

Project Justification

- If cash flows are uniform, can use simple formulas; otherwise, need to use spreadsheet to discount each period's cash flows
- In practice, the payback period is used to evaluate most small projects:

$$\text{Payback period} = \frac{IV_0}{OP}, \quad \text{for } OP > 0$$

where

$IV_0 = IV_{\text{new}} - SV_{\text{current}}$, net initial investment expenditure at time 0 for project

IV_{new} = initial investment cost at time 0 for (new) project

SV_{current} = salvage value of current project (if any) at time 0

$OP = \begin{cases} OR - OC, & \text{uniform operating profit per period from project} \\ OC_{\text{current}} - OC_{\text{new}}, & \text{net uniform operating cost savings per period} \end{cases}$

OR = uniform operating revenue per period from project

OC = uniform operating cost per period of project

Discounting

- NPV and NAV equivalent methods for evaluating projects
- Project accepted if $NPV \geq 0$ or $NAV \geq 0$

Weighted Average Cost of Capital: $i = (\% \text{ debt})i_{\text{debt}} + (\% \text{ equity})i_{\text{equity}}$
 $= (0.5)0.06 + (0.5)0.30 = 0.18$

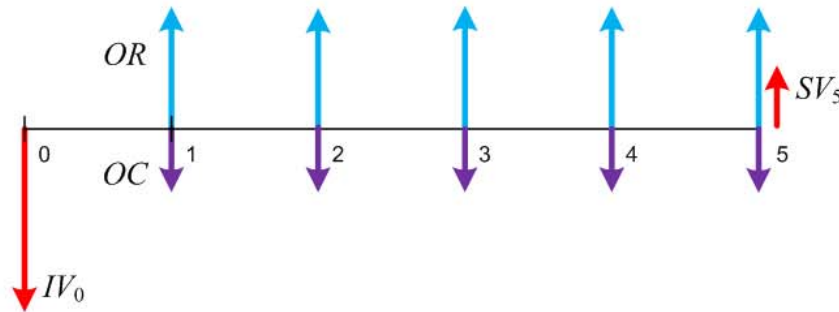
$$NPV = PV \text{ of } OP - IV^{\text{eff}}$$

Net Present Value:

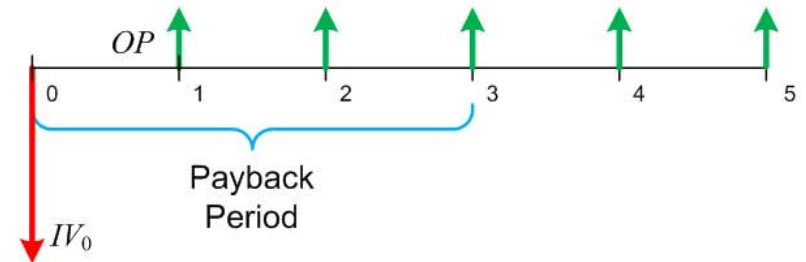
$$= OP \left[\frac{1 - (1+i)^{-N}}{i} \right] - IV^{\text{eff}}, \quad i \neq 0$$

Net Annual (Periodic) Value: $NAV = OP - K$

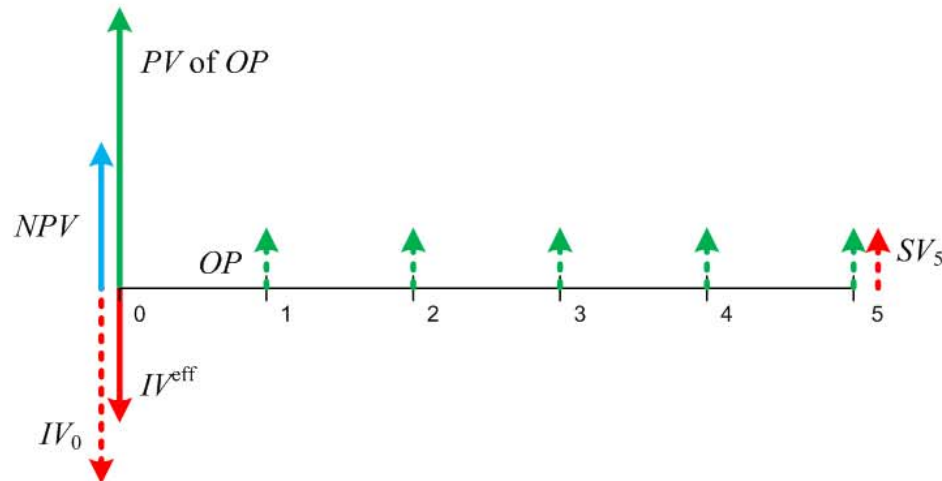
Project with Uniform Cash Flows



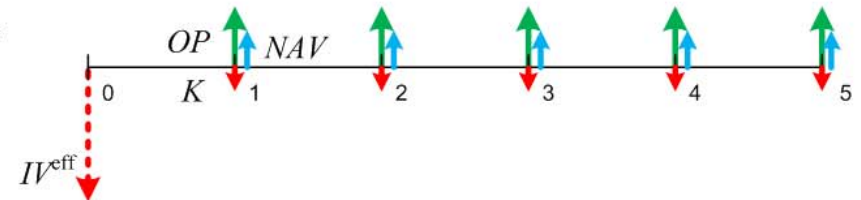
(a) Actual cash flows.



(b) Payback method.



(c) Net present value (NPV).

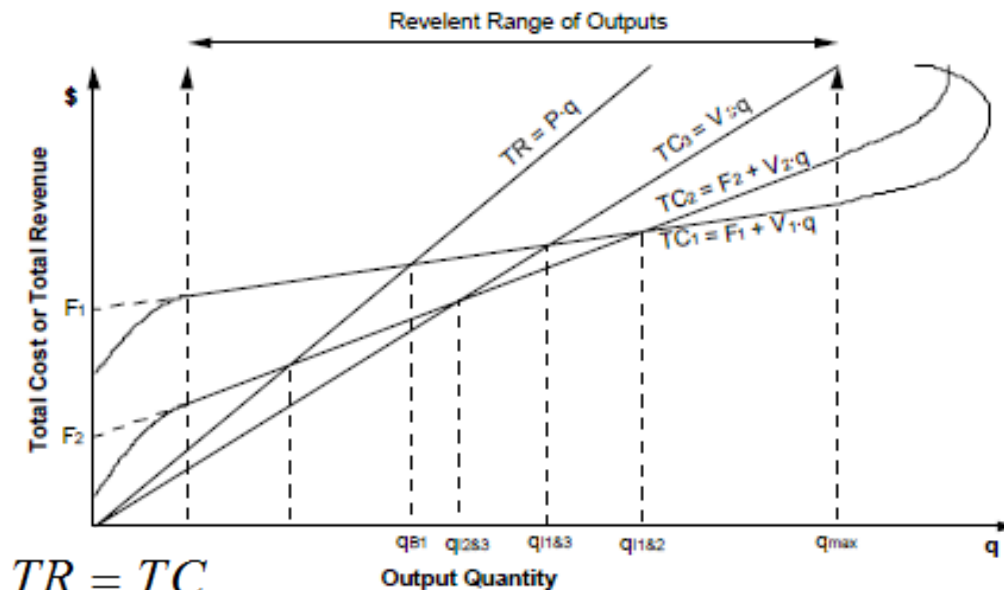


(d) Net annual value (NAV).

Cost Reduction Example

Common				
Cost of Capital	(i)	8%	8%	
Economic Life	(N , yr)	15	15	
Annual Demand	(q /yr)	500,000	500,000	
Sale Price	($\$/q$)			
Project		Current	New	Net
Investment Cost	(IV , \$)	2,000,000	5,000,000	3,000,000
Salvage Percentage		25%	25%	
Salvage Value	(SV , \$)	500,000	1,250,000	750,000
Eff. Investment Cost	(IV^{eff} , \$)	1,842,379	4,605,948	2,763,569
Cost Cap Recovery	(K , \$/yr)	215,244	538,111	322,866
Oper Cost per Unit	($\$/q$)	1.25	0.50	(0.75)
Operating Cost	(OC , \$/yr)	625,000	250,000	(375,000)
Operating Revenue	(OR , \$/yr)	0	0	0
Operating Profit ($OR - OC$)	(OP , \$/yr)	(625,000)	(250,000)	375,000
Analysis				
Payback Period (IV/OP)	(yr)			8.00
PV of OP	($\$$)	(5,349,674)	(2,139,870)	3,209,805
NPV (PV of $OP - IV^{\text{eff}}$)	($\$$)	(7,192,053)	(6,745,818)	446,236
NAV ($OP - K$)	($\$/yr$)	(840,244)	(788,111)	52,134
Average Cost (($K + OC$)/ q)	($\$/q$)	1.68	1.58	

(Linear) Break-Even and Cost Indifference Pts.



$$TR = TC$$

$$P \cdot q = F + V \cdot q$$

$$(P - V)q = F$$

$$\text{Break-Even Point: } q_B = \frac{F}{P - V}$$

$$TC_1 = TC_2$$

$$F_1 + V_1 \cdot q = F_2 + V_2 \cdot q$$

$$F_1 - F_2 = (V_2 - V_1)q$$

$$\text{Cost Indifference Point: } q_{I1\&2} = \frac{F_1 - F_2}{V_2 - V_1}$$

If output q is in units produced, then $F = K$ and $V = \frac{OC}{q}$.