IIT ROORKEE

NPTEL ONLINE CERTIFICATION COURSE

Project Management for Managers

Lec – 22

Stand-Alone Risk Analysis- I

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Sensitivity Analysis :

Since future is uncertain, we want to know the effect of input on output

Sensitivity Analysis

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	YEAR 0	*YEARS* 1 - 10
1. INVESTMENT	(20,000)	
2. SALES		18,000
3. VARIABLE COSTS (66 2/3 % OF SALES)		12,000
4. FIXED COSTS		1,000
5. DEPRECIATION		2,000
6. PRE-TAX PROFIT		3,000
7. TAXES		1,000
8. PROFIT AFTER TAXES		2,000
9. CASH FLOW FROM OPERATION		4,000
10. NET CASH FLOW	(20,000)	4,000

Find NPV? Given Salvage Value =0, and cost of capital = 12%

Present value of an annuity of ₹ 1 paid for period t at a rate $k = [1 - 1/(1 + k)^t]/k$																				
	Rate																			
Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	17.226	15.678	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	18.046	16.351	14.877	13.590	12.462	11.470	10.594	9.818	9.129	8.514	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870

Sensitivity Analysis

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	YEAR 0	*YEARS* 1 - 10
1. INVESTMENT	(20,000)	
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3. VARIABLE COSTS (66 2/3 % OF SALES)		12,000
4. FIXED COSTS		1,000
5. DEPRECIATION		2,000
6. PRE-TAX PROFIT		3,000
7. TAXES		1,000
8. PROFIT AFTER TAXES		2,000
9. CASH FLOW FROM OPERATION		4,000
10. NET CASH FLOW	(20,000)	4,000

NPV = -20,000,000 + 4,000,000 (5.650) = 2,600,000

If we change sales from 18 to 15, and keep Investment 20, variable cost 66.67% of sales , FC = 1000.

Sensitivity Analysis

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	YEAR 0	YEARS 1 - 10
1. INVESTMENT	(20,000)	
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NPV = -20,000,000 + 4,000,000 (5.650) = 2,600,000

RS. IN MILLION

	RANGE			NPV		
KEY VARIABLE	PESSIMISTIC	EXPECTED	OPTIMISTIC	PESSIMISTIC	EXPECTED	OPTIMISTIC
INVESTMENT (RS. IN MILLION)	24	20	18	-0.65	2.60	4.22
SALES (RS. IN MILLION)	15	18	21	-1.17	2.60	6.40
VARIABLE COSTS AS A PERCENT OF SALES	70	66.66	65	0.34	2.60	3.73
FIXED COSTS	1.3	1.0	0.8	1.47	2.60	3.33

Merits:

1. How robust or vulnerable the project is.
2. It indicates where future work may be done. If NPV is highly sensitive to the changes in some factor, it may be worthwhile to explore how the variability of the critical factors may be contained.

Shortcomings:

- Only one variable is considered.
- Subjectivity in interpretation of different projects.
- Shows change in NPV, does not show how likely that change would be.

Scenario Analysis: More then one variable can be changed simultaneously.

How many scenarios???

Scenario Analysis

Procedure

1. Select the factor around which scenarios will be built.
2. Estimate values of each of the variables for each Scenario
3. Calculate NPV / IRR under each scenario

Merits:

1. Better than sensitivity analysis.

2.Many variables can be considered.

Demerits:

1.Economy can not always be recession, stability and boom (no discrete scenario).It varies on continuum.

2. If 10 inputs, then the analysis has to estimate 3*10=30 scenario analysis

Break Even Analysis

As a manager you should know how much should be produced and sold at a minimum to ensure that the project does nor loose money. Point of no profit no loss.

BEA: Two types (1) Accounting BEA (2) Financial BEA

In the example we know that ratio of variable cost to sales is 0.667 (12/18).

This means that every rupee of sales makes a profit of Re 0.333 .

Break-Even Analysis

- **Accounting Break –Even Analysis level for sales will be**

$$\frac{\text{Fixed Costs + Depreciation}}{\text{Contribution margin ratio}} = \frac{1 + 2}{0.333} = \text{Rs. 9 million}$$

	Year 0	(‘000) Year 1 - 10
1. Investment	(20,000)	
2. Sales		18,000
3. Variable costs ($66\,^{2}/_{3}$% of sales)		12,000
4. Fixed costs		1,000
5. Depreciation		2,000
6. Pre-tax profit		3,000
7. Taxes		1,000
8. Profit after taxes		2,000
9. Cash flow from operation		4,000
10. Net cash flow	(20,000)	4,000

Financial BEA: The focus is on NPV not on accounting profit.