Event 7 – Rate of Return
Lessons 14 and 15

Methods for Comparing Projects

Present Worth Method: Select a study period, usually the least common multiple of the lives. Find the NPW of each alternative over the study period and select the best. The interest rate for the NPW computation is the MARR.

Annual Worth Method: Compute the net annual worth of each alternative and select the best. The interest rate for the NAW computation is the MARR.

Rate of Return Method: Do incremental analysis.
1. Rank the alternatives in order of increasing investment.
2. The defender is the alternative with the smallest investment and the challenger is the alternative with the second lowest investment.
3. Find the IRR of the challenger over the defender. If the IRR is greater than or equal to the MARR accept the challenger and discard the defender. If the IRR is less than the MARR accept the defender and discard the challenger. The remaining alternative becomes the defender.
4. If some alternatives have not been considered, let the one with the next greater investment be the challenger and return to step 3.
5. If all alternatives have been considered, stop. Select the defender as the best alternative.

1. Consider Pedro’s 3-truck and 1-truck options considered in Event 6. The Economic add-in analysis forms for the two options are included in the E7_student.xls workbook. For this problem, we add the option for Pedro to make no investment. This is called the “Do Nothing” option.

a. Compare the two options on a cash basis.

What interest rate do you use to compare the options on a cash basis? ______

Which should Pedro select? __________________

<table>
<thead>
<tr>
<th>Option</th>
<th>Profit for 5 years</th>
<th>Annual profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Truck Option</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Truck Option</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do Nothing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
b. Compare the options with regard to the three measures: NPW, NAW and IRR. For the Do Nothing option, the NPW and NAW are 0. The IRR is undefined for the Do Nothing option.

With MARR = 15%, which should Pedro select? 

<table>
<thead>
<tr>
<th>Option</th>
<th>NPW</th>
<th>NAW</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Truck Option</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Truck Option</td>
<td></td>
<td></td>
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</tbody>
</table>

c. Compare the options with regard to the NPW, NAW and IRR measures.

With MARR = 20%, which should Pedro select? 

<table>
<thead>
<tr>
<th>Option</th>
<th>NPW</th>
<th>NAW</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Truck Option</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Truck Option</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

d. Compare the options with regard to the three NPW, NAW and IRR measures.

With MARR = 50%, which should Pedro select? 

<table>
<thead>
<tr>
<th>Option</th>
<th>NPW</th>
<th>NAW</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Truck Option</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Truck Option</td>
<td></td>
<td></td>
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</tbody>
</table>

e. What lesson is to be learned from Problem 1 regarding the effect of the MARR on the decision and the decisions suggested by the three measures?
2. Pedro’s MARR is 15%. Use the rate of return method (incremental analysis) to decide Pedro’s best course of action. The three options are: Do nothing, 3 Trucks, and 1 Truck. When using the Compare Projects command for incremental analysis, check the Compute IRR box but do not check the Dynamic box.

Round 1

The defender is: Do Nothing. The challenger is: ___________

IRR of the Incremental Investment is: ____________

The winner of the round is: ___________

Round 2

The defender is: ____________ The challenger is: ____________

IRR of the Incremental Investment is: ____________

The winner of the round is: ___________

The Winner is: ____________

3. Repeat the process when the MARR is 20%.

Round 1

The defender is: Do Nothing. The challenger is: ___________

IRR of the Incremental Investment is: ____________

The winner of the round is: ___________

Round 2

The defender is: ____________. The challenger is: ____________

IRR of the Incremental Investment is: ____________

The winner of the round is: ___________

The Winner is: ____________

What lesson to be learned from Problems 2 and 3 regarding the IRR as a comparison method?
4. The U.S. Army must replace its fleet of cargo trucks. Three designs are under consideration. All designs provide the same level of service. We describe below the cost of a single truck with 2.5 tons of capacity. Assume end of year payments for operating costs.

**Design A:** Using modern materials a truck can be constructed that lasts 30 years. The initial cost of the truck is $150,000. The annual operating and maintenance cost is $6,000.

**Design B:** Using current technology and a design similar to the old trucks, the Army can buy a new truck for an initial cost of $50,000. The truck lasts for 10 years and has an annual operating cost is $10,000. It has no salvage value after 10 years.

**Design C:** This alternative uses the same trucks as alternative B, with an initial cost of $50,000. The operating cost for the first 10 years is $10,000. After 10 years, the truck is reconditioned for a cost of $25,000. This will add another 5 years to its life. After reconditioning the operating cost will be $13,000 per year.

Which truck should the army select if it uses an interest rate of 12% for economic decisions? For the analysis express expenditures in $1000s. Use the *Economic add-in* to make the decision on which design the Army should select.

To set up the problem use the add-in to define three projects representing the designs. Set the number of investments to 0 and use the *Cash Flow* sections to describe the truck costs. Show the costs as negative cash flows.

a. Use the *Compare Multiple* command to select the three projects. Check the LCM (*Least Common Multiple*) to define the study period. Do not check the *Dynamic* button.

What study period is used for the analysis? ______

Compare the Net Annual Cost (NAC) of the three designs and indicate which is the best.

NAC(A) ________ ; NAC(B) ________ ; NAC(A) ________ .

Decision: __________

b. Why can’t you just compare the IRR values for each project to make the selection?
c. Use incremental analysis and the ROR method to make your selection. Show the sequence of comparisons on the back of this page. When you do the comparisons for this method do not check the Dynamic button on the Compare Projects dialog.