The CFO is responsible for investment, financing and cash management decisions. It is owned by shareholders, and managers should ideally do their best to represent and act upon the desires of shareholders.

Managers exist to help the firm maximise the market value of its equity. This means maximising the wealth of the shareholders (owners) by increasing the share price, which is done by managers who take on profitable investments.

```
\text{market value of equity} = \text{share price} \times \text{number of shares}
```

Managers must balance the needs of both shareholders and other stakeholders such as customers and employees. By maintaining and pleasing customers, the firm continues as an effective company that boosts shareholder returns: happy customers = more business = ideally maximising shareholder equity.

The share price may drop if shareholders are not confident in the future of a company, and may rise if the company seems promising. **Capital Market Efficiency** means that the market prices we observe should reflect all relevant information available at a point in time.

## 1.3 The time value of money and interest rates

The basic valuation principle is that benefits greater than costs increases the value of the firm. In finance we consider the costs and benefits of cash flows at different points in time.

- **Costs** are the opportunity cost of the next best action.
- **Benefits** are the things derived from taking an action.

The **time value of money** is the difference between the value of money today and the value of money in the future. We can convert money in the present into money in the future by lending it to the bank (we earn interest on it, increasing its value in the future). We can exchange money in the future for money in the present by borrowing from a bank (we pay interest to the bank, decreasing the value in the future).

Example: investing $100 in the bank at 2% interest for 1 year gives a present value of $100 and a future value of $100 × (1 + 0.02) = $102. So the future value of $100 in 1 year at 2% is $102.

## 1.4 Simple and compound interest

**Simple interest**: we earn interest only on the principal cash flow, and not on any accrued interest. For example, we earn the 2% on the $100, so $2 of interest each year.

```
FV_n = PV_0\,(1 + n \times r)
```

**Compound interest**: interest is earned on any principal cash flows and on any accrued interest. For example, we earn 2% on the total balance, so (100 × 0.02) $2 in the first year, (102 × 0.02) $2.04 in the second year, and (104.04 × 0.02) in the third. [Added: the third figure, which is $2.0808, or about $2.08.]

```
FV_n = PV_0\,(1 + r)^n
```

The future value of a cash flow is calculated based on the principal and interest accrued.

[Added: Worked values for $100 at 2%.]

| Year | Balance with simple interest ($) | Balance with compound interest ($) |
|---|---|---|
| 0 | 100.00 | 100.00 |
| 1 | 102.00 | 102.00 |
| 2 | 104.00 | 104.04 |
| 3 | 106.00 | 106.12 |

## 3.2 Loan payments

A loan is borrowing money and making repayments to pay off the loan over a fixed period of time. Fixed rate loans fix the interest rate for 1–3 years, and then rates can change after that.

Periodic loan payments (C) are represented by an ordinary annuity, because they are a series of equal cash outflows that occur at the end of every period and last for the number of periods the loan exists. Each repayment is composed of two parts:

- the principal we are repaying; and
- the interest being charged on the principal borrowed.

The present value of a loan is found by discounting the periodic payments (C) to the current period. Alternatively, we can find the periodic payment C by substituting in the PV of the loan, the interest rate and the number of periods and solving for C. This works because discounting the payments strips off the interest being charged on them, leaving the sum of the principal balances.

```
PV_0(OA) = C \times \frac{1}{r}\left(1 - \frac{1}{(1+r)^n}\right)
```

Here PV0 is the original amount of the loan (the principal at the start), and the bracketed annuity factor is the PV of one dollar per period discounted at r% over n years.

**Loan amortisation schedule**

[Added: Schedule is for a loan of 20,000 dollars repaid over 4 years. The year 1 interest of 2,000 implies a rate of 10%. All amounts in the table are in dollars.]

| Year | Annual payment | Interest paid | Principal repaid | Principal remaining |
|---|---|---|---|---|
| 0 | | | | 20,000.00 |
| 1 | 6,309.42 | 2,000.00 | 4,309.42 | 15,690.58 |
| 2 | 6,309.42 | 1,569.06 | 4,740.36 | 10,950.22 |
| 3 | 6,309.42 | 1,095.02 | 5,214.40 | 5,735.82 |
| 4 | 6,309.42 | 573.58 | 5,735.84 | 0.00 |
| Totals | 25,237.68 | 5,237.66 | 20,000.02 | |

- The annual payment is the value of C, and is therefore the same across all periods.
- The interest paid is the principal remaining × the interest rate.
- The principal repaid is the annual payment − the interest paid.
- The principal remaining is the previous balance of principal remaining − the principal repaid.

[Added: The totals differ from exact figures by a few cents because each line is rounded.]

### 3.10 Level of risk of investments

Default risk (credit risk) is the risk of inability to make coupon payments or maturity payments when due. S&P Global Ratings and Moody's Investors Service classify bonds according to a rating of their default risk.

| Class | Ratings | Features |
|---|---|---|
| Investment grade debt | AAA to BBB | Risk similar to banks. Unlikely to default, so you can safely assume you will receive your payments when due. |
| Speculative (junk) bonds | BB to D | Higher risk and less certainty you will receive your payments back. They have a higher yield to maturity, as investors expect a higher return to offset the higher risk. |

### 3.11 Coupon rate and yield to maturity

The coupon rate stays the same during the entire life of the investment. For example, it will always pay 4% coupons, so coupons for a $100 face value bond will always be $4. However, the yield to maturity can change during the life of the bond, depending on the required return demanded on the bonds at any point in time.

**Solving for the yield to maturity in exams**

- **Coupon-paying bond:** it will be a multiple choice question with a range of possible rD values. Substitute each into the coupon-bond equation. The correct answer is the one that gives a PV above, below or at the face value of $100, depending on what the question asks.
- **Zero-coupon bond:** solve for rD by discounting the single face value payment at maturity.

### 3.12 Relationship between coupon rates and yield to maturity

| Price against face value | The bond sells at | Yield to maturity against coupon rate |
|---|---|---|
| Price = face value | Par | rD = coupon rate |
| Price > face value | A premium | rD < coupon rate |
| Price < face value | A discount | rD > coupon rate |

### 3.13 Price sensitivity to interest rates

The probability of interest rates rising over a longer period of 10 years is higher than over a shorter period of 1 year. Rising interest rates cause the prices of bonds to fall.

Therefore the prices of **longer maturity bonds are more sensitive** to changes in interest rates. Investors bear higher interest rate risk with these longer-term bonds because there is a risk of the price decreasing. The large number of coupon payments in longer maturity bonds also means they are more affected by interest rates.

## Lecture 9: Capital Budgeting II

A project's NPV is only as good as its cash flow estimates, which must be incremental, after tax, consistent with inflation and discounted at a rate that matches the project's risk.

### 9.1 Key points

A number of issues exist when estimating cash flows for choosing projects.

| Issue | Key point |
|---|---|
| Timing of cash flows | Predict short-term cash flows, then assume a perpetual growth rate g. Take the PV of the known cash flows, add the value of the single cash flow at the end of the known period (the PV of the perpetual cash flow), and add them all together. |
| Financing charges | Not included in the cash flow analysis. They are included in the discount rate. |
| Types of costs | Incremental costs (the change from the project) are included. Sunk costs are not. |
| Change in net working capital | ΔNWC = NWC in the current period − NWC in the previous period. |
| Corporate income taxes | After tax = before tax × 0.7. |
| Depreciation tax shield | Tax shield = depreciation expense × 0.3. |
| Tax on asset disposal | Tax paid = gain × 0.3. Tax saved = loss × 0.3. |
| Free cash flows | See the formulas below. Also include initial and future investment outlays, changes in NWC and the after-tax salvage value. |
| Inflation | Fisher relationship: (1 + nominal) = (1 + real)(1 + inflation). For after tax, multiply each cash flow by 0.7. For after inflation, multiply each cash flow by (1 + inflation) raised to the number of periods we are discounting from. |
| Projects with different lives | Only compare NPV across the same life. Lowest common multiple: repeat projects until they have the same life and calculate NPV at the end. Perpetuity and EAV methods are in 9.9. |
| WACC | The required rate of return on investments of similar risk to the company. It can't be used if the project alters business risk or financial risk. |

## 12.11 Factors affecting equity option prices

The **price of the underlying share, the exercise price and the time to expiration** determine the price of an option.

```
\text{Option premium (price)} = \text{Intrinsic value (IV)} + \text{Time value (TV)}
```

**Intrinsic value** is the value by which the option is within the money.

- Call option: intrinsic value = St − X.
- Put option: intrinsic value = X − St.
- The lowest intrinsic value is 0 (it cannot be negative).

**Time value** = total option premium − intrinsic value. As we approach the expiration date the time value **approaches 0**, and on the expiration date the time value **is 0**.

[Added: Worked check. A call with X = $10, a share price of $12 and a premium of $3 has intrinsic value $2, so its time value is $1.]

**Figure: long call and long put (described)**

- **Long call**, profit = Max(ST − X, 0) − C. The line is flat at −C until X, then slopes up. The 'in the money' region is circled to the right of X, where intrinsic value = St − X.
- **Long put**, profit = Max(X − ST, 0) − P. The line slopes down from the left until X, then is flat at −P. The 'in the money' region is circled to the left of X, where intrinsic value = X − St.

**Effect of an increase in each factor, for a buyer**

| An increase in… | Value of a call option | Value of a put option | Why (added) |
|---|---|---|---|
| Current price S | Increasing | Decreasing | A higher S makes a call more likely to finish in the money and a put less likely. |
| Exercise price X | Decreasing | Increasing | A higher X means a call pays less and a put pays more. |
| Time to expiration T | Increasing | Increasing | More time for the price to move in the buyer's favour. |
| Volatility of prices σ | Increasing | Increasing | Bigger price swings give more chance of a large gain, while the buyer's loss is limited to the premium. |
| Risk-free interest rate rf | Increasing | Decreasing | A higher rate reduces the PV of the exercise price paid on a call and of the exercise price received on a put. |
| Expected dividends D | Decreasing | Increasing | Dividends lower the share price on the ex-dividend date, which hurts calls and helps puts. |