Week 4:
Capital Budgeting
Capital budgeting is an analysis of potential additions to fixed assets, long-term decisions involving large expenditures and is very important to a firm's future Therefore capital budgeting is "Capital budgeting is the process in which a business determines and evaluates potential expenses or investments that are large in nature. These expenditures and investments include projects such as building a new plant or investing in a long-term venture. Often times, a prospective project's lifetime cash inflows and outflows are assessed in order to determine whether the potential returns generated meet a sufficient target benchmark, also known as "investment appraisal."

Capital budgeting involves:

- Estimating CFs (inflows and outflows)
- Assessing the riskiness of CFs
- Determining an appropriate discount rate
- Finding NPV and/or IRR
- Acceptance of project if NPV>0 and/or IRR>r (WACC)

Types of investment decisions:

1) Independent projects
   Projects that, if accepted or rejects, will not affect the cash flows of another project

2) Mutually exclusive projects
   Projects that, if accepted, preclude the acceptance of competing projects

Types of project cash flows:

1) Conventional CF project (C)
   A negative CF (initial cost outlay) is followed by a series of positive cash inflows – hence there is one change of signs (-ve to +ve)

2) Non-conventional CF Project (NC)
   Two or more changes of signs – the most common is an outlay, followed by positive CFs, then a terminal cost in order to complete the project (eg. repair damaged site)

Alternative decision methods:

- Non-discounting methods
  - **Payback period method**
    The number of years required to recover a project's costs
    How long it takes to get our money back
    Decision rule: An investment is acceptable if its calculated pay back is less than a pre-specified cut off rate

Assume cost of capital (when required) = 10%

YEAR	Project L	Project S
0	-$100	-$100
1	$10	$70
2	$60	$50
3	$80	$20

	0	1	2	2.4	3
C_t	-$100	$10	$60	$100	$80
Cumulative	-$100	-$90	-$30	$0	$50

Payback_L = 2 + 30/80 = 2.375 years

Advantages: Provides an indication of a projects risk and liquidity, easy to calculate and understand

Disadvantages: Ignores the time value of money, ignores CFs occurring after the payback period, arbitrary choice of cut off date

- Discounting methods
  - **Discounted pay back**

    Uses discounted CFs rather than raw CFs

    (Project L Illustration)

	0 (10%)	1	2		3
C_t	-$100	$10	$60		$80
$PV(C_t)$	-$100	$9.09	$49.59		$60.11
Cumulative	-$100	-$90.91	-$41.32		$18.79

    Discounted payback = 2 + 41.32/60.11 = 2.687 yrs

    Recover investment and capital costs in 2.687yrs.

    In your own time calculate the discounted payback for Project S.
    ANSWER: Recover investment and capital costs in 1.871yrs.

  - **Net Present Value (NPV)**

    The required rate of return (r) is the minimum return that a project must earn in order to be acceptable

    The cost of capital (k) if often used as the minimum required rate of return for capital budgeting purposes

    The cost of capital (k) is the cost of investment funds, usually viewed as a weighted average of the cost of funds from all sources

    NPV: Sum of the PVs of inflows and outflows minus cost CF0, which is often negative

    $$NPV = \text{sum of}(NCF_t/(1+k)^t)$$

    By hand → discount all cash flows from t=1 onwards, and sum together to get NPV

    By calculator → CFLO CLR, enter interest per year (i/yr), enter cash flows typing number then pressing CFj button (don't forget +/- signs), then down key NPV

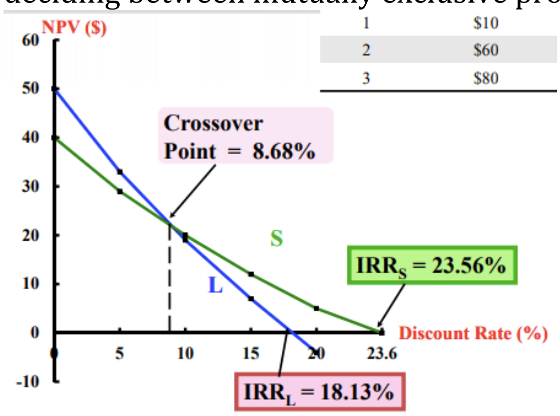
    Decision rules: Accept a project is NPV>0

NPV rationale = PV (benefit of inflows) – PV (costs) = net gain in wealth
The project with highest NPV adds greatest value, so if mutually exclusive choose the highest NPV, or if independent choose both if both NPV>0
Advantages: Uses cash flows not earnings, uses all cash flows of a project, discounts cash flows properly
Disadvantages: Relies on accurate estimate of cash flows and the discount rate, projects likely to be replicated with maturity of differing lengths
The higher the discount rate, the lower the NPV

- **Internal Rate of Return (IRR)**

IRR is the discount rate that forces PV inflows = cost, this is the same as forcing NPV=0
IRR is popular because it provides a single number that summarises the merit of a project
IRR = NPV = 0, solve for IRR
= NPV = sum of $(NCF_t/(1+IRR)^t)=0$
Decision rule: If IRR > k, accept project, if IRR < k, reject project
By calculator → CFLO CLR, enter i/yr, enter cash flows, down key IRR/yr
If IRR > k, then the projects rate of return is greater than its cost – some return is left over to boost stockholder's returns (e.g. if k=10% and IRR=15%, the project is profitable)

NOTE: there are some potential errors with the use of IRR in deciding between mutually exclusive projects



The Crossover Point is the discount rate at which the NPV for the two projects are equal (it can be thought of as the rate of indifference), it is also the IRR of the incremental cash flows
If NPVL (blue) > NPVS (green) or IRRS>IRRL = CONFLICT
If NPVS > NPVL or IRRS>IRRL = NO CONFLICT
THEREFORE CHOOSE RHS OF CROSSOVER POINT
When k is larger than the crossover rate (RHS), IRR and NPV leads to the same decision

When k is smaller than the crossover rate (LHS), there is conflict between IRR and NPV
NPV is always preferred as it measures additional wealth obtained
To find the crossover rate:

1. Find cash flow differences between the projects (i.e. find the incremental cash flows – the change in cash flow).

2. Incremental CF's $_{L\text{-}S}$

YEAR	Project L	Project S	Cash Flow L-S
0	-$100	-$100	$0
1	$10	$70	-$60
2	$60	$50	$10
3	$80	$20	$60

and calculate the IRR of incremental cash flow = 8.68%

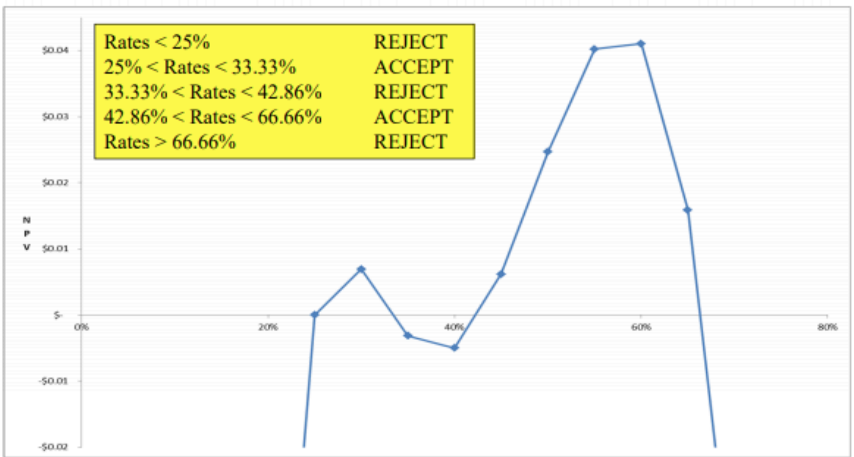
3. You Can subtract S from L or vice versa, but better to have first CF negative

4. If profiles don't cross, one project dominates the other.

Reasons NPV profiles cross: Size/scale differences (smaller project frees up fund at T=0 for investment, the higher the opportunity cost, the more valuable these funds so high k favours small projects) and timing differences (project with faster payback provides more CF in early years for reinvestment, if k is high early CFs are especially good, NPVS>NPVL
Reinvestment rate assumptions:

-NPV assumes reinvestment at k (opportunity cost capital)
-IRR assumes reinvestment at IRR
-Reinvestment at k is more realistic so NPV method is best
-NPV should always be used to choose between mutually exclusive projects (cash is king)

Another pitfall of IRR is multiple rates of return: in cases where there is more than one IRR, the calc will produce the first one it finds with no mention that there might be others, so you should create the NPV profile
EXAMPLE: We have four IRRs (Non-conventional CFs – four sign changes):



Another pitfall is lending or borrowing differences and where there is no feasible IRR solution

- Profitability Index (PI)
    - Capital rationing: is a limit set on funds available for investment
    - Soft rationing = limits imposed by top management
    - Hard rationing = firm is unable to raise money it requires to undertake all profitable projects, firm may be forced to pass up positive NPV projects

Profitability index is a relative measure of value and an investment return measurement much like NPV with one difference – NPV finds the dollar amount differences between the sum of PV future cash flows and amount of initial investment, whereas PI finds the ratio

PI = (Value created/resource consumed) = (NPV/Initial Investment)

Therefore PI measures the ratio between cash flow to investment, so the higher the ratio the more cash flow to investment

Decision rule: Accept a project if the PI>0, stay indifferent if PI=0, don't accept if PI<0

Profitability Index example:

Taken Inn is planning to open cafes in several cities and has estimates the required outlay and NPV for each of the following cities. Taken Inn is subject to hard capital rationing from its bank who has set a limit at $1,000,000 this year. Develop a profitability index for the following four centres and state which would be selected. All three centres plan to last for three years and the firm uses a 10% discount rate. In which cities should Taken Inn open cafes and why?

CITY	INITIAL OUTLAY	ANNUAL INFLOWS	NPV @10%	Profitability Index
Sydney	500,000	$220,000	$47,107.44	0.094
Melbourne	300,000	$130,000	$23,290.76	0.078
Perth	250,000	$100,000	-$1,314.80	-0.005
Hobart	125,000	$60,000	$24,211.12	0.194

Hobart, Sydney and Melbourne a total budget of $925,000

Advantages: considers time value of money, it presents a relative profitability of the project which allows comparison of two investments irrespective of their amount of investment, a higher PI would indicate a better IRR

Disadvantages: is also its relative indications, two projects having vast difference in investment and dollar return can have same PI, in such a situation therefore NPV methods remains best