Lecture 1: Estimating the cash flows and NPV of a project:

PMT = NPV/[1-(1+i)^-n/i]

Estimate cash flows on an incremental basis:

- Value of project depends on incremental (additional) cash flows after tax as
  - That follow from project acceptance
- Cash flows are not accounting profits
  - Accounting profits include income which are not yet received
  - Also includes depreciation charges which are not cash flows
- Important to include all incidental effects on the remainder of the firm's business
- Recognize after-sales cash flows come later such as downstream activities on service

Working capital requirements:

- Firms use sales and COGS to estimate cash flows
- **Cash inflow = Sales - Increase in accounts receivable (AR)**
- **Cash outflow = COGS +increase in inventory - Increase in accounts payable (AP)**
- **Net cash flow = cash inflow - cash outflow**
- A positive amount of (AR + INV - AP) = additional investment in net working capital
  - Treated as a cash outflow
- All investments in WC over the life of the project are recovered as cash inflow at end

Include opportunity costs:

- Should include OC of a resource used in a project even when no cash changes hands

Sunk cost/overhead/inflation/salvage value

- Ignore irreversible sunk costs
- Ignore the accountants allocation of existing overheads
  - include only any changes in the overhead expenses generated by a project
- Remember salvage value (net of any taxes) when the project comes to an end
- Treat inflation consistently by discounting nominal cash flows at a nominal rate of return and real cash flows at a real rate

Depreciation:

- Allowable depreciation - only tax allowable depreciation
- Provides an annual tax shield (dep x Tax rate
- Non cash expense that needs to added back to profit after tax

Investment timing:

- Sometimes you can defer an investment and select a start date in the future that the project becomes more valuable
- If the timing decision does not affect other future decisions that you might wish to make. You should choose the timing with the highest NPV
- The optimal time to invest is the one the maximises NPV
  - As soon as the rate of the increase in value drops below the cost of capital

The choice between long and short-lived equipment:

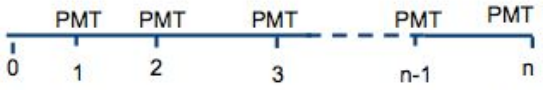
- Should compare assets on the equivalent annual cash flow (EAC)
- Take the less EAC

When to replace an old machine:

- First calculate EAC of new machine
- The figure out salvage value of the Salvage value
- If replace today: NPV = salvage value today + (EAC of year 1/discount rate)
- If replace in year one: NPV = Salvage value in year one plus EAC (and bring everything back to year 1

Critical assumptions of annuity/perpetuity:

$$PV = PMT\left[\frac{1-(1+i)^{-n}}{i}\right] \quad \text{or} \quad PV = \left[\frac{PMT}{i}\right]$$



1. The first annuity payment is at the end of the first period
2. There are **n** payments in the annuity series or infinite number of payments in the perpetuity
3. PV is calculated at year 0

Cost of excess capacity:

- Suppose a new project requires heavy use of an existing information system and will bring the purchase date of a new replacement system forward from year 4 to year 3.
- The new system has a life of five years, and at a discount rate of 6% the present value of the cost of buying and operating it is $500,000.
- We begin by converting the $500,000 present value to an EAC of $118,700 (=500,000/[(1−1.06^{-5})/0.06])
- When the new system in turn wears out, we will replace it with another; so we have effective additional cost of $118,700 a year indefinitely

- If we undertake the new project, the series of expenses begins in year 4

T=0	1	2	3	4	5	6	7
				118.7	118.7	118.7	118.7

- If we do not undertake the new project, the series of expenses begins in year 5

T=0	1	2	3	4	5	6	7
					118.7	118.7	118.7

- The new project therefore results in an additional cost of $118,700 in year 4
- This has a present value of 118700(1.06)$^{-4}$ =$94,020 that needs to be deducted against the NPV of the new investment project

Lecture 2 - Evaluating and Mitigating the risks of a project; Real options:

Sensitivity analysis:

- Revenue = Unit sales x unit price
- **Revenue = (market share x market size) x Unit price**
- Positive NPV → go ahead with project
- Firm needs to conduct sensitivity analysis with respect to key variables
- Each underlying variable is set one at a time at its optimistic or pessimistic value

Value of information:

- The production department is worried that a particular machine will not work as designed and that the operation will have to be performed at an extra cost of ¥20,000 per unit
- If it does occur, NPV is reduced by ¥6,140 million
- The chance for the problem to occur is 10%
- Suppose that a ¥10 million pretest of the machine will allow you to clear up the potential problem
- The value of additional information about unit variable cost from the pretest is:
  –¥10M + (.10 x ¥6,140M) = +¥604 million (invest)

Pretest cost + (probability x NPV reduced if occurs)

Sensitivity analysis evaluation:

Benefits	Drawbacks
- Forces the manager to identify the underlying variables - Indicates where additional information would be most useful, and helps to expose inappropriate forecasts	- What exactly optimistic or pessimistic means - Underlying variables are likely to be interrelated not independent

If variables are interrelated, we may use scenario analysis to look at different but consistent combinations of variables

Break even analysis:

- **NPV =(Revenue - VC - FC - Depreciation(1-tc) + Depreciation) x Annuity factor - Investment**
- Managers frequently calculate break even points in terms of accounting profits which does not consider the opportunity cost of capital on the investment (or the time value of money)
- **Profit before tax = Revenue - VC - FC - Dep**
- A business with high FC is said to have high operating leverage and high business risk, and will have a high break even sales
- Operating leverage is usually defined in terms of accounting profits rather than cash flows.
- Degree of operating leverage:

Degree of Operating Leverage (DOL):

$$DOL = \frac{\text{percentage change in profits}}{\text{percentage change in sales}}$$

or

$$DOL = 1 + \frac{\text{fixed costs including depreciation}}{\text{pretax profits}}$$

Monte carlo simulation:

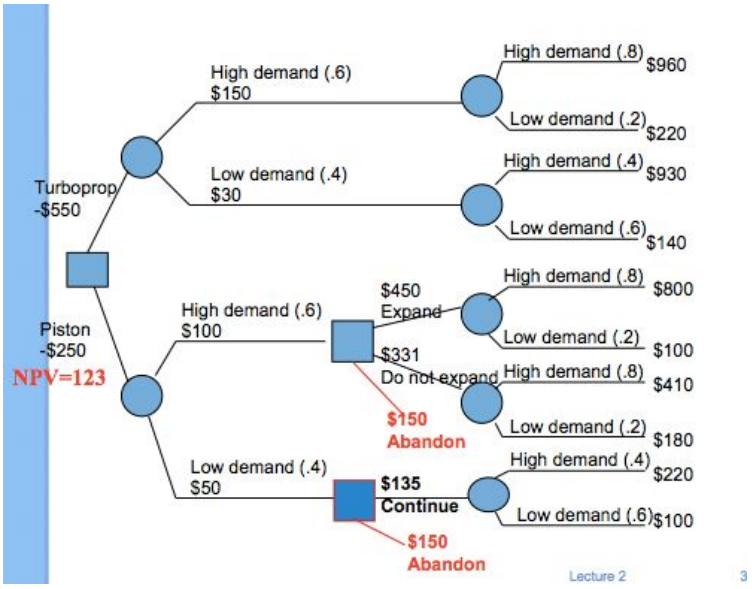
- Simulation is a tool for considering all possible combinations of variables and showing the entire distribution of project outcomes
- Steps:

1) **Modelling the project** by giving the computer a set of equations to specify the interdependence between different variables and between different periods
2) **Specifying the probabilities** of possible forecast errors for each of the variables that determine cash flows
3) **Stimulate cash flows** - Select at random at value from the distribution of each variable and calculate the net cash flow for each period, repeat the process thousand times to get probability distributions of the project cash flows in each period (which reflect project risk)
4) **Calculate the PV**/expected cash flows from the distributions of project cash flows to find their present values.

Real options:

- Option to expand, to abandon. Timing options (to postpone investments). Production options
- Do not show up in the assets in the accounting balance sheet but are reflected in the MV of shares

Decision trees - Magna Charter example:



First consider whether to expand Piston next year:

- Expected payoff from expansion as of year 2 is (.8 x 800) + (.2 x 100) = $660
- If the discount rate is 10%, the NPV of expanding computed as of year 1 is $NPV_{t=1}$ = -150 + (660/1.10) = $450
- If no expansion, the expected payoff as of year 2 is (.8 x 410) + (.2 x 180) = $364
- The NPV of not expanding, computed as of year 1 is $NPV_{t=1}$ = 0 + (364/1.10) = $331 (less than expansion)
- Should purchase the second piston plane to expand if market demand is high in year 1

Value of option to expand = NPV with expansion option - NPV without expansion
Value of the option to abandon = NPV with abandon option - NPV without abandonment