



Lecture note#7: Using Net Present Value and Internal Rate of Return in Financial Calculus.

If I put my savings SV_o in a bank for N years with an interest rate R , the value of my savings at the end of this period SV_N could be reckoned using the following equation:

$$SV_N = SV_o (1+R)^N$$

If $SV_o = 1000,000$ SR and $R=0.065$, and $N =5$

$$SV_N = 1000,000 * (1+0.065)^5$$

$$SV_N = 1,370,086 \text{ SR.}$$

$$SV_N = 1,370,086 / (1+0.065)^5$$

We can also say that SV_o is the present value PV of SV_N (in such index date/year) N years ago, thus we can write this follows:

$$PV = SV_N / (1+R)^N$$

Further, the sum of more than one term of SV_N of ravenous in different years, is called the Net Present Value NPV .

$$NPV = [SV_1 / (1+R)^1] + [SV_2 / (1+R)^2] + \dots + [SV_N / (1+R)^N]$$



If the total sum of the NPV= ZERO, we say R is the Internal Rate of Return IRR of successive annual revenue(s) V of particular investment project. Thus manually one can try different values of R in the above equation until one gets the R that makes the total sum of NPV equal to or approaches Zero.

The net present value NPV and the internal rate of return IRR are used to test the feasibility of investment and development projects. There are three types as follows:

- 1- **Financial cost benefit analysis-FCBA:** in order to test the financial feasibility of the investment projects in terms of reckoning their yielded financial profit that goes to the investor.
- 2- **Economic cost benefit analysis-ECBA:** in order to test the economic feasibility of the development projects in terms of reckoning the economic benefits they add to improve and consolidate the local/national economy, i.e., the benefit of the society at large.
- 3- **Social cost benefit analysis-SCBA:** in order to test the feasibility of the development projects in terms of reckoning the social benefits (social utility) they add to increase the degree of happiness of the consumers.

The following page shows an example of the financial cost benefit analysis; using NPV and IRR as quantitative indicators to ensure the feasibility of the investment project. At the beginning we reckon the total sum of the costs and revenues in each year of the life cycle of the project (V_1, V_2, \dots , and V_N); and afterwards we get the row of surplus that we use it in the process of reckoning the NPV, using the following equation:

$$NPV = [V_1] + [V_2 / (1+R)^1] + [V_3 / (1+R)^2] + \dots + [V_{N-1} / (1+R)^N]$$

And reckoning the IRR, using the following equation:

$$[V_1] + [V_2 / (1+R)^1] + [V_3 / (1+R)^2] + \dots + [V_{N-1} / (1+R)^N] = 0$$



Financial cost benefit analysis for testing the feasibility of constructing an apartment building

Land cost

Plot area 300 m²
 Price per M2 1000 \$
 Total land cost 300000 \$ could be: nominal, real, or market value

Building cost

Covering area 150 M²
 Number of floors 5
 Building cost per M² 300 \$
 Total building cost 225000

Other costs:

One can add other types of costs, e.g., loan installments, administrative, supervision, design, and/or license fees; also contingency costs, inflation, taxes, etc.

Years	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Land cost	300000									
Building cost	225000									
Operation and Maintenance		3000	3000	3000	3000	3000	3000	3000	3000	3000
Total costs	525000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Down payment	150000									
Installments	0	150000	150000	150000	150000	150000	150000	150000	150000	150000
Revenue	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000
Surplus	-375000	147000	147000	147000	147000	147000	147000	147000	147000	147000

NPV

(\$32,754.55)

r=10% NPV should be in positive value

IRR

37%

IRR (FIRR) should be more than r, where it is

, e.g., the highest money rent in banks

Notes: in case of renting some, or all, parts of the building, the capital cost of those parts, or the whole building,

should be added to the value of revenue in the last year, i.e., 2025.

Project life cycle=10 years.

Index year for costs and prices: e.g., 2016.



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