Comparing Projects
- Many ways to compare business projects including NPV, IRR, profitability index, payback period, average accounting return etc.
- **Best methods take account of:**
  - Time value of money,
  - Risk, and
  - The value of the project to the firm

Net Present Value (NPV)
- **Net Present Value** is the preferred method to value projects
- It is the same as discounted cash flow (DCF) valuation

\[
NPV = V_0 = \sum_{t=0}^{T} \left( \frac{C_t}{(1+r)^t} \right) = C_0 + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_T}{(1+r)^T}
\]
- Decision criteria is that projects with positive NPV should be accepted
- Time value of money is incorporated in discount rate
- Risk can be incorporated into NPV by increase discount rate (r) which generally decreases the NPV
- Positive NPV projects add to a firm’s asset value and share price
- **NPV terminology**
  - Value, present value and net present value used interchangeably
  - Value means worth in terms of cash. Also called market value
  - Present value means the cash worth now (t=0), taking into account time value of money
  - Net present value means add all of the present values together

*(Calculation Example: NPV)*

Internal Rate of Return (IRR)
- **Internal rate of return** - discount rate that makes a project’s NPV equal to zero

\[
NPV = C_0 + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2}
\]

\[
0 = C_0 + \frac{C_1}{(1+r_{IRR})^1} + \frac{C_2}{(1+r_{IRR})^2}
\]
- Decision rule is to accept projects with an IRR (r_{IRR}) that is more than the required return of the project (r)
- IRR is very closely related to NPV
  - If projects IRR > required return (r), NPV positive
  - IRR = required return, NPV zero
  - IRR < required return, NPV negative

*(Calculation Example: IRR)*

- **IRR Problems**
  - Similarly to NPV, IRR takes the time value of money and risk into account
  - IRR is also very intuitive since people and managers are familiar with returns
  - But some problems with using IRR include:
    - Scale effects when comparing mutually exclusive projects
    - Multiple feasible IRR’s for projects with non-conventional cash flows

*(Calculation Example: IRR, Scale Effects, and Mutually Exclusive Projects)*

*(Calculation Example: Non-conventional Cash Flows and Multiple Feasible IRR’s)*
Pay-back Period

- **Payback period** measure in years and shows how long project takes to ‘pay itself off’ → how many years it is expected to take to re-coup the cost of the project and break even
- Projects with shorter payback periods are preferred
- Sometimes managers use decision rule that any project with a PB period above a threshold number of years should be rejected
- **PB Period: Pros and Cons**
  - Advantage
    - Intuitive, simple to understand and simple to calculate
  - Disadvantages
    - Doesn’t explicitly take time value of money of risk into account
    - Provides no indication about how much more the firm will be worth if project is accepted
    - Ignores all cash flows after the payback period
    - Suffers from the same scale effect problems as IRR when ranking mutually exclusive project

\[
P\text{B period} = (\text{Time of first positive cumulative cash flow}) - \left( \frac{\text{First positive cumulative cash flow}}{\text{Cash flow in that year}} \right)
\]

*(Calculation Example: Payback Period)*

*(Calculation Example: Solving for Time - Logarithms)*
RETURNS AND INFLATION - LECTURE 1B

Asset Classes
Main investable asset classes are:

- **Equity** - known as stocks and shares
  - Dividends are the periodic cash income from equity
- **Property** - such a real estate (land, buildings) and equipment
  - Rent is the periodic cash income from property
- **Debt** is usually divided into:
  - **Long term debt** - bonds or loans
    - Coupons are the periodic cash income from bonds
    - Loan payments are the periodic cash income from bonds
    - Both bonds and loans pay the principal or face value at maturity
  - **Short term debt** - bank accepted bills (BAB’s), certificates of deposit (CD’s), promissory notes with maturity of less than 1 year and generally only pay the principle → not periodic payments

Income, Capital and Total Returns
- Total returns on stocks, bonds, real estate, and any asset can be broken into two parts, the income return and the capital return
  - **Income return** - proportion of asset’s price that is paid out in cash per time period
    \[ r_{income} = \frac{C_1}{P_0} \]
    - Where \( C_1 \) is the cash flow at \( t=1 \) and \( P_0 \) is the price at \( t=0 \)
    - The cash flow income:
      - From equity is called dividends or drawings
      - From debt is called coupon or loan payments
      - From real estate is rent
  - **Capital return** - rate of increase in the asset’s price per time period
    \[ r_{capital} = \frac{P_1 - P_0}{P_0} \]
    - When a dividend is paid (actually when the ex-dividend date occurs), the stock price falls
    - Therefore, all things remaining equal, dividends (income returns) come at the expense of price (capital returns)
  - **Total return** - sum of income and capital returns
    \[ r_{total} = r_{capital} + r_{income} = \frac{P_1 - P_0 + C_1}{P_0} = \frac{P_1 - P_0 + C_1}{P_0} \]

*(Calculation Example: Components of Returns)*

Inflation and Rates of Returns
- **Inflation** - increase in general level of prices in an economy
  - Positive inflation reduces buying power of money
- **Returns** (effective returns or Annualised Percentage Rates) - usually stated as ‘nominal’ rates which means they have not been reduced by inflation
  \[ 1 + r_{real} = \frac{1 + r_{nominal}}{1 + r_{inflation}} \]
  - Rates used in these equations should be effective rates, not APR’s
  - Fisher equations only work with total or capital returns

*(Calculation Example: Inflation and Returns)*
Books Values, Market Values and the Accounting Identity

- Accounting identity says that the book value of assets (A) equals the book value of liabilities (L) plus the book value of owners’ equity (OE):
  - A = L + OE
- Finance version uses market values instead of book values. Market value of assets (V) equals the market value of debt (D) plus the market value of equity (E):
  - V = D + E
- **Book values:** A = L + OE
  - Book values are accounting figures usually taken from balance sheet
  - Since most financial sheet items are recorded at historical cost, book values are:
    - + Accurate when first recorded, but
    - - Old, state and out of date
- **Market values:** V = D + E
  - Market value - current price that asset is actually traded at
  - If the asset was sold, the the market value would be the cash flow received.
  - Market values are:
    - + Timely and useful but
    - - Can be difficult and costly to measure, especially if the asset is illiquid (doesn’t trade often)
    - - If the market price can’t be observed, then estimation needed which is inaccurate
- **Book value of equity (OE)**
  - OE = Contributed equity + retained profits + reserves
    - Contributed equity - amount of shares first bought when company floated or had its IPO (Initial Public Offering)
    - Retained Profits - accumulation of net income less dividends since the IPO
    - Reserves - includes things like Asset Revaluation Reserve, Foreign Currency Translation Reserve
- **Market value of equity (E)**
  - E = share price x number of shares outstanding
    - $P_{share} \times n_{shares}$
  - Market value of equity (E) is the share price trading on the ASX multiplied by total number of shares outstanding
  - Market value or equity also called the market capitalisation of equity or just `market cap`
- **Contrasting book and market values of equity**
  - When a new firm first floats its shares in an IPO, the book value of equity will equal the market price
  - But after the moment when the shares are first sold in the IPO, then the market value of equity will go up and down as the stock is traded on the exchange
  - Book value of equity will only change when the firm makes a profit (or loss) and increases its retained profits or when the firm raises more contributed equity in a right issues or other form of capital raising
  - If a firm (acquirer) wants to take over another firm (target), it will have to buy all of the target firm’s equity, or at least a controlling stake
    - Acquirer will have to pay the market value of equity to the target firm’s shareholders, which is often much higher than the book value

*(Example: Equity Value of Just Jeans Group - Takeover)*

*(Calculation Example: Asset, Debt and Equity Valuation from Market Prices)*

**Balance Sheet Equations**

- Balance sheet represented as an equation
  - $A = L + OE$ in book values or $V = D + E$ in market values
- Book total assets (A) can be broken into:
  - Current assets (CA) - cash, inventory and accounts receivables which are generally expected to last less than one year
- Non-current assets (NCA) - property, plant and equipment (PPE), copyrights, patents, deferred tax assets and other things which last for more than one year
- $A = CA + NCA$

**Liabilities same**

**Business Decisions**
- Most of business decisions related to balance sheet equations
- Book assets and liabilities can be broken into their current and non-current parts: $CA + NCA = CL + NCL + OE$
- **Investment decision:** which assets ($V$ or $A$) to buy?
- **Financing decision:** which type of funding ($L$ or $OE$)
- **Working capital decision:** how much working capital ($CA - CL$)
- **Payout policy decision:** how much to pay out to equity holders ($OE$) in the form of dividends and buybacks (also called repurchases)
- $\rightarrow$ Investment decisions most important.
  - Idea is to accept the most positive NPV projects since that will maximise business’s market value of assets ($V$) and therefore also maximise shareholders’ wealth

**Business Structures**

Three main forms of business structure which are:
- **Sole trader** - sole equity owner
- **Partnership** - two or more partners own the equity in the business
- **Corporation** - company or firm, where shareholders own the equity in the business

**Unlimited Liability: Sole Traders and Partners**
- Possible for them to be sued and lose all business assets and personal assets
- Face unlimited potential losses on their equity, so lowest possible equity price is negative infinity ($-\infty$) and the lowest possible return on equity is also negative infinity ($-\infty$)
  - $-\infty < E_{\text{s sole traders and partners}} < -\infty$
- No limit on how high equity price and return could be, each has no limit (positive infinity, $\infty$)
  - $-\infty < R_{E, \text{s sole traders and partners}} < -\infty$

*(Calculation Example: Unlimited liability)*

**Limited liability: Corporations**
- Shareholders cannot lose more than the value of their equity (the shares)
- Shareholders in a corporation cannot be sued for their personal assets
- Therefore, lowest possible share price in a corporation is zero
  - $0 = E_{\text{corporation}} < \infty$
- The lowest possible return is therefore negative one ($-1$ or $-100\%$)
  - $-1 = R_{E, \text{corporation}} < \infty$

**Business Funding**

Corporations can be financed by:
- Ordinary shares (common stock)
- Preference shares
- Bonds
- Loans
- Short term debt - overdrafts or money market securities

**Corporate Insolvency (or Bankruptcy)**
- When firm is insolvent it cannot pay its debts when they’re due $\rightarrow$ usually because current liabilities are too high compared to current assets