Sensitivity Analysis

The effect of variation may be determined using sensitivity analysis. Some of the parameters or factors commonly evaluated for sensitivity are MARR, interest rates, life estimates, recovery period for tax purposes, all types of costs and many other factors.

Usually, one factor at a time is varied and independence with other factors is assumed.

Sensitivity analysis, itself a study usually performed in conjunction with the engineering economy study, determines how a measure of worth – Pw, Aw, ROR or B/C and the alternative selected will be altered if a particular factor or parameter varies over a stated range of values.

Plotting the sensitivity of PW, AW or ROR versus the parameter studied is very helpful. Two alternatives can be compared with respect to a given parameter and the breakeven point computed. This is the value at which the two alternatives are economically equivalent.

Determining sensitivity to parameter estimates:

There is a general procedure that you may follow when conducting a sensitivity analysis study. The steps are:

1- Determine which parameter of interest might vary from the most likely estimated value.
2- Select the probable rage and increment of variation for each parameter.
3- Select the measure of worth to be calculated.
4- Compute the results for each parameter using the measure of worth as a basis.
5- To better interpret the results, graphically display the parameter versus the measure of worth.

Ex:

Investment cost = 80.000$
Zero salvage value
Before tax cash flow income relation = [25.000$ - 2000t] per year
(t = 1, 2, …, n).
MARR varies from 10% to 25% per year for different types of asset investment.

Economic life varies from 8 to 12 years

Evaluate of PW and AW sensitivity by varying:
a) the parameter MARR, while n = 10 years.
b) Parameter n, while MARR is constant at 15% per year.

Solution:

a) Follow the procedure above
   Step 1. The MARR, i , is the parameter of interest.
   Step 2. Select increments to evaluate sensitivity to MARR, the range for I is 10% to 25%.
   Step 3. The measures of worth are PW and AW

Step 4. set up the PW and AW relations.
For example, at i = 10%.

PW = - 80.000 + 25.000 (P/A, 10%, 10) –
-   2000 (P/G, 10%, 10) = 27330#

AW = P/A/P, 10%, 10) = 4529$

The measures of worth for all four i values at 5% intervals are:

i	PW	AW
10%	27330$	4529$
15%	11512	2294
20%	- 965	- 229
25%	- 10711	- 3000

Step 5. A plot of MARR versus AW

The steep negative slope indicates that the decision to accept the proposal based on AW is quite sensitive to variations in the MARR. If the MARR is established at the upper and of the range, the investment is not attractive.

b) Step 1. Asset life n is the parameter.
Step 2. select 2 year increments to evaluate sensitivity to n over the range 8 to 12 years.
Step 3. the measures of worth are PW and AW.
Step 4. Set up the same PW and AW relations as in part K, for i= 15%, measures of worth results are

N	PW	AW
8	7221$	1609
10	11511$	2294

Step 5 plot AW versus n

This is a characteristic shape for sensitivity analysis of an n value. Since the PW and AW measures are positive for all values of n, the decision to invest is not materially affected by the estimated life.