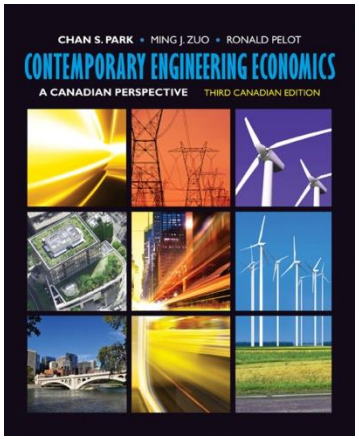
Present- and Future-Worth Analyses



Lecture No. 13
Chapter 5
Contemporary Engineering Economics
Third Canadian Edition

Lecture 13 Objectives

- How do you determine the net present-worth (cost) and net future-worth (cost) of a project?
- How do make an accept or reject decision with the PW and FW criteria?

Present-Worth Analysis

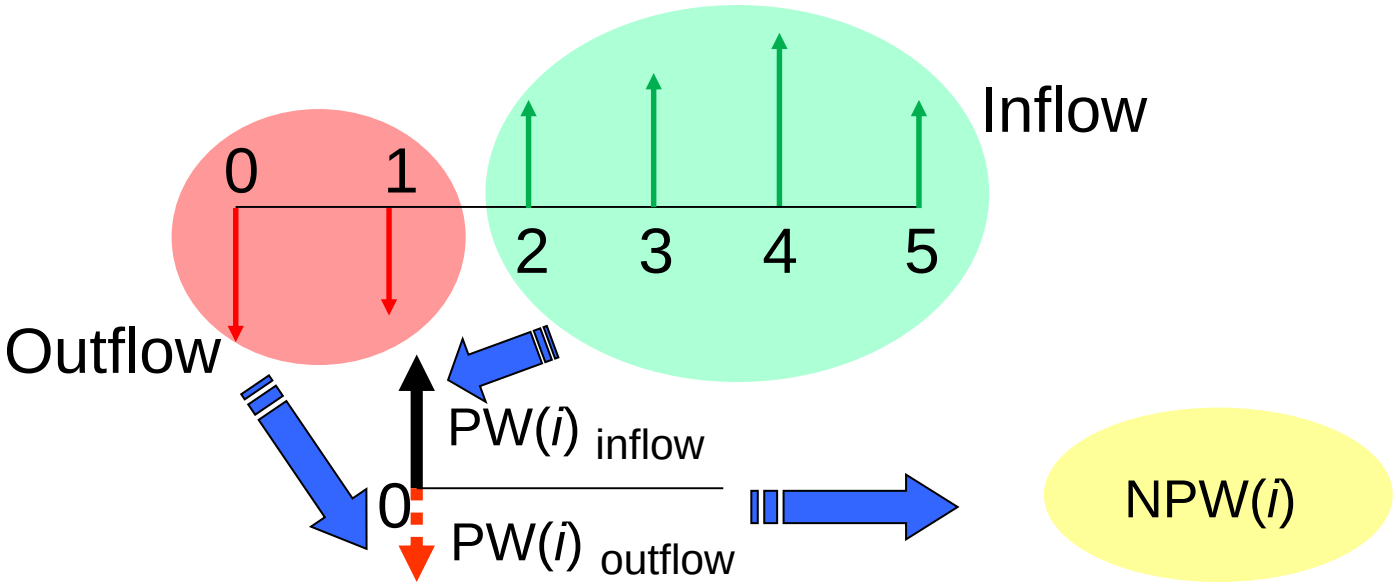
- Principle:

  Are the anticipated cash inflows from a proposed project sufficient to attract investors to invest in the project?

- Method:

  The present worth of all cash inflows are compared to the present worth of all cash outflows. The difference between the present worth of these cash flows is net present worth (NPW).

Net Present Worth



Net-Present-Worth Criterion

- A firm's interest rate it wants to earn on its investment is referred to as minimum acceptable rate of return (MARR) :
- Decision Rule:
  - If PW(i) > 0, accept the investment
  - If PW(i) = 0, remain indifferent to the investment
  - If PW(i) < 0, reject the investment

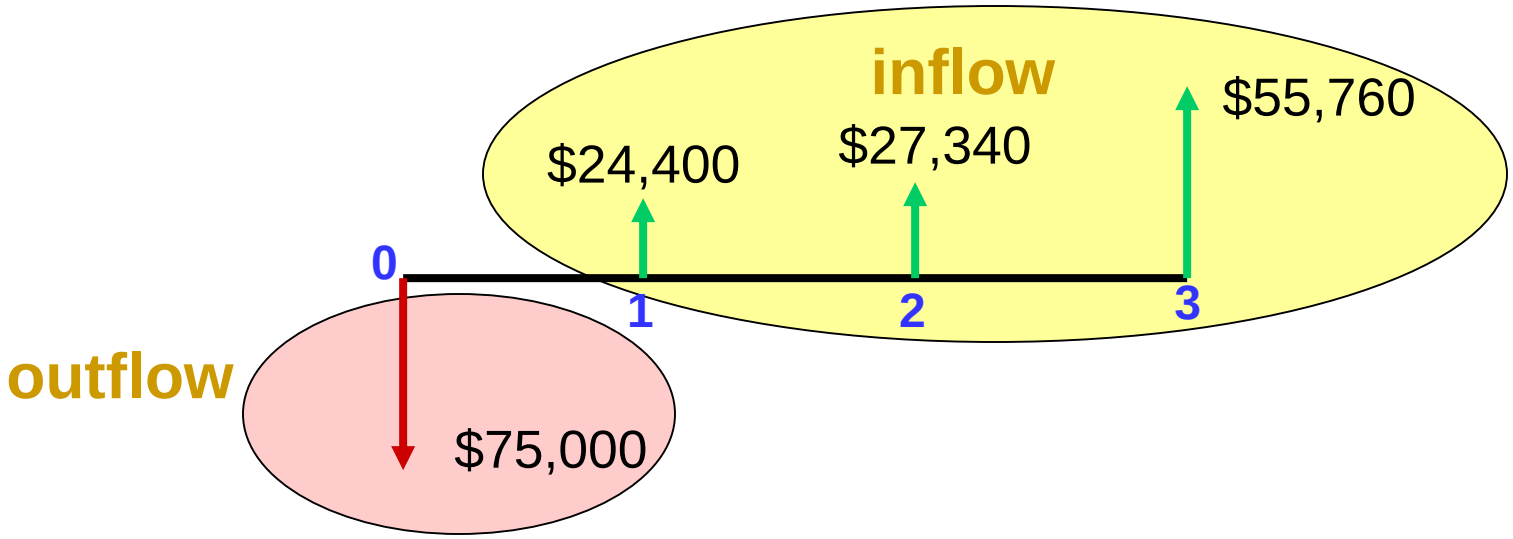
Example 5.5: Net Present Worth

- Tiger Machine Tool Company is considering the acquisition of a new metal cutting machine. The required initial investment of $75,000 and the projected cash benefits over the three-year project life are:

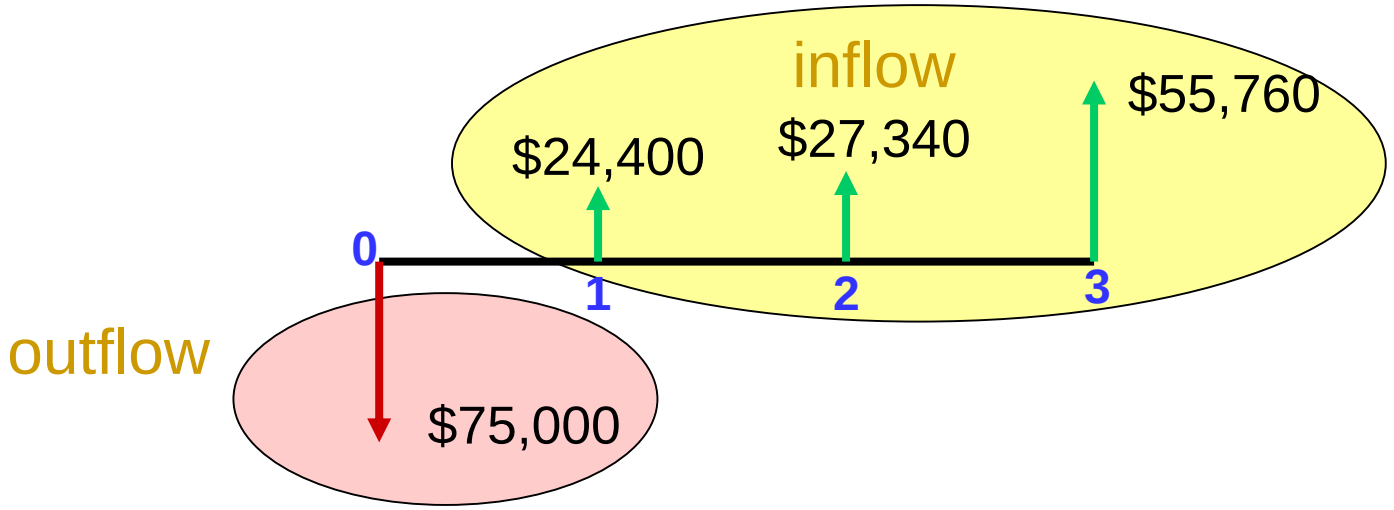
End of Year	Net Cash Flow
0	-75,000
1	24,400
2	27,340
3	55,760

- Evaluate this project at MARR = 15%

Example 5.5: Net Present Worth



Example 5.5 Solution:



$$PW(15\%)_{Inflow} = \$24,400(P/F,15\%,1) + \$27,340(P/F,15\%,2)$$
$$+\$55,7600(P/F,15\%,3)$$
$$= \boxed{\$78,533}$$

$$PW_{Outflow}(15\%) = \boxed{\$75,000}$$

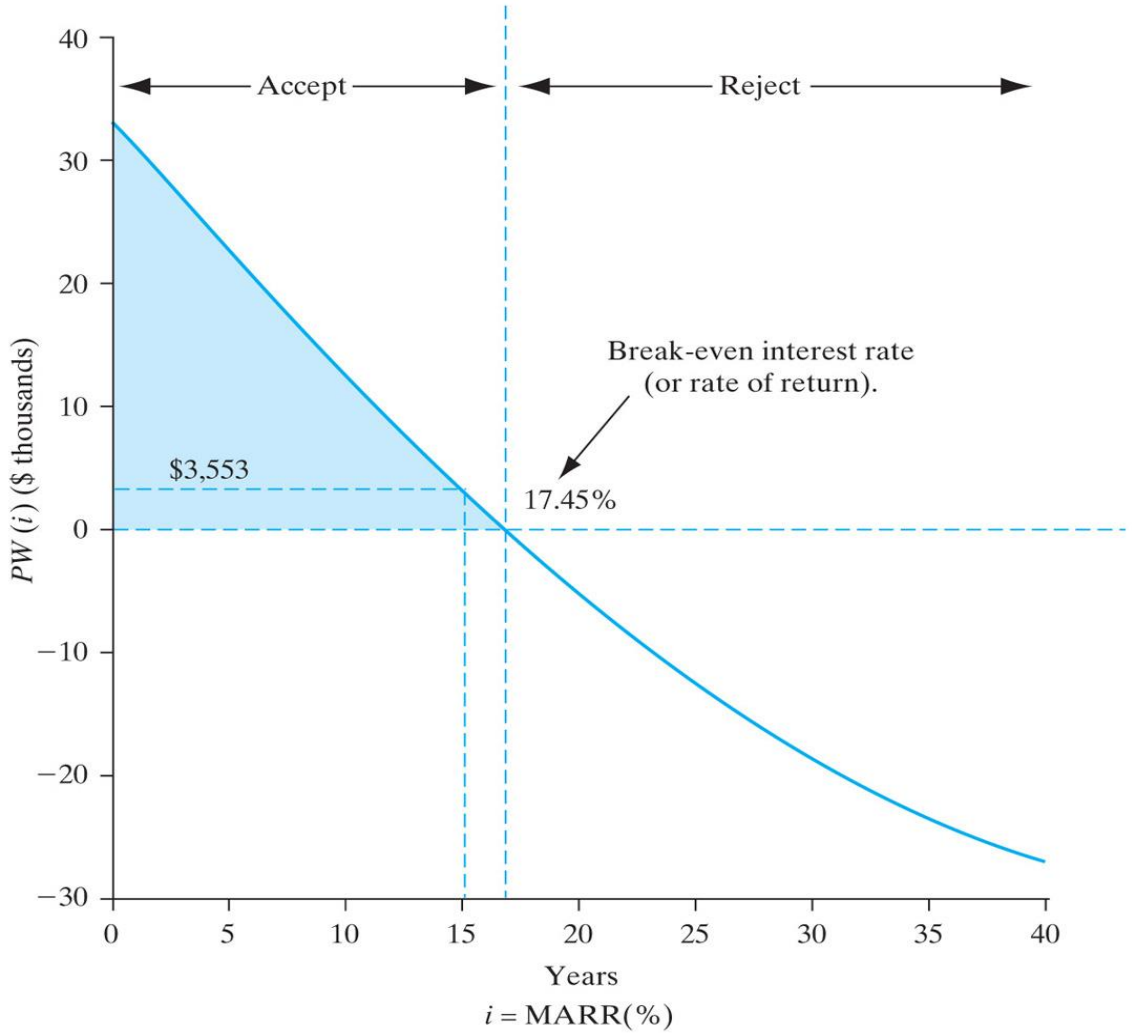
$$NPW(15\%) = \$78,553 - \$75,000$$
$$= \boxed{\$3,553 > 0, Accept}$$

Present-Worth Amounts at Varying Interest Rates (Example 5.5)

i (%)	PW(*i*)	*i*(%)	PW(*i*)
0	$32,500	20	-$3,412
2	27,743	22	-5,924
4	23,309	24	-8,296
6	19,169	26	-10,539
8	15,296	28	-12,662
10	11,670	30	-14,673
12	8,270	32	-16,580
14	5,077	34	-18,360
16	2,076	36	-20,110
17.45*	0	38	-21,745
18	-751	40	-23,302

*Break-even interest rate

Present-Worth Profile (Example 5.5)



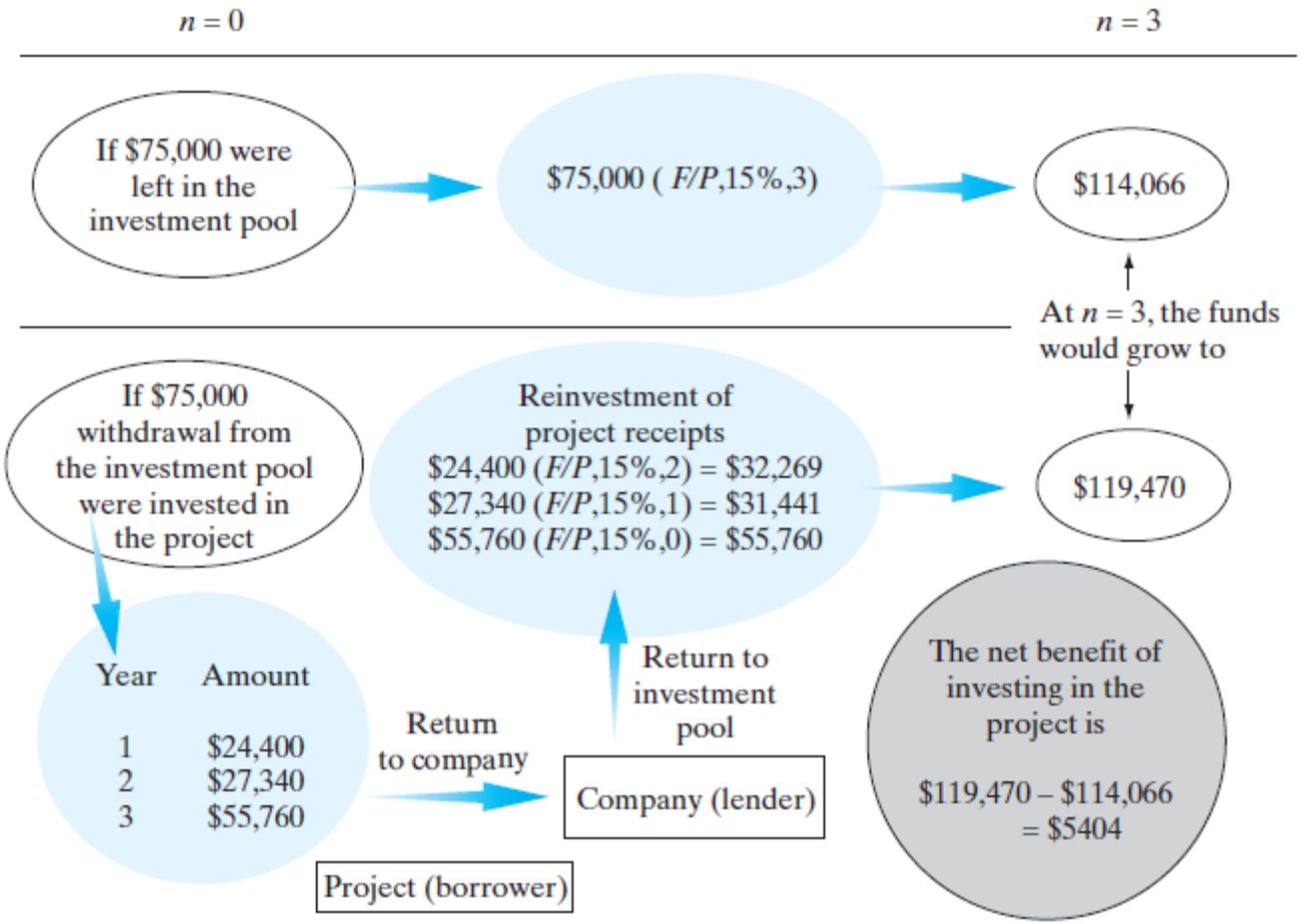
Meaning of Net Present Worth

- In Example 5.5, what does $3,553 really mean?
- We can explain the meaning of MARR in the NPW calculations by using:
  1. Investment Pool Concept
  2. Borrowed Funds Concept

Investment Pool Concept

- Suppose the company has $75,000. It has two options. (1) Take the money out and invest it in the project or (2) leave the money in the pool and continue to earn the MARR (i.e., a 15% interest).
- If you take Option 1, any proceeds from the project will be returned to the investment pool and earn 15% interest yearly until the end of the project period.
- Let's see what the consequences are for each option.

Investment Pool Concept



PW(15%) = $5,404(P/F,15%,3) = $3,553

Borrowed-Funds Concept

- Suppose that the firm has no internal funds to finance the project, so will borrow the entire investment from a bank at an interest rate of 15%.
- Then, any proceeds from the project will be used to pay off the bank loan.
- Then, our interest is to see how much money would be left over at the end of the project period.

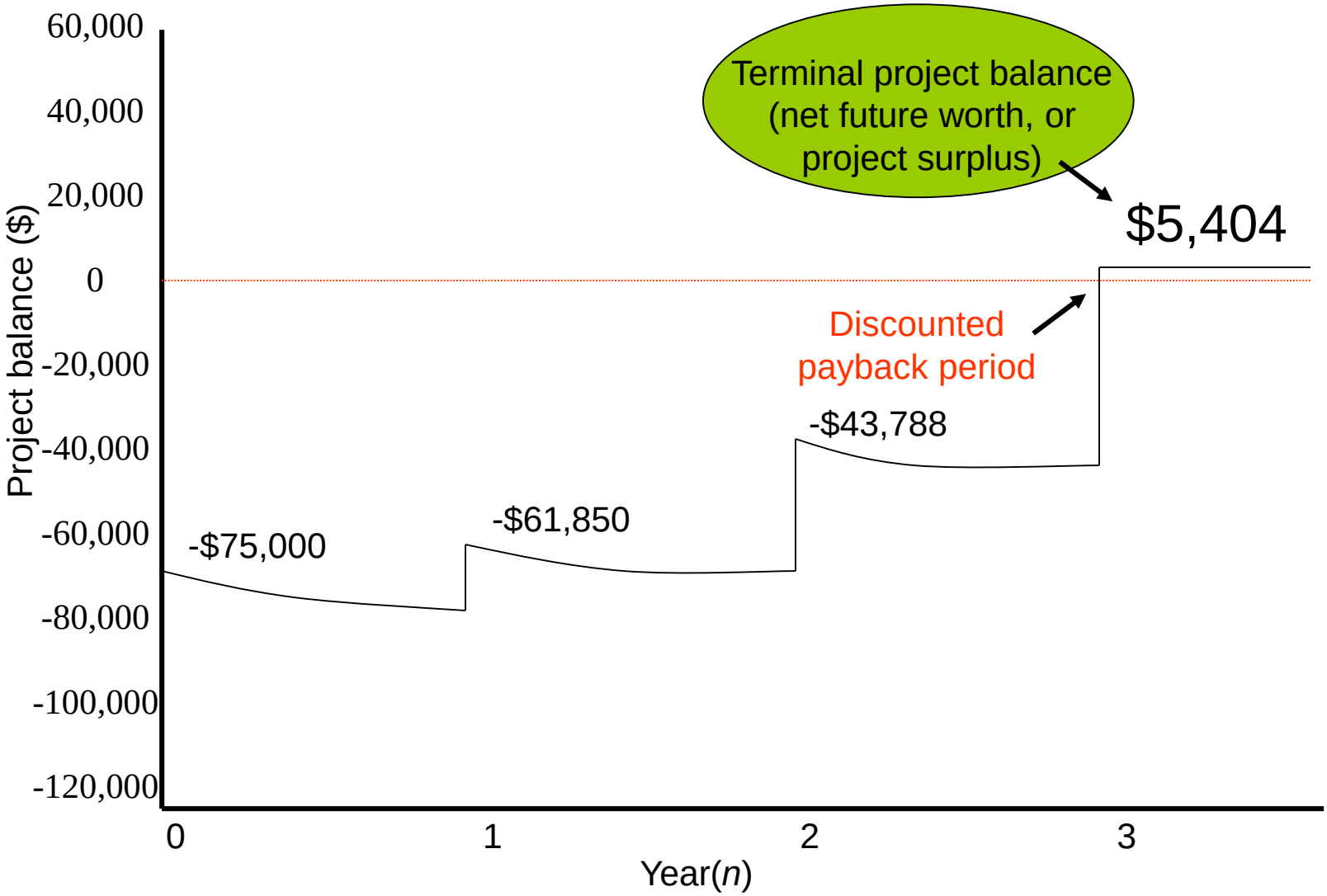
Borrowed-Funds Concept

N	0	1	2	3
Beginning Balance		-$75,000	-$61,850	-$43,788
Interest		-$11,250	-$9,278	-$6,568
Payment	-$75,000	+$24,400	+$27,340	+$55,760
Project Balance	-$75,000	-$61,850	-$43,788	**+$5,404**

Terminal project balance

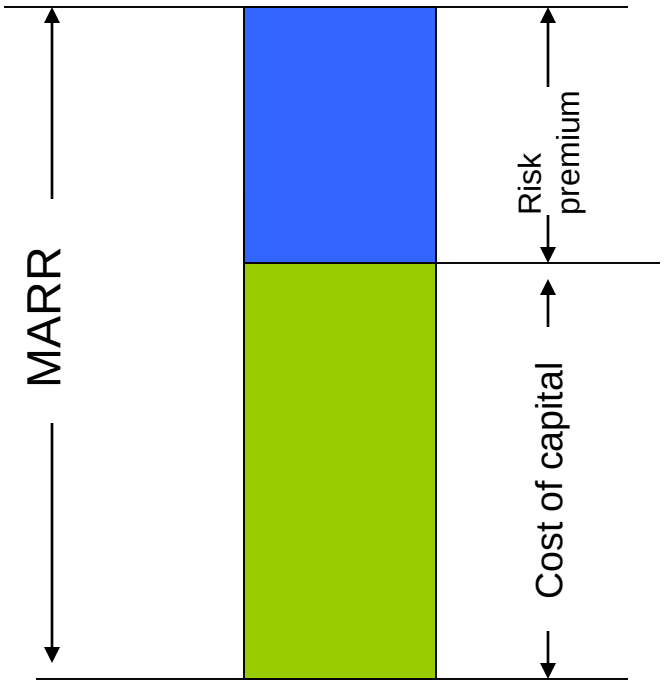
PW(15%) = $5,404 (*P*/*F*, 15%, 3) = $3,553

Borrowed-Funds Concept



Basis for Selecting the MARR

- Cost of capital
  - The required return necessary to make an investment project worthwhile.
  - Viewed as the rate of return that a firm would receive if it invested its money someplace else with a similar risk.
- Risk premium
  - The additional risk associated with the project if you are dealing with a project with higher risk.



Future-Worth Analysis

- Principle:

  Future-worth analysis calculates the future worth of an investment undertaken.

- Method:

  The future worth of all cash inflows are compared to the future worth of all cash outflows. The difference between the future worth of these cash flows is net future worth (NFW).

Net-Future-Worth Criterion

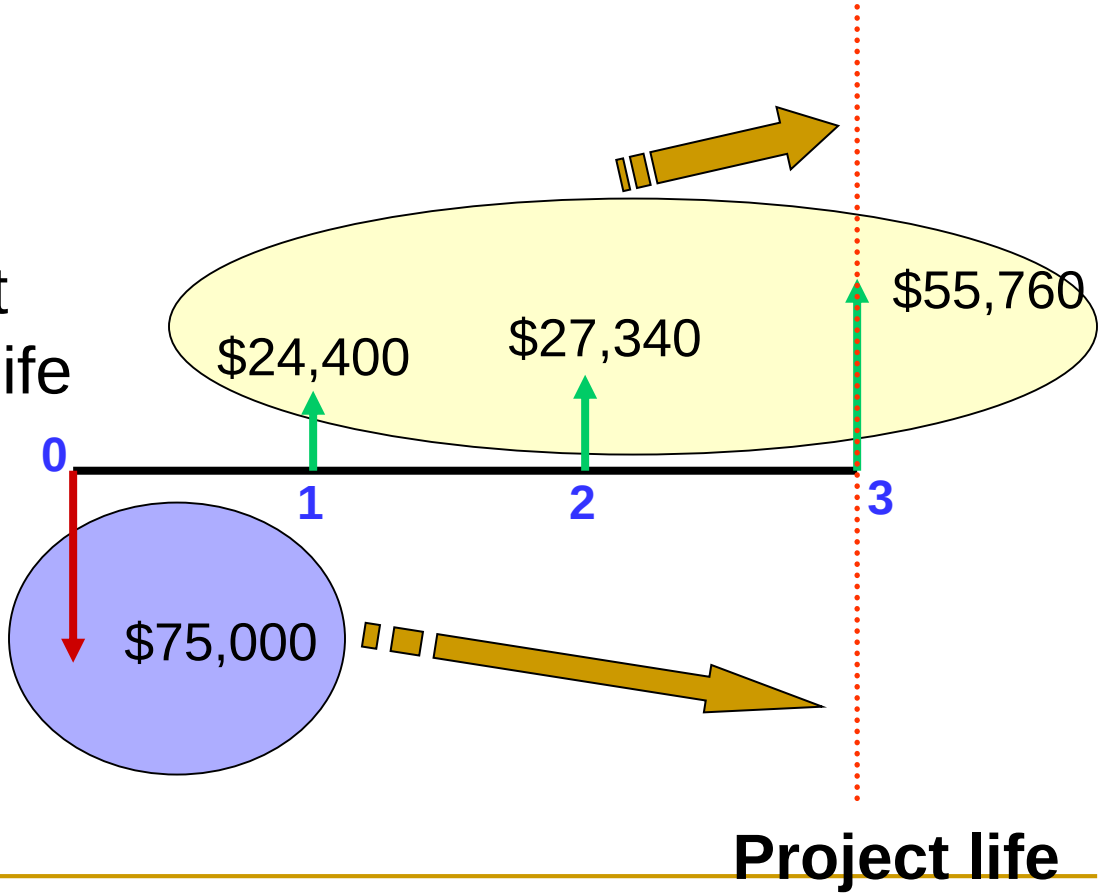
- Measures the surplus in an investment project at the end of its investment period.

- Decision Rule:
  - If FW(i) > 0, accept the investment
  - If FW(i) = 0, remain indifferent to the investment
  - If FW(i) < 0, reject the investment

Example 5.6: Net Future Worth

Continuation of Example 5.5: Net Present Worth

- Given: Cash flows and MARR (*i*)
- Find: The net equivalent value at the end of project life



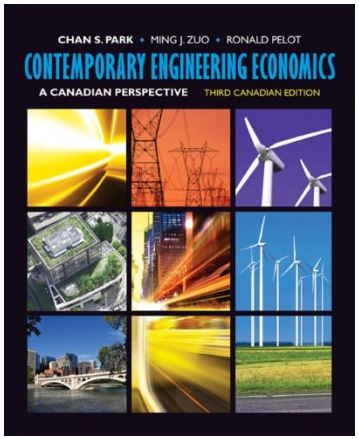
Example 5.6: Solution

$$FW(15\%)_{\text{inflow}} = \$24{,}400(F/P,15\%,2) + \$27{,}340(F/P,15\%,1)$$
$$+\$55{,}760(F/P,15\%,0)$$
$$= \boxed{\$119{,}470}$$

$$FW(15\%)_{\text{outflow}} = \$75{,}000(F/P,15\%,3)$$
$$= \boxed{\$114{,}066}$$

$$NFW(15\%) = \$119{,}470 - \$114{,}066$$
$$= \boxed{\$5{,}404 > 0,\ \text{Accept}}$$

Summary



Net-present-worth method compares projects on the basis of converting all cash flows to a present worth. A project is acceptable if its net present worth is greater than zero.