

## **Economic Evaluation**

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- **Objective of Analysis**
- **Criteria**
  - Nature
  - Peculiarities
- **Comparison of Criteria**
- **Recommended Approach**

## **Objectives of Economic Evaluation Analysis**

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- **Is individual project worthwhile? Above minimum standards?**
- **Is it best? Is it at top of ranking list?**

## **Principal Evaluation Criteria**

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- **Net Present Value**
- **Benefit - Cost Ratio**
- **Internal Rate of Return**
- **Cost-Effectiveness Ratio**
- **Pay-Back Period**

## **Net Present Value**

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- **NPV = B - C (Present Values)**
- **Objective:**
  - To Maximize
- **Advantage:**
  - Focus on Result
- **Disadvantages:**
  - Interpretation of NPV
  - Does not account for scale, therefore difficult to use for ranking

## Evaluation of Projects S and T

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Project	Benefit \$	Cost \$	Net Value \$	NPV as % of Cost
S	2,002,000	2,000,000	2,000	0.1
T	2,000	1,000	1,000	100

## Benefit - Cost

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- Ratio =  $\Sigma B / \Sigma C$  (Present Values)
- Objective:
  - To Maximize
- Advantage:
  - Common Scale, Useful in Ranking
- Disadvantages:
  - Treatment of Recurring Costs  
 $\Sigma B / \Sigma C$  or Net Benefits/Investment  
= > Bias against operating projects
  - Ranking sensitive to  $r$   
low  $r$  = > higher rank for long-term projects

## A Comparison of a Capital Intensive and Operations Project (Benefits in Present Values)

Project	K	R
Investment, $C_k$	\$1,000,000	\$1,000,000
Annual Cost, $C_r$	\$50,000	\$500,000
Annual Benefits	\$200,000	\$700,000
Annual Return	\$150,000	\$200,000
Useful Life	10 Years	10 Years
Total Benefits	\$2,000,000	\$7,000,000
Total Cost, $C_k + C_r$	\$1,500,000	\$6,000,000
Benefit/Cost Ratio	1.34 better than	1.17
Annual Return	15% worse than	20%
Net Value Present	\$500,000 worse than	\$1,000,000

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## The Ranking of Projects by Benefit-Cost Criterion Can Depend on DR

Project	Investment $C_k, \$$	Annual Benefits $R, \$$	Project Life N Years	Benefit - cost at discount rate of	
				3%	10%
A	1000	200	10	1.73	1.23
B	1000	125	20	1.86 (best)	1.05 (best)

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## Internal Rate of Return

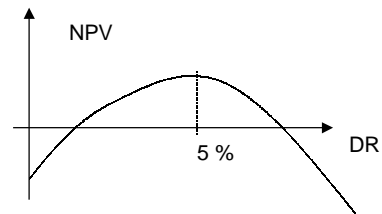
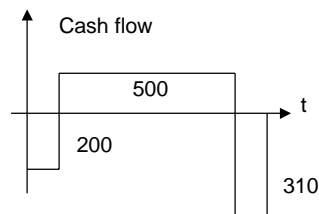
- IRR =  $r$  such that  $NPB = 0$
- Objective:
  - Maximize IRR
- Advantages:
  - No need to choose  $r$
  - Manipulation by  $r$  impossible
- Disadvantages:
  - Difficult to calculate (except by PC)
  - Ambiguous
- Note: ranking by IRR and B/C ratio may differ

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## Projects can Lead to Ambiguous Solutions for the Internal Rate of Return

Project	Investment, \$	Annual Benefits \$	Project Life Years	Closure cost at Year N-1 \$
P	$C_k$	R	N	$C_c > RN - C_k$
Q	200	100	5	310



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## Ranking of Projects by Internal Rate of Return and Benefit-Cost Ratio Can Differ

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Project	Investment, C <sub>k</sub> , \$	Annual Benefits R, \$	Project Life N Years	Benefit - Cost r = 3%	Internal Rate of Return, 0%
A	1000	200	10	1.71	15.10 (best)
B	1000	125	20	1.86 (best)	10.93

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## Pay-Back Period

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- **PBP = Cost/Annual Benefits**
  - Note: undiscounted
- **Objective:**
  - To minimize
- **Advantages:**
  - Really simple
  - No choice of r
- **Disadvantages**
  - Difficult to rank correctly projects with different useful lives or uneven cash flows

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## Evaluation of Projects V and W

Project	Investment, C <sub>k</sub> , \$	1	2	3	4	5	6	Payback Period Years	NPV at 10%	IRR
V	2000	1000	1000	1000				2	487	23.4%
W	2000	800	800	800	800	800	800	2.5	1484	32.7%

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## Cost-Effectiveness Ratio

- | **Ratio = Units of Benefit/Cost**  
    ("Bang for Buck")
- | **Objective:**
  - To Maximize
- | **Advantage:**
  - Avoids charade of trying to assign \$ values to "intangibles"
- | **Disadvantage:**
  - No sense for minimum standard or limits

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## **Recommended Procedure (if you have discretion)**

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- | **Examine nature of projects**
  - Easy to put into \$ terms
  - Steady cash flows - or with closures costs, various lives
  - An operation project or straight capital investment
- | **Choose method accordingly**
- | **Remember: No method is perfect  
ultimately a judgment call**
- | **Current “best practice” uses several criteria  
simultaneously; uses judgment to decide on  
project**