



Economic Feasibility Studies



Introduction

- Every long term decision the firm makes is a *capital budgeting decision* whenever it changes the company's cash flows.
- The difficulty with making these decisions is that typically, *many cash flows* are affected, and they usually extend over a long period of time.
- *Investment appraisal criteria* help us in analyzing capital budgeting decisions by aggregating the multitude of cash flows into one number.

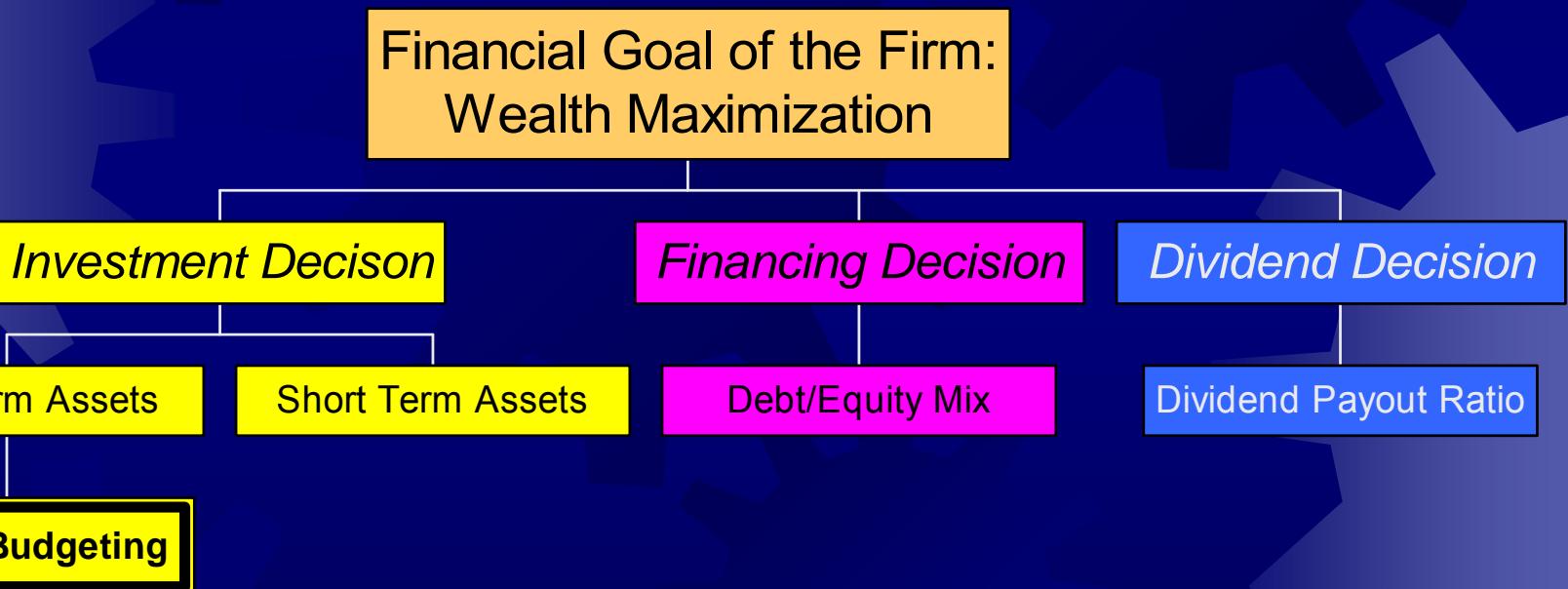


Introduction

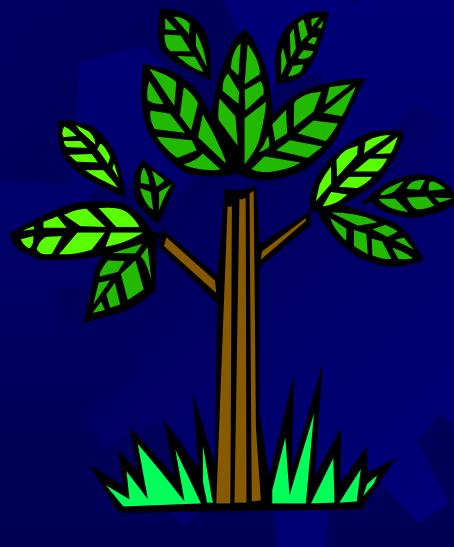
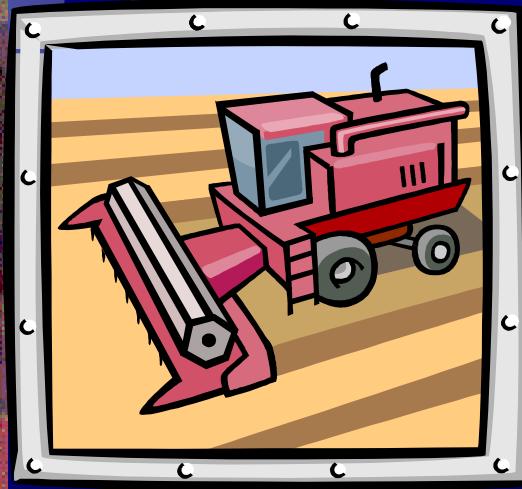
- * The important points are:
- * Capital budgeting is the most significant financial activity of the firm.
- * Capital budgeting determines the core activities of the firm over a long term future.
- * Capital budgeting decisions must be made carefully and rationally.

Capital Budgeting Within A Firm

The Position of Capital Budgeting



Examples of ‘Long Term Assets’



Aspects of Capital Budgeting

Capital Budgeting involves:

- 1- Committing significant resources.**
- 2 -Planning for the long term: 5 to 50 years.**
- 3- Decision making by senior management.**
- 4- Forecasting long term cash flows.**
- 5- Estimating long term discount rates.**
- 6- Analyzing risk.**



Aspects of Capital Budgeting

Capital Budgeting:

Emphasize the firm's goal of wealth maximization, which is expressed as maximizing an investment's Net Present Value

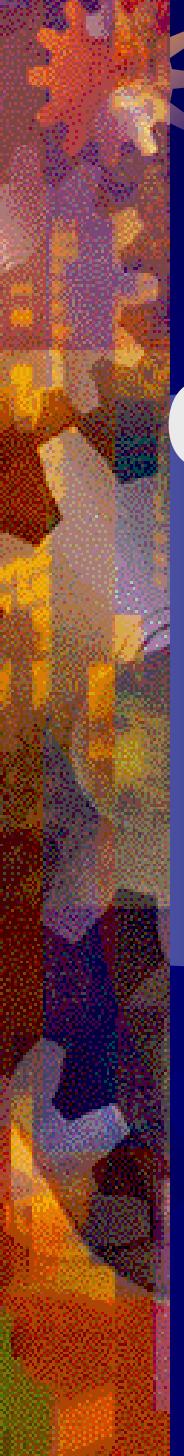
Requires calculating a project's relevant cash flows

Aspects of Capital Budgeting

Capital Budgeting Uses:

Sophisticated forecasting techniques:-

- Time series analysis by the application of simple and multiple regression, and moving averages
- Qualitative forecasting by the application of various techniques, such as the Delphi method



Aspects of Capital Budgeting

Capital Budgeting requires:

Application of time value of money formula

Application of NPV analysis to forecasted cash flows

Aspects of Capital Budgeting

Risk Analysis

- Application of Sensitivity and Break Even analyses to analyze risk.
- Application of Simulation and Monte Carlo Analysis as extra risk analysis.
- Application of long term forecasting and risk analysis to projects with very long lives



Unit 2: Project Cash Flows

Training Goals:

- 1- Understand why to use the cash flows concept in long term investment decisions.**
- 2- Discuss the major components of relevant cash flows.**



Project Cash Flows

The definition, identification,
and measurement of cash flows
relevant to project evaluation.



Why Cash Flows?

- * **Cash flows, and not accounting estimates, are used in project analysis because:**
 1. They measure actual economic wealth.
 2. They occur at identifiable time points.
 3. They have identifiable directional flow.
 4. They are free of accounting definitional problems.





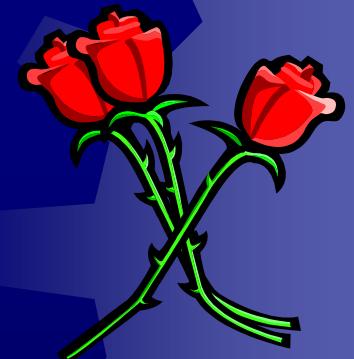
The Meaning of RELEVANT Cash Flows.

- * A relevant cash flow is one which will **change** as a direct result of the decision about a project.
- * A relevant cash flow is one which will occur in the **future**. A cash flow incurred in the past is irrelevant. It is sunk.
- * A relevant cash flow is the difference in the firm's cash flows **with** the project, and **without** the project.



Cash Flows: A Rose By Any Other Name Is Just as Sweet.

- * Relevant cash flows are also known as:-
- * Marginal cash flows.
- * Incremental cash flows.
- * Changing cash flows.
- * Project cash flows.





Project Cash Flows: Yes and No.

- ✿ **YES:- these are relevant cash flows -**
 - ✓ Incremental future sales revenue.
 - ✓ Incremental future production costs.
 - ✓ Incremental initial outlay.
 - ✓ Incremental future salvage value.
 - ✓ Incremental working capital outlay.
 - ✓ Incremental future taxes.



Project Cash Flows: Yes and No.

- * NO:- these are not relevant cash flows -
 - ☒ Changed future depreciation.
 - ☒ Reallocated overhead costs.
 - ☒ Adjusted future accounting profit.
 - ☒ The cost of unused idle capacity.
 - ☒ Outlays incurred in the past.



Cash Flows and Depreciation: Always A Problem.

- * **Depreciation is NOT a cash flow.**
- * **Depreciation is simply the accounting amortization of an initial capital cost.**
- * **Depreciation amounts are only accounting journal entries.**
- * **Depreciation is measured in project analysis only because it reduces taxes.**



Other Cash Flow Issues.

- * **Tax payable**: if the project changes tax liabilities, those changed taxes are a flow of the project.
- * **Investment allowance**: if a taxing authority offers this ‘extra depreciation’ concession, then its tax savings are included.
- * **Financing flows**: interest paid on debt, and dividends paid on equity, are NOT cash flows of the project.

Using Cash Flows

All relevant project cash flows are set out in a table.

The cash flow table usually reads across in End Of Years, starting at EOY 0 (now) and ending at the project's last year.

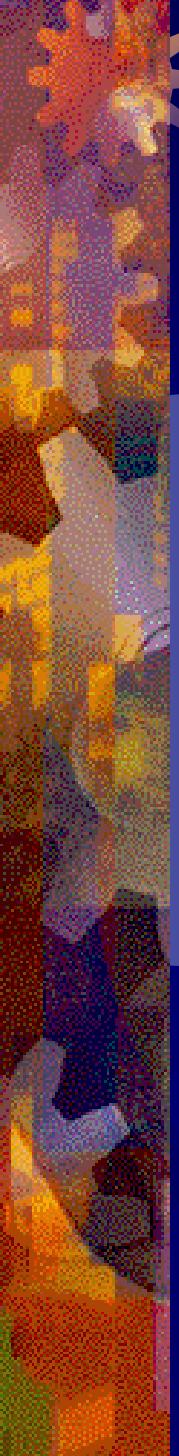
The cash flow table usually reads down in cash flow elements, resulting in a Net Annual Cash Flow. This flow will have a positive or negative sign.



Project Cash Flows: Summary

- * Only future, incremental, cash flows are Relevant.
- * Relevant Cash Flows are entered into a yearly cash flow table.
- * Net Annual Cash Flows are discounted to give the project's Net Present Value.





Unit 3: Essential Formulae in Project Appraisal

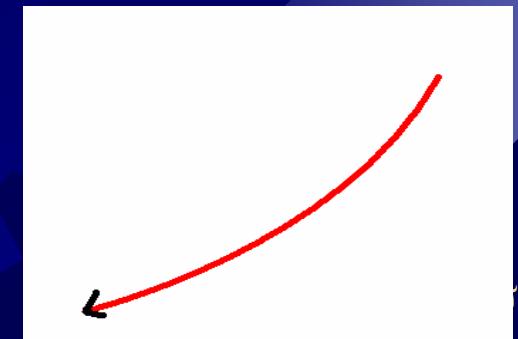
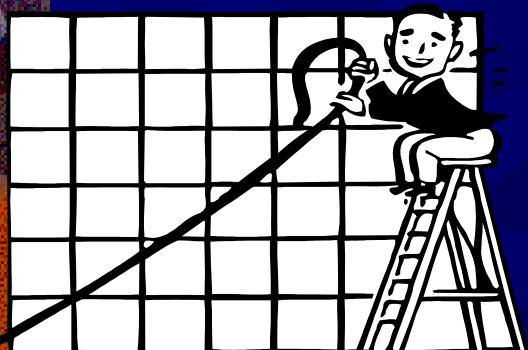
**A Coverage of the Formula and
Symbols Used to Evaluate
Investment Projects**

Fundamentals in Financial Evaluation

- ★ Money has a time value: a \$ or £ or € today, is worth more than a \$ or £ or € next year.
- ★ A risk free interest rate may represent the time value of money.
- ★ Inflation can create a difference in money value over time. It is NOT the time value of money. It is a decline in monetary purchasing power.

Moving Money Through Time

- * Investment projects are long lived, so we usually use annual interest rates.
- * With compound interest rates, money moved forward in time is '**compounded**', whilst money moved backward is '**discounted**'.



Financial Calculations

- * Time value calculations in capital budgeting usually assume that interest is annually compounded.
- * ‘Money’ in investment projects is known as ‘cash flows’: the symbol is:
 C_t Cash flow at end of period t.

Financial Calculations

- The present value of a single sum is:

$$PV = FV (1 + r)^{-t}$$

the present value of a dollar to be received at the end of period t , using a discount rate of r .

- The present value of a series of cash flows is:

$$PV = \sum_{1}^t \frac{CF_t}{(1 + r)^t}$$

Financial Calculations: Cash Flow Series

- ★ A payment series in which cash flows are *Equally sized* And *Equally timed* is known as an annuity.

There are 3 types:

1. Ordinary annuities; the cash flows occur at the end of each time period.
2. Annuities due; the cash flows occur at the start of each time period.

Financial Calculations: Cash Flow Series

4. Perpetuities; the cash flows begin at the *end* of the first period, and go on *forever*.

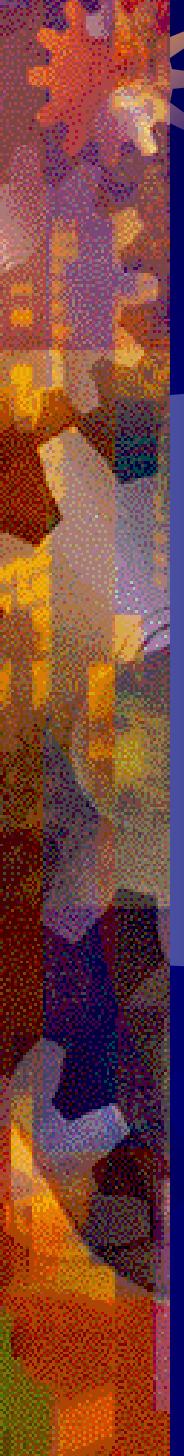
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Unit 4: Investment Decisions Under Certainty

Training Goals: To Understand How to use the following Methods:

1. The Net Present Value
2. The Payback Period Rule
3. The Discounted Payback Period Rule
4. The Average Accounting Return
5. The Internal Rate of Return
6. Problems with the IRR Approach
7. The Profitability Index



1- Why To Use Net Present Value?

- ★ Accepting positive NPV projects benefits shareholders.
- ✓ NPV uses cash flows
- ✓ NPV uses all the cash flows of the project
- ✓ NPV discounts the cash flows properly



The Net Present Value (NPV) Rule

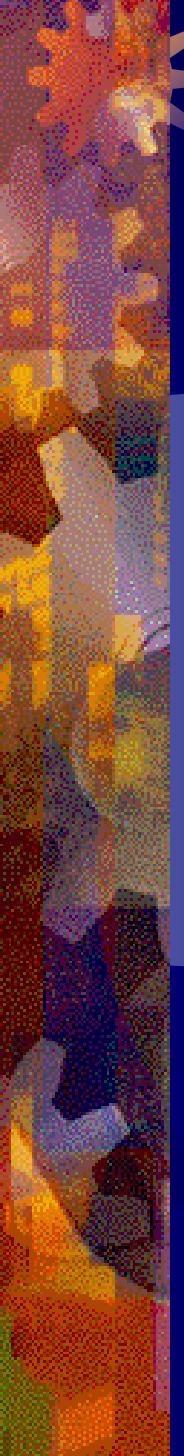
- ★ Net Present Value (NPV) =
Total PV of future CF's - Initial Investment
- ★ Estimating NPV:
 - 1. Estimate future cash flows: how much? and when?
 - 2. Estimate discount rate
 - 3. Estimate initial costs
- ★ Minimum Acceptance Criteria: Accept if $NPV > 0$
- ★ Ranking Criteria: Choose the highest NPV



Good Attributes of the NPV Rule

- * 1. Uses cash flows
- * 2. Uses ALL cash flows of the project
- * 3. Discounts ALL cash flows properly

- * Reinvestment assumption: the NPV rule assumes that all cash flows can be reinvested at the discount rate.



2. The Payback Period Rule

- ★ How long does it take the project to “pay back” its initial investment?
- ★ Payback Period = number of years to recover initial costs
- ★ Minimum Acceptance Criteria:
 - ★ set by management
- ★ Ranking Criteria:
 - ★ set by management



The Payback Period Rule (continued)

★ Disadvantages:

- Ignores the time value of money
- Ignores cash flows after the payback period
- Biased against long-term projects
- Requires an arbitrary acceptance criteria
- A project accepted based on the payback criteria may not have a positive NPV

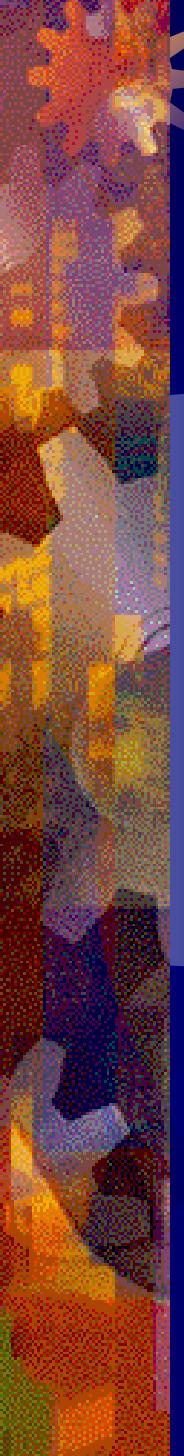
★ Advantages:

- Easy to understand
- Biased toward liquidity



3 The Discounted Payback Period Rule

- ★ How long does it take the project to “pay back” its initial investment taking the time value of money into account?
- ★ By the time you have discounted the cash flows, you might as well calculate the NPV.



4. The Average Accounting Return Rule

$$AAR = \frac{\text{Average Net Income}}{\text{Average Book Value of Investent}}$$

- ✿ Another attractive but fatally flawed approach.
- ✿ Ranking Criteria and Minimum Acceptance Criteria set by management
- ✿ Disadvantages:
 - Ignores the time value of money
 - Uses an arbitrary benchmark cutoff rate
 - Based on book values, not cash flows and market values
- ✿ Advantages:
 - The accounting information is usually available
 - Easy to calculate

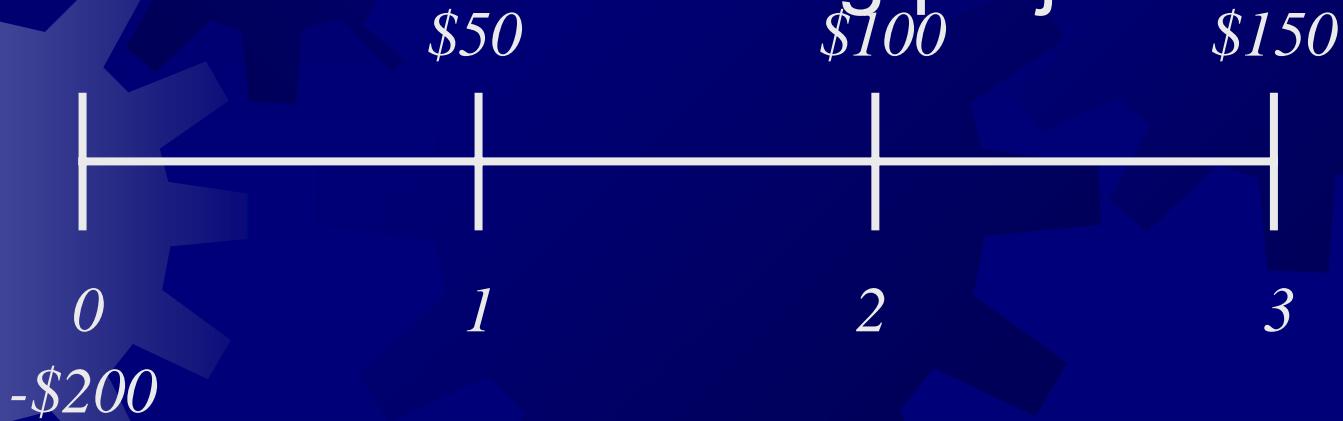


5. The Internal Rate of Return (IRR) Rule

- ★ IRR: the discount that sets NPV to zero
- ★ Minimum Acceptance Criteria:
 - Accept if the IRR exceeds the required return.
- ★ Ranking Criteria:
 - Select alternative with the highest IRR
- ★ Reinvestment assumption:
 - All future cash flows are assumed to be reinvested.
- ★ Disadvantages:
 - Does not distinguish between investing and borrowing.
 - IRR may not exist or there may be multiple IRR
 - Problems with mutually exclusive investments
- ★ Advantages:
 - Easy to understand and communicate

The Internal Rate of Return: Example

Consider the following project:



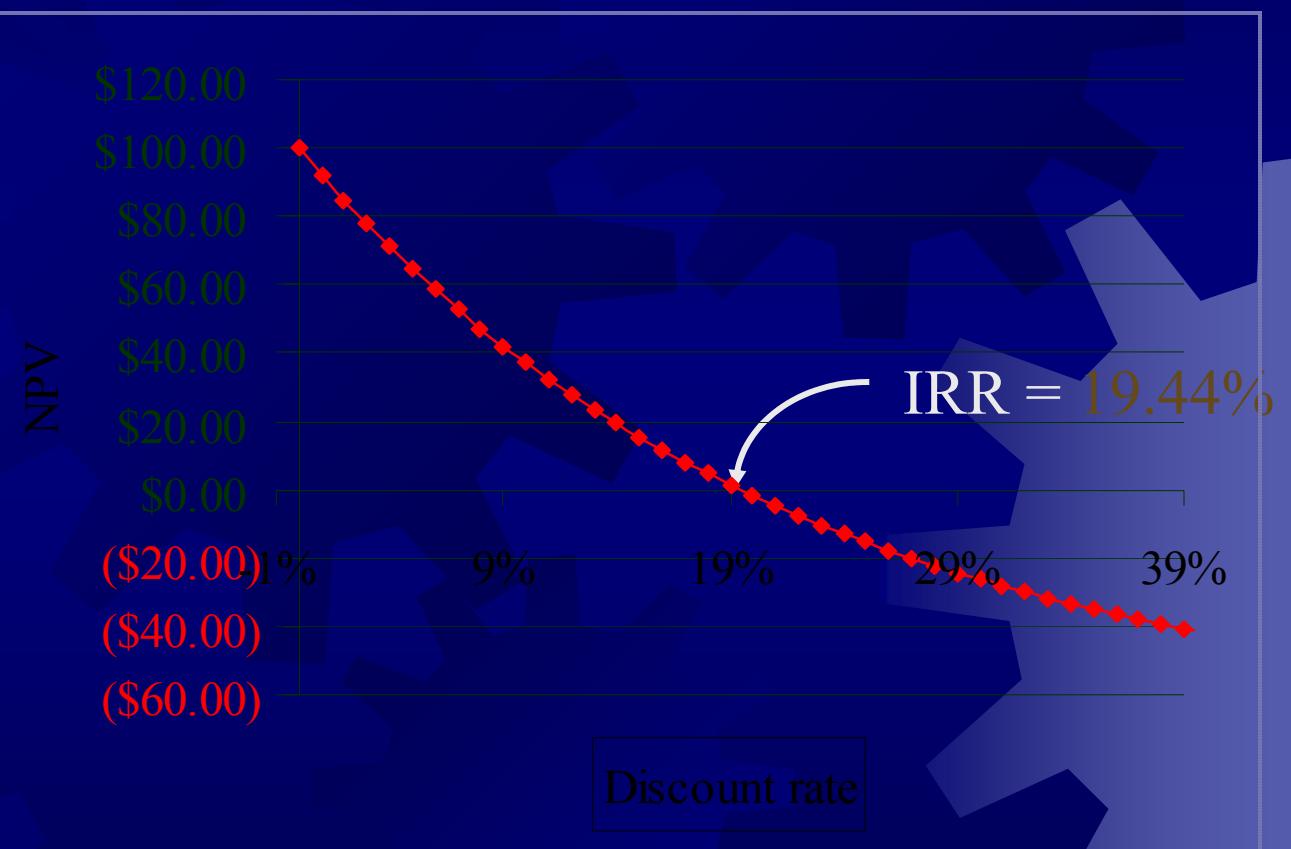
The internal rate of return for this project is
19.44%

$$NPV = 0 = \frac{\$50}{(1 + IRR)} + \frac{\$100}{(1 + IRR)^2} + \frac{\$150}{(1 + IRR)^3}$$

The NPV Payoff Profile for This Example

If we graph NPV versus discount rate, we can see the IRR as the x-axis intercept.

Discount Rate	NPV
0%	\$100.00
4%	\$71.04
8%	\$47.32
12%	\$27.79
16%	\$11.65
20%	(\$1.74)
24%	(\$12.88)
28%	(\$22.17)
32%	(\$29.93)
36%	(\$36.43)
40%	(\$41.86)



Mutually Exclusive vs. Independent Project

- ★ Mutually Exclusive Projects: only ONE of several potential projects can be chosen, e.g. acquiring an accounting system.
 - RANK all alternatives and select the best one.
- ★ Independent Projects: accepting or rejecting one project does not affect the decision of the other projects.
- ★ Must exceed a MINIMUM acceptance criteria.

7. The Profitability Index (PI) Rule

$$PI = \frac{\text{Total PV of Future Cash Flows}}{\text{Initial Investent}}$$

- ★ Minimum Acceptance Criteria: Accept if $PI > 1$
- ★ Ranking Criteria:
 - Select alternative with highest PI
- ★ Disadvantages:
 - Problems with mutually exclusive investments
- ★ Advantages:
 - May be useful when available investment funds are limited
 - Easy to understand and communicate
 - Correct decision when evaluating independent projects



8 The Practice of Capital Budgeting

- ✿ Varies by industry:
 - ✿ Some firms use payback, others use accounting rate of return.
- ✿ The most frequently used technique for large corporations is IRR or NPV.

Example of Investment Rules

Compute the IRR, NPV, PI, and payback period for the following two projects.
Assume the required return is 10%.

Year	Project A	Project B
0	-\$200	-\$150
1	\$200	\$50
2	\$800	\$100
3	-\$800	\$150

Example of Investment Rules

	Project A	Project B
CF_0	-\$200.00	-\$150.00
PV_0 of CF_{1-3}	\$241.92	\$240.80
NPV =	\$41.92	\$90.80
IRR =	0%, 100%	36.19%
PI =	1.2096	1.6053

Example of Investment Rules

Payback Period:

Time	Project A		Project B	
	CF	Cum. CF	CF	Cum. CF
0	-200	-200	-150	-150
1	200	0	50	-100
2	800	800	100	0
3	-800	0	150	150

Payback period for project B = 2 years.

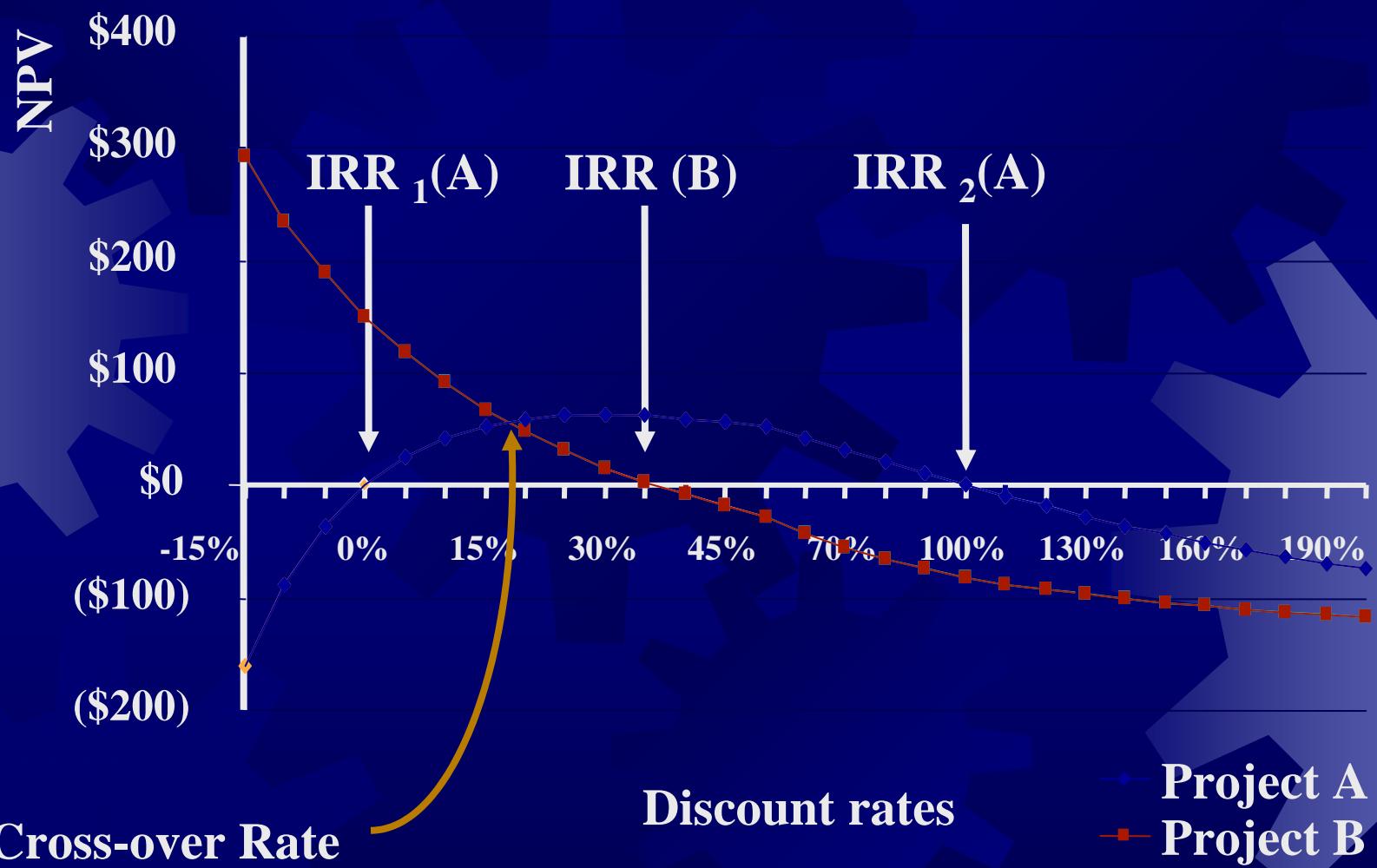
Payback period for project A = 1 or 3 years?

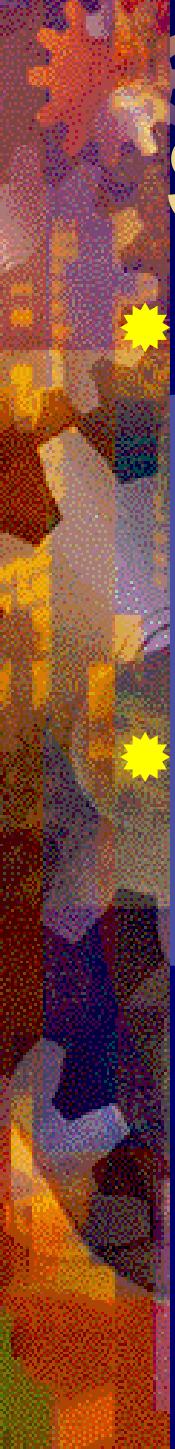
Relationship Between NPV and IRR

Discount rate NPV for ANPV for B

-10%	-87.52	234.77
0%	0.00	150.00
20%	59.26	47.92
40%	59.48	-8.60
60%	42.19	-43.07
80%	20.85	-65.64
100%	0.00	-81.25
120%	-18.93	-92.52

NPV Profiles





Selection of Techniques:

- * **NPV** is the technique of choice; it satisfies the requirements of: the firm's goal, the time value of money, and the absolute measure of investment.
- * **IRR** is useful in a single asset case, where the cash flow pattern is an outflow followed by all positive inflows. In other situations the IRR may not rank mutually exclusive assets properly, or may have zero or many solutions.



Selection of Techniques:

- * **ARR** allows many valuations of the asset base, does not account for the time value of money, and does not relate to the firm's goal. It is not a recommended method.
- * **PB** does not allow for the time value of money, and does not relate to the firm's goal. It is not a recommended method.



The Notion of Certainty

- ★ Certainty allows demonstration and evaluation of the capital budgeting techniques, whilst avoiding the complexities involved with risk.
- ★ Certainty requires forecasting, but forecasts which are certain.
- ★ Certainty is useful for calculation practice.
- ★ Risk is added as an adaption of an evaluation model developed under certainty.

Unit 5: Risk Analysis

Incorporating Risk Into
Project Analysis Through
Adjustments To The
Discount Rate, and By The
Certainty Equivalent Factor.



Introduction: What is Risk?

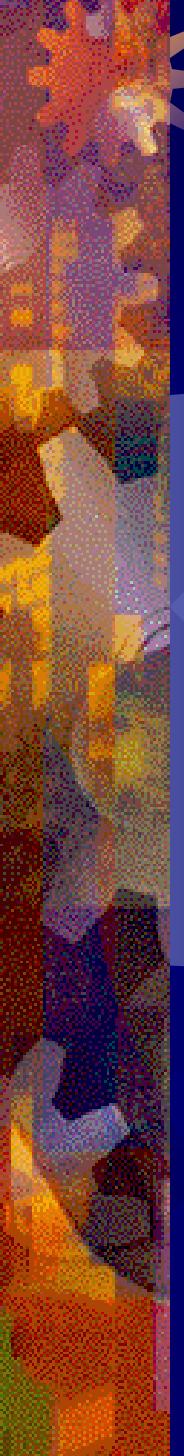
- ◆ Risk is the variation of future expectations around an expected value.
- ◆ Risk is measured as the range of variation around an expected value.
- ◆ Risk and uncertainty are interchangeable words.

Where Does Risk Occur?

- * In project analysis, risk is the variation in predicted future cash flows.

Forecast Estimates of Varying Cash Flows

End of Year 0	End of Year 1	End of Year 2	End of Year 3	
	-\$760	?	-\$876	?
	-\$235	?	-\$231	?
-\$1,257	\$127	?	\$186	?
	\$489	?	\$875	?
	\$945	?	\$984	?
				\$454



Handling Risk

There are several approaches to hand risk:

- In this unit, risk is accounted for by (1) applying a discount rate commensurate with the riskiness of the cash flows, and (2), by using a certainty equivalent factor
- Risk may be also accounted for by evaluating the project under simulated cash flow and discount rate scenarios.

Using a Risky Discount Rate

- * The structure of the cash flow discounting mechanism for risk is:-

$$NPV = \frac{Risky\ cashflow_1}{(1 + riskyrate)^1} + \frac{Risky\ cashflow_2}{(1 + riskyrate)^2} + \dots - Initial\ Outlay$$

- The \$ amount used for a ‘risky cash flow’ is the expected dollar value for that time period.
- A ‘risky rate’ is a discount rate calculated to include a risk premium. This rate is known as the RADR, the Risk Adjusted Discount Rate.



Defining a Risky Discount Rate

- * Conceptually, a risky discount rate, k , has three components:-
- * A risk-free rate (r), to account for the time value of money
- * An average risk premium (u), to account for the firm's business risk
- * An additional risk factor (a) , with a positive, zero, or negative value, to account for the risk differential between the project's risk and the firms' business risk.

Calculating a Risky Discount Rate

A risky discount rate is conceptually defined as:

$$k = r + u + a$$

Unfortunately, k, is not easy to estimate.
Two approaches to this problem are:

- 1- Use the firm's overall Weighted Average Cost of Capital, after tax, as k . The WACC is the overall rate of return required to satisfy all suppliers of capital.
- 2- A rate estimating $(r + u)$ is obtained from the Capital Asset Pricing Model, and then a is added.

Calculating the WACC

Assume a firm has a capital structure of:
50% common stock, 10% preferred stock,
40% long term debt.

Rates of return required by the holders of each
are : common, 10%; preferred, 8%; pre-tax debt,
7%. The firm's income tax rate is 30%.

$$\begin{aligned} \text{WACC} &= (0.5 \times 0.10) + (0.10 \times 0.08) + \\ &\quad (0.40 \times (0.07 \times (1 - 0.30))) \\ &= 7.76\% \text{ pa, after tax.} \end{aligned}$$



The Capital Asset Pricing Model

- * This model establishes the covariance between market returns and returns on a single security.
- * The covariance measure can be used to establish the risky rate of return, r , for a particular security, given expected market returns and the expected risk free rate.

Calculating r from the CAPM

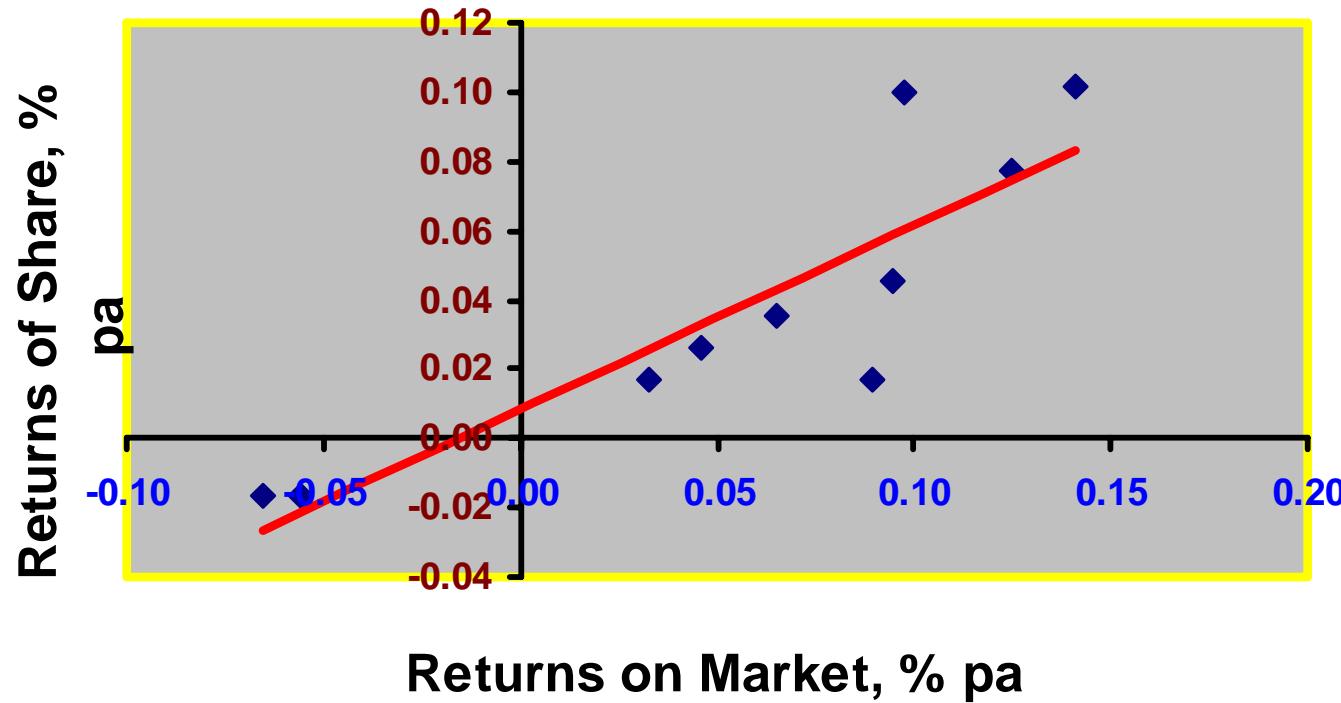
- * The equation to calculate r , for a security with a calculated Beta is:

$$E(\tilde{r}) = R_f + \beta(R_m - R_f)$$

Where : $E(r)$ is the required rate of return being calculated, R_F is the risk free rate: B is the Beta of the security, and R_m is the expected return on the market.

Beta is the Slope of an Ordinary Least Squares Regression Line

Share Returns Regressed On Market Returns



* The Regression Process

The value of Beta can be estimated as the regression coefficient of a simple regression model. The regression coefficient ‘a’ represents the intercept on the y-axis, and ‘b’ represents Beta, the slope of the regression line.

$$r_{it} = a + b_i r_{mt} + u_{it}$$

Where

r_{it} = rate of return on individual firm i's shares
time t

r_{mt} = rate of return on market portfolio at time t

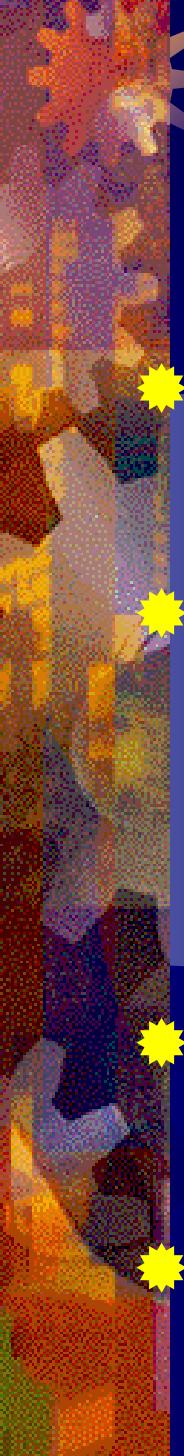


The Certainty Equivalent Method: Adjusting the cash flows to their ‘certain’ equivalents

The Certainty Equivalent method adjusts the cash flows for risk, and then discounts these ‘certain’ cash flows at the risk free rate.

$$NPV = \frac{CF_1 \times b}{(1 + r)^1} + \frac{CF_2 \times b}{(1 + r)^2} etc - CO$$

Where: b is the ‘certainty coefficient’ (established by management, and is between 0 and 1); and r is the risk free rate.



Analysis Under Risk:Summary

- * Risk is the variation in future cash flows around a central expected value.
- * Risk can be accounted for by adjusting the NPV calculation discount rate: there are two methods – either the WACC, or the CAPM
- * Risk can also be accommodated via the Certainty Equivalent Method.
- * All methods require management judgment and experience.