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Capital Budgeting

LOS No. 1: Introduction

- Capital Budgeting is the process of **Identifying & Evaluating** capital projects i.e. projects where the cash flows to the firm will be received over a period longer than a year.
- Any corporate decisions with an **IMPACT ON FUTURE EARNINGS** can be examined using capital budgeting framework.
- **Categories of Capital Budgeting Projects:**
  (a) Replacement projects to maintain the business
  (b) Replacement projects for cost reduction
  (c) Expansion projects
  (d) New product or market development
  (e) Mandatory projects

Types of Capital Budgeting Proposals:

(a) Mutually Exclusive Proposals: when acceptance of one proposal implies the automatic rejection of the other proposal.

(b) Complementary Proposals: when the acceptance of one proposal implies the acceptance of other proposal complementary to it, rejection of one implies rejection of all complementary proposals.

(c) Independent Proposals: when the acceptance/rejection of one proposal doesn't affect the acceptance/rejection of other proposal.

LOS No. 2: Net Present Value (NPV)

NPV=PV of Cash Inflows – PV of Cash Outflows

Decision: If NPV is

+ve	Accept the project- increase shareholder's wealth
-ve	Reject the project-decrease shareholder's wealth
Zero	Indifferent-No effect on shareholder's wealth

$$NPV = -CF0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \text{----------} + \frac{CF_n}{(1+k)^n}$$

Where,
CF_0 = the initial investment outlay.
CF_t = after- tax cash flow at time t
K = required rate of return for project.

LOS No. 3: Profitability Index (PI)/ Benefit cost Ratio/ Desirability Factor/Present Value Index

$$PI = \frac{\text{PV of Cash InFlows}}{CF_0 \text{ or Present value of Outflows}}$$

CF_0 = Initial Cash Out Flows

Note:
NPV = - CF_0 + PV of future Cash In Flows
CF_0 + NPV = PV of Future Cash In Flows
If NPV is given, then
Add Initial outlay in NPV to get, PV of Cash inflows.

Decision:
If NPV is Positive, the PI will be greater than one.
If NPV is Negative, the PI will be Less than one.

Rule:

If PI > 1,	Accept the project
PI < 1,	Reject the project
PI = 1,	Indifferent

LOS No. 4: Pay-Back Period Method (PBP)

The pay- back period (PBP) is the number of years it takes to recover the initial cost of an investment.

Case I: When Cash inflows are Constant/ equal

$$\text{Pay-back Period} = \frac{\text{Initial Investment/ outflow}}{\text{Annual Cash Inflow}}$$

Case II: When Cash inflows are unequal

$$\text{Pay-back Period} = \text{Full years until recovery} + \frac{\text{Unrecovered Cost}}{\text{Cash Flow during next Year}}$$

Decision:
Shorter the PBP, better the project.
Drawback:
PBP does not take into account the time value of money and cash flows beyond the payback period.
Benefit:
The main benefit of the pay-back period is that it is a good measure of project liquidity.

LOS No. 5: Discount pay-back period

- The discounted payback period uses the present value (PV) of project's estimated Cash flows.
- It is the number of years it takes a project to recover its initial investment in present value terms.
- Discounted pay-back period must be greater than simple pay-back period.

LOS No. 6: IRR Techniques (Internal Rate of Return)

- IRR is the discount rate that makes the PV of a project's estimated cash inflows equal to the PV of the project's estimated cash outflows.
- i.e. IRR is the discount rate that makes the following relationship:

PV (Inflows) = PV (Outflows)

➔ IRR is also the discount rate for which the NPV of a project is equal to ZERO.

➔ IRR= Lower Rate + $\frac{\text{Lower Rate NPV}}{\text{Lower Rate NPV} - \text{Higher Rate NPV}}$ × Difference in Rate (HR-LR)

How to find the starting rate for calculation of IRR:

Step 1: Calculate Fake Pay-back period:

$$\text{Fake Pay-back Period} = \frac{\text{Initial Investment}}{\text{Average Annual Cash Flow}}$$

Step 2: Locate the above figure in Present Value Annuity Factor Table and take this discount rate to start the calculation of IRR.

Accept/Reject Criteria:

IRR > Cost of Capital	Accept the Proposal
IRR = Cost of Capital	Indifferent
IRR< Cost of Capital	Reject the Proposal

LOS No. 7: Accounting Rate of Return

$$\text{ARR} = \frac{\text{Average Net Profit}}{\text{Initial Investment}}$$

Note:

$$\text{Average Net Profit} = \frac{NP_1 + NP_2 + NP_3 \ldots\ldots NP_n}{n}$$

1. It ignores time value of money.
2. It takes into account accounting profits rather than cash flows.

LOS No. 8: Net Profitability Index or Net PI

$$\text{Net PI} = \frac{\text{NPV}}{\text{Initial Investment / Present Value of Outflows}}$$

Decision: Higher the Better.

LOS No. 9 : Project NPV/ Project IRR

	Equity Approach	Total Fund Approach / Overall Project Approach
Discount Rate	K_e	K_0
Initial Outflow	Equity Share Capital (Fund)	Equity – Share Capital (Fund) + Debenture + Long-term Loan + Preference Share Capital Or Total Cost of Project

Operating Cash Inflows	Cash Inflow available for equity	Cash Inflow available for overall project
Terminal Cash flows	SV adjusted for Tax Release of Working Capital	SV adjusted for Tax Release of Working Capital
NPV	NPV that a project earns for the equity share holders	NPV that a project earns for the company as a whole.

Calculation of Project Cash Flows

Sale Price Per Unit	xxx
- Variable Cost Per Unit	xxx
Contribution Per Unit	xxx
X No. of Unit	xxx
Total Contribution	xxx
- Fixed Cost	xxx
EBDIT	xxx
- Depreciation	xxx
EBIT	
- Tax	xxx
NOPAT	
Add : Depreciation	xxx
CFAT	xxx

Note 1 : Treatment of Depreciation

- [EBDIT – Depreciation] [1 – Tax Rate] + Depreciation

Or

- EBDIT (1 – Tax Rate) + Tax saving on Depreciation

Note 2 : Treatment of Interest Cost / Finance Cost

- Finance Cost are already reflected in the Projects required rate of return / WACC / K_o
- This shows that Interest on Long Term Loans as well as its Tax Saving is already considered by K_o

Note 3 : Treatment of Working Capital

		Time
• Introduction of Working Capital	Outflow	Year 0
• Release of Working Capital	Inflow	End of project Life

Working Capital should never be adjusted for tax as it is a balance sheet item. Working capital is also not subject to depreciation.

Note 4 : Treatment of Tax

If we have loss in a particular year, there are two adjustments

1. **Set-off** : assumed the firm as other profitable business, Loss in a year generate tax savings in that year.
2. **Carry Forward :** The company has an individual business or a new business having no other operations, loss in a year will be carried forward to future years for the purpose of Set-off.

Note 5 : Key Points to Remember

1. Decisions are based on cash flows, not accounting income:

- ❖ Consider INCREMENTAL CASH FLOWS, the change in cash flows that will occur if the project is undertaken.

2. **Sunk costs should not be included in the analysis.**
   - ❖ These costs are not effected by the accept/reject decisions. Eg. Consulting fees paid to a marketing research firm to estimate demand for a new product prior to a decision on the project.
3. **Externities / Cannibalization**
   - ❖ When considering the full implication of a new project, loss in sales of existing products should be taken into account & also consider positive effects on sale of a firm's other product line.
4. **Cash flows are based on Opportunity Costs.**
   - ❖ Opportunity costs should be included in projects costs.
5. **The timing of cash flows is important.**
   - ❖ Cash flows received earlier are worth more than cash flows to be received later.
6. **Cash flows are analyzed on an after-tax basis.**

Calculation of Equity Cash Flows

EBITDA	xxx
- Depreciation & Amortization	xxx
EBIT	
- Interest	xxx
EBT	
- Tax	xxx
PAT	xxx
Add : Depreciation	xxx
Less: Principal Repayment	xxx
EQUITY CASH FLOWS	**xxx**

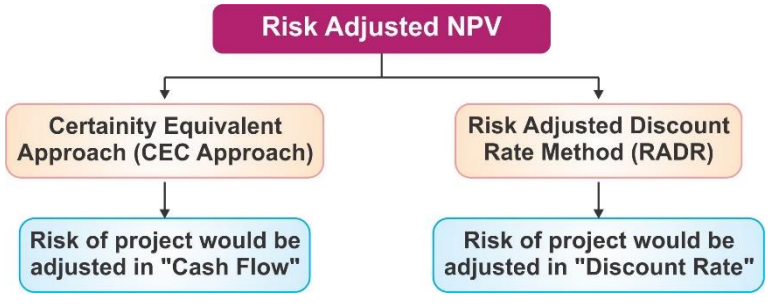
Modified NPV/ IRR

- When Cost of Capital & Re-investment rate are separately given, then we calculate Modified NPV.
- **Modified IRR:** It is the discount rate at which Modified NPV is Zero.

i.e. Modified NPV = $\frac{Terminal\ Value}{(1+K_0)^n}$ - PV of Cash Outflow

'**or**' PV of cash outflow = $\frac{Terminal\ Value}{(1+K_0)^n}$

LOS No. 10: Calculation of Risk Adjusted NPV



Risk-Adjusted Discount Rate Method (RADR)

(1+ RADR) = (1+ Risk-free rate) (1 + Risk Premium)

Note:

- Under this method, Project should be discounted using risk- adjusted discount rate rather than risk-free discount rate.
- Project having higher risk should be discounted with higher rate.
- Higher the risk of the project, higher should be the discount rate.
- NPV calculated by using RADR is known as "Risk Adjusted NPV".
- CV is a measure of risk, higher the CV, higher the risk.
- Imagine the firm to be market portfolio, K_o can be treated as R_m

RADR = R_F + Risk Index (K_o – R_F)

Certainty Equivalent Co-efficient (CEC) Method

It involves discounting of certain Cash Flows instead of Total Cash Flows.

Steps involved:

Step 1: Calculate all cash flows arising from the project.

Step 2: Calculate certain cash flow by using CEC (Certainty Equivalent Co-efficient)

Certain Cash Flow = Cash Flow × CEC

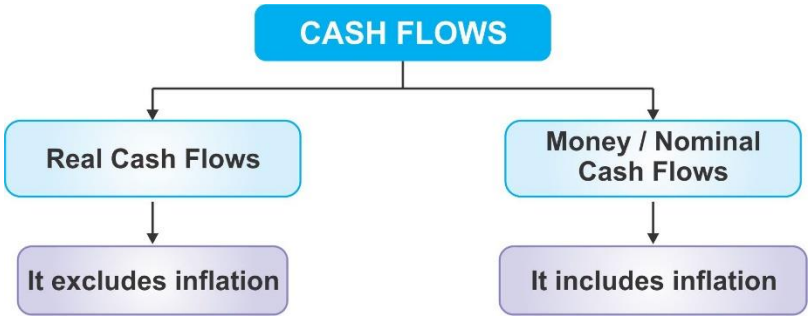
Step 3: Compute NPV by taking certain risk-free Cash Flow and risk-free discount rate.

Note:

- Higher the CEC, lower the risk and vice-versa.
- CEC of cash flow arising in year 0 will always be One.

LOS No. 11: Inflation under Capital Budgeting

1. Cash Flow:



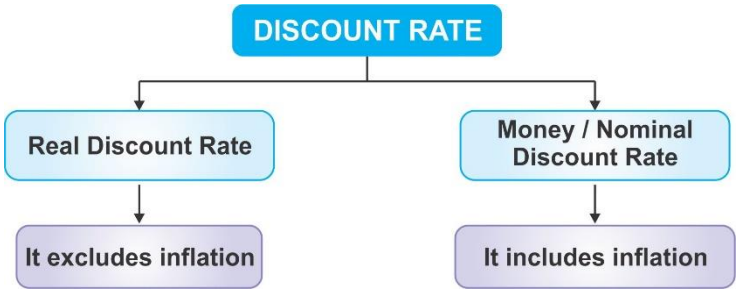
Conversion of Real Cash Flow into Money Cash Flow & Vice-versa

Money Cash Flow = Real Cash Flow $(1 + \text{Inflation Rate})^n$

Or

$$\text{Real Cash Flow} = \frac{\text{Money Cash Flow}}{(1+\text{Inflation Rate})^n}$$

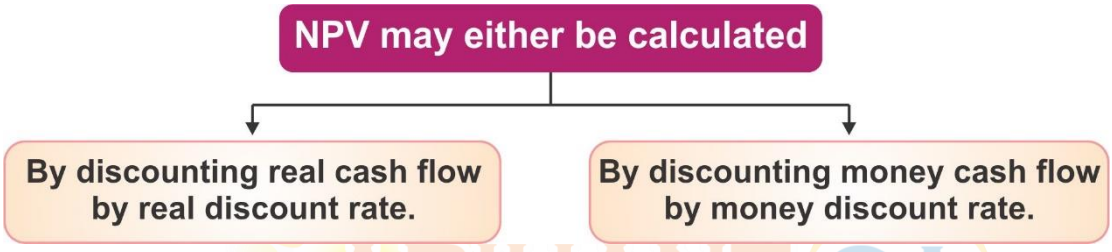
2. Discount Rate:



Conversion of Real Discount Rate into Money Discount Rate & Vice-versa

(1 + Money Discount Rate) = (1+ Real Discount Rate) (1+Inflation Rate)

3. NPV :



Note:

- Answer in both the case will be same.
- Depreciation is not affected by inflation rate as depreciation is changed on the book value of the asset & not market value.

LOS No. 12: Replacement Decision

"Whether to repair existing machine"
Or
"Whether to replace the existing machine and buy new machine"

Case 1 : Life of new machine = Remaining Life of Old Machine
(We can apply incremental principle i.e. New – Old)

Initial Investment = Cost of New Machine – SV of Old Machine
Operating CF's = CFAT from New Machine – CFAT from Old Machine
Terminal CF's = SV from New Machine – SV from Old Machine

Case 2 : Life of new machine ≠ Remaining Life of Old Machine
We can't apply incremental principle
Use equated Annual Annuity Approach (EAA)

Steps Involved:
Step 1: Calculate NPV **or** PV of cash inflow **or** PV of cash outflow of each project.
Step 2: Calculate equated annual amount by using this formulae:

$$= \frac{\text{NPV or PV of cash out flow or PV value of cash Inflow}}{\text{PVAF (k\%,n years)}}$$

LOS No. 13: Probability Distribution Approach

Expected NPV/ Expected Cash Flow / Expected Value

$$\sum NPV \times Probability$$

Standard Deviation:

$$\sigma = \sqrt{\sum[\text{probability} \times (\text{Given NPV} - \text{Expected NPV})^2]}$$

- Higher the S.D, Higher the risk & Vice-versa.

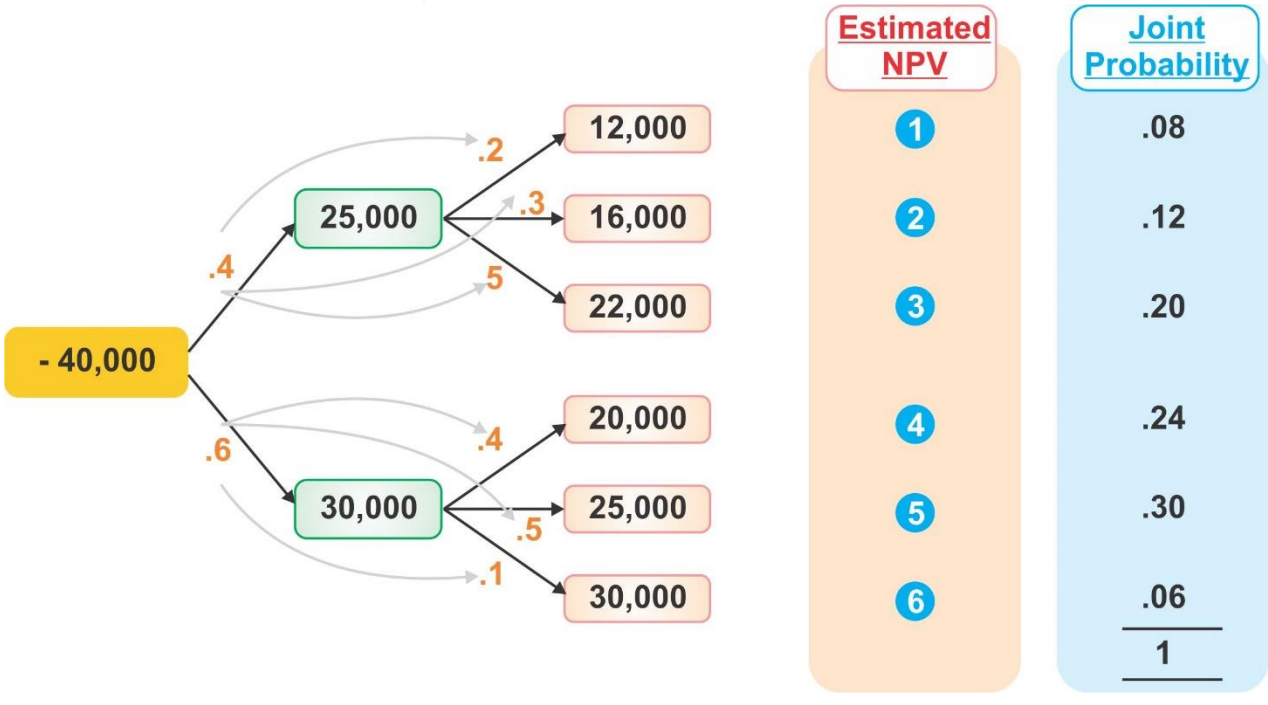
Co-efficient of Variation (CV):

$$CV = \frac{\text{Standard Deviation}}{\text{Expected NPV}}$$

- Higher the CV, higher the risk & vice-versa

LOS No. 14: Decision Tree Approach & Joint Probability

Type 1 : Moderately Correlated Cash Flows

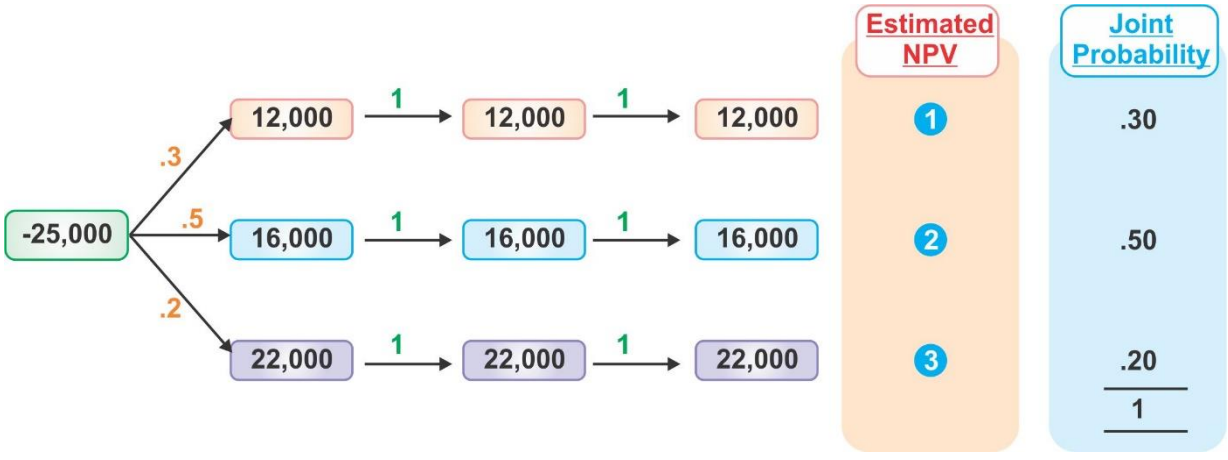


- Decision Tree is a graphical representation of two or more than 2 years cash flows, which are dependent to each other.
- Joint probability is the product of two or more than two dependent probabilities.
- The total of joint probabilities is always equal to 1.
- Joint probability is applicable in case of dependent cash flows.

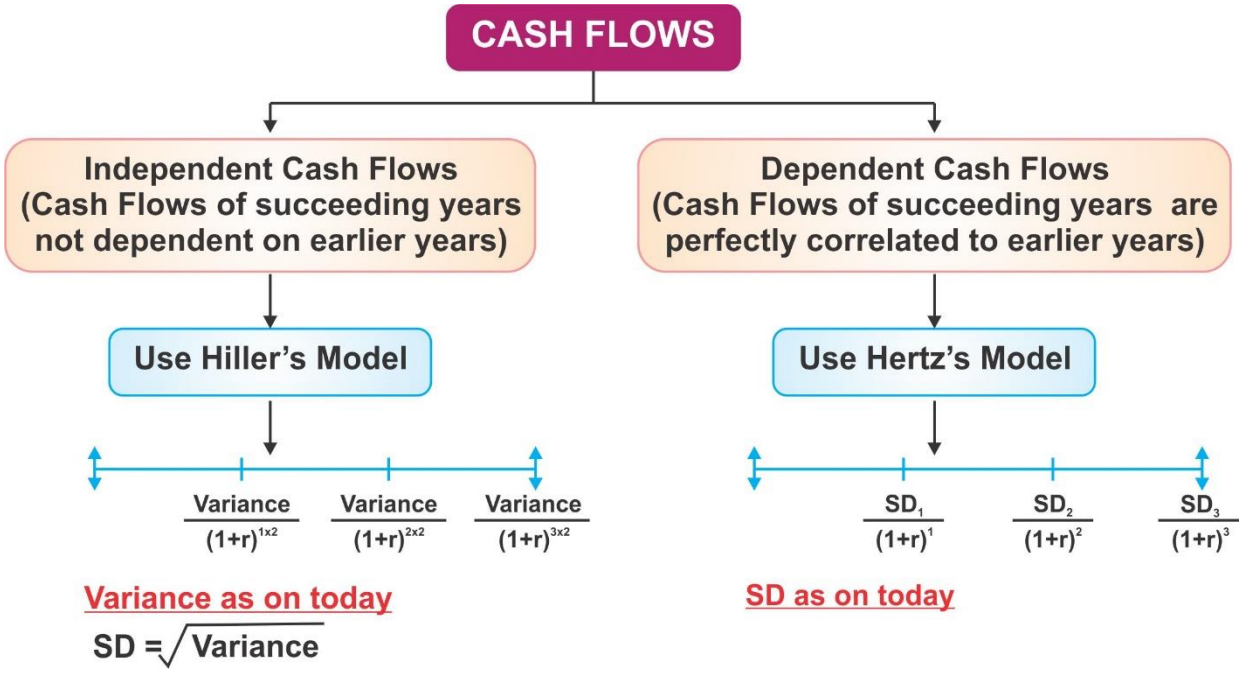
Steps Involved:

Step 1: Identify the various paths or outcomes
Step 2: Compute joint probability.
Step 3: Compute NPV of each path.
Step 4: Compute Expected NPV.

Type 2 : Perfectly Correlated Cash Flows



Type 3 : Hiller's and Hertz's Model



LOS No. 15: Scenario Analysis

- Scenario Analysis is an analysis of the NPV of a project under a series of specific scenarios (worst, most likely and best scenario) based on macro-economics, industry and firm-specific facto
- Under this, all inputs are set at their most optimistic or pessimistic or most likely levels and NPV is computed.
- Decision is based on the NPV under all scenarios.

LOS No. 16: Sensitivity Analysis

- Also known as "What if" Analysis.
- Sensitivity Analysis is one of the methods of analyzing the risk surrounding the capital expenditure Decision and enables an assessment to be made of how responsive the project's NPV is to changes in those variables based on which NPV is computed.

- Sensitivity Analysis is a tool in the hand of firms to **analyze change in the project's NPV for a given change in one of the variables.**
- Under this analysis we try to measure risk of each factor taking NPV=0.
- Key factors which are used to calculate NPV are as follows:

	Inverse Effect
Cash Inflows	Decrease
Cash Outflows	Increase
Discount Rate	Increase
Life of the project	Decrease

- **Decision Rule**
  - Management should pay maximum attention towards the factor where minimum percentage of adverse changes causes maximum adverse effect.

Example:

- If NPV is to become Zero with 5% change in initial investment relative to 10% change in cash inflows, project is said to be more sensitive to initial investment then to cash inflows.

Note:
Sensitivity Analysis is calculated for each factor separately, keeping other factors constant.

Method 1 : Margin of Safety Approach (MOS)

Set NPV = 0 & Calculate the Break Even Values and Margin of Safety for Each Factor

$$\text{Sensitivity (\%)} = \frac{\text{Change}}{\text{Base}} \times 100$$

Decision : Most critical / Sensitive Factor is that Factor for which MOS is least.

Method 2 : Shock Approach

Shock each Risk Factor in the adverse direction like 10% / 20% & Find out the Revised NPV or %age fall in NPV

$$\text{\% Fall In NPV} = \frac{\text{Revised NPV} - \text{Original NPV}}{\text{Original NPV}} \times 100$$

Decision : Most critical / Sensitive Factor is that Factor for which results in Maximum Fall in NPV.

LOS No. 17: Capital Rationing

- Capital rationing is the situation under which company is not able to undertake all +ve NPV projects due to lack of funds.
- Firm must prioritize its capital expenditure with the goal of achieving the maximum increase in value for shareholders.
- If the firm has unlimited access to capital, the firm can undertake all projects with +ve NPV.

Divisible Projects
Those projects which can be taken in parts
E.g. Construction of Flats.

Indivisible Projects
Those projects which cannot be taken in parts
E.g. Construction of Ship.

Case I: Divisible Project

Steps Involved:

Step 1: Calculate NPV of each project.
Step 2: Identify whether capital rationing exists.
Step 3: Calculate Net Profitability Index or Profitability Index (PI) for each project.
Step 4: Rank the project
Step 5: Allocate money according to rank.

Case II: Indivisible Project

Steps Involved:

Step 1: Calculate NPV of each project.
Step 2: Identify whether capital rationing exists.
Step 3: Take possible combinations of projects taking into consideration limitation of funds.
Step 4: Select that combination which gives highest NPV.

LOS No. 18: Overall Beta/ Asset Beta/ Project Beta/ Firm Beta

Situation 1 :

100 % Equity Firm → Unlevered Firm

$$\beta_{Equity} = \beta_{Assets} = \beta_{Overall}$$

Situation 2 :

Debt + Equity Firm → Levered Firm

$$\beta_{Levered} = \beta_{Unlevered} = \beta_{Overall} = \beta_{Assets}$$

- Overall Beta of the companies belonging to the same industry/sector, always remain same.
- Equity Beta and debt Beta may change with the change in Capital structure.
- Overall Beta of a project can't be changed with the change in capital structure of a particular company.
- According to MM, the change in capital structure doesn't change the overall beta.
- Debt is always assume to be risk free, so. Debt Beta = 0.

$$\text{Overall Beta} = \text{equity Beta} \times \frac{Equity}{Equity + Debt\,(1-tax)} + \text{Debt Beta} \times \frac{Debt\,(1-tax)}{Equity + Debt\,(1-tax)}$$

Overall Cost of Capital/ Discount Rate

Cost of Capital (K_o) = $K_e W_e + K_d W_d$ **$K_e = R_f + \beta_{equity}(R_m - R_f)$** **Or** **$K_d$ = Interest (1 – tax rate)**	**OR**	**$K_o = R_f + \beta_{Overall}(R_m - R_f)$** **(Only applicable when tax rate is missing)**

Note:

- If interest rate is not given, it is assumed to be equal to risk-free rate.
- If Beta Debt is not given, it is assumed to be equal to Zero
- If debt = 0

Overall Beta = Equity Beta
i.e. for 100% equity firm overall beta & equity beta is same

Estimating the project Discount Rate (Pure Play Technique)

CAPM can be used to arrive at the project discount rate by taking the following steps:

1. Estimate the project beta.
2. Putting the value of Beta computed above into the Capital Asset Pricing Model (CAPM) to arrive at the cost of equity.
3. Estimate the cost of debt.
4. Calculate the WACC for the project.

Proxy Beta (If more than one comparable co. data is given)

- Sometimes overall beta of similar companies belonging to same sector may be slightly different.
- In such case we use proxy beta concept by taking average of all the given companies.

LOS No. 19: Backward Decision Tree

- It is a graphical presentation of a decision making situation. We have branches coming out of nodes.

Decision Nodes → From which this alternative will come out.

Choice Nodes → Certain outcome like High Demand or Low Demand or success or failure will come out.

- The tree is drawn from left to right. However, calculation can be done from right to left.

At Every  , Calculate expected value

At Every  , Move towards best alternative.

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