

Chapter 8 Rate of Return Analysis: Multiple Alternatives

- **Why incremental analysis is necessary**
 - Comparing ROR values of two or more alternatives will not give the best alternative.
 - This is so because an alternative with high ROR may be actually generating little value.
 - For example consider two single-year projects, where in Project A the initial investment is \$1 and the revenue in Year 1 is \$2. These number, are \$100 and \$110 for Project B.
 - The ROR of Project A is 100%, while that of Project B is 10%. But clearly Project B may generate more value!
 - Therefore, to compare alternatives on the basis of ROR, an incremental analysis is necessary.

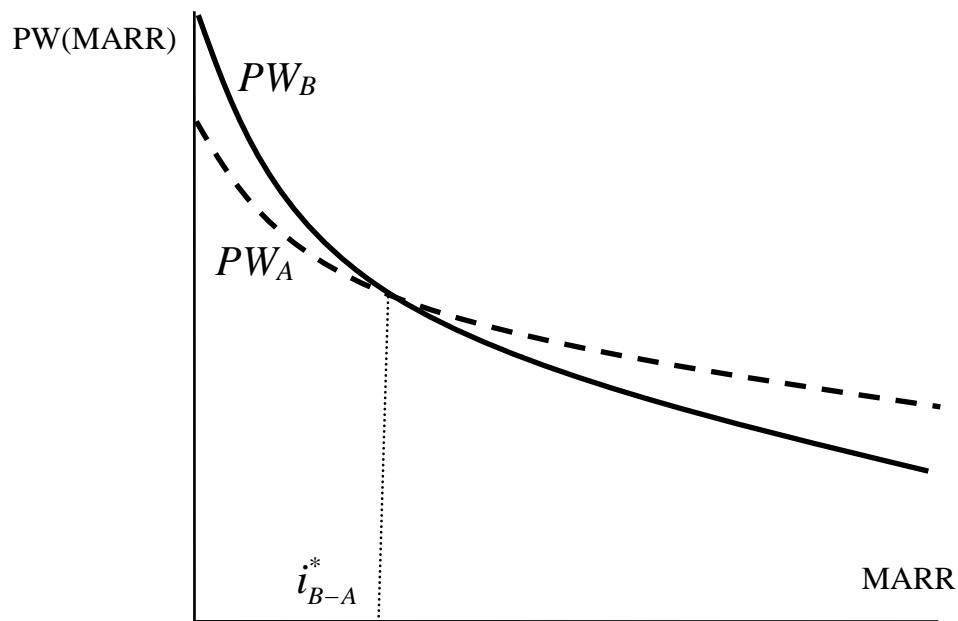
- **Steps for comparing two alternatives with incremental ROR analysis using PW**
 - For equal-life alternatives, compare over the common life.
 - For unequal life alternatives, develop the cash flows over the LCM of lives or the study period. (See Chapter 5.)
 - Designate the alternative with the highest initial investment as B, and the other as A.
 - Evaluate the incremental cash flow series

$$\Delta F_t = FB_t - FA_t, , t = 1, 2, \dots$$

- For the series ΔF_t , find the ROR, denoted by i_{B-A}^* , assuming such a ROR is unique.
- If $i_{B-A}^* < \text{MARR}$ select A. Otherwise, select B.
- For example, for the two single-year projects above, $\Delta F_0 = 100 - 1 = \$99$ and $\Delta F_1 = 110 - 2 = \$108$, and $i_{B-A}^* = 108/99 - 1 = 9.1\%$.
- If $\text{MARR} = 8\%$, then Project B is better.
- If $\text{MARR} = 10\%$, Project A is better.

• **Justification of the incremental cash flow approach**

- The i_{B-A}^* value is the MARR value for which the two alternatives A and B are equivalent in terms of PW.
- If $\text{MARR} \geq i_{B-A}^*$ (equivalently $i_{B-A}^* < \text{MARR}$), then $PW_A > PW_B$. Otherwise, if $\text{MARR} < i_{B-A}^*$, $PW_B \geq PW_A$.



- **Comparing with AW**

- Using AW, i_{B-A}^* could be found by solving the equation

$$AW_B(i) - AW_A(i) = 0.$$

- For unequal-life alternatives, if the cash flows repeat, over the LCM, it is sufficient to utilize AW over one life cycle of each alternative. Otherwise, compare over a study period.

- **Comparing more than two alternatives**

- Rank the alternatives from smallest to largest initial investment.
- Compare first alternative (with smallest initial investment) with the second alternative as discussed above.
- Compare the winning alternative with the third alternative.
- Continue with this pair-wise comparison until all alternatives are considered.

- **When you can do nothing**

- If the do-nothing alternative could be selected, start the analysis by eliminating the alternatives with $ROR < MARR$.
- If all alternatives have $ROR < MARR$, select the do-nothing alternative wins over other alternatives considered.

- **When multiple roots exist**
 - The same methods (Descartes and Nordsrom) check whether the incremental cash flow has multiple ROR solutions.
 - When multiple roots of the incremental ROR equation exists, our approach in this class is not to use ROR analysis.
 - Multiple roots are likely to exist in incremental analysis, the method breaks-down commonly.
 - That is, incremental ROR comparison is not too practical.