BULETINUL Universităţii Petrol – Gaze din Ploieşti	Vol. LIX No. 1/2007	47 - 52	Seria Ştiinţe Economice

A Case Studies Approach to the Teaching of the Feasibility Projects Using Cost/Benefit Analysis

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Abstract

The first part of the paper describes a case study in the use of COST/BENEFIT ANALYSIS in project appraisal which serves to illustrate different aspects of the practical problem (the use of several Cost/Benefit Indicators, Shadow Rates, Sensitivity Analysis and Risk Analysis). In the second part it describes the features and use of the Cost/Benefit Package (CBPACK/PC). The package is designed to support the cost/benefit analysis of investment projects and includes computational procedures to obtain the following: Rate of Return (RR); Present Value (PV); First Year Benefit (FYB); Benefit Cost Ratio (BCR); Cost Parametric Analysis (CPA) of rate of return computation; Risk Analysis. Some examples are run on PC with package.

Keywords: *cost/benefit analysis, package programs, investment project*

Introductory Remarks

The Cost/Benefit Analysis, developed by World Bank, is a complex method for critical examination of the profitability by using the financial rate of return and the updating techniques. The purpose of any cost/benefit analysis is to balance the cost against the benefits associated with any activity. Economic investment, research and development projects, information processing, etc. should be measured by their ability to provide sufficient to justify their cost. One of the more difficult aspects is the multidimensional nature of uncertain costs and benefits data.

The objective is to establish the combination of characteristics that provides the best overall cost/benefit performance. The major objective of this method is to use economic criteria in all our judgments to select effectively feasibility projects. The financial cost and the time constrains involved in a Risk Analysis are very important elements in the decisions. The major advantage of the Risk Analysis is that, it enables us, to attack more difficult problems and to make decisions we would not have felt competent to make. The Risk Analysis provides an efficient tool to handle the difficulties of optimization under uncertainty (Project Identification, Marginal Projects, Optimization of Project Specifications).

The CBPACK (available on PC/AT) is designed for Cost/Benefit Analysis used in the Feasibility Projects and includes computational procedures to obtain cost/benefit indicators. The objectives of the CBPACK package are the following:

- to cover the complete set of computations and situations arising in the cost/benefit analysis of projects;
- to give the user full control of his analysis;
- to make program and data handling easier for the user.

The software demonstrations illustrate the type of problems that may be solved with CBPACK. The case study chosen gives an idea about the potential and usefulness of the method and the CBPACK package for:

- specification of streams and storage data (The cost and benefit sources during the life of the project);
- use of several Cost/Benefit Indicators (rate of return, benefit/cost ratio, first year benefit, net present value);
- use of Shadow Rates and Sensitive Analysis (Perform a cost parametric analysis of the value of the rate of return of the project);
- use of Risk Analysis (All costs and benefit streams have a probability distribution associated: Uniform, Step-Rectangular, Discrete, Triangular, Normal, Beta).

The hardware minimum configuration is: PC, 10MB RAM, Color Display, S-VGA.

The case method is often compared to other teaching methods such as lectures, simulation, or role playing with respect to its ability to reach specific course objectives. Teaching with cases have been shown to be more powerful an lectures, simulations, or role playing with respect to its ability to reach specific course objectives.

Teaching with cases has been shown to more powerful than lectures, for instance, in increasing students' analytical skills, decision – making skills, evaluation and judgement skills. In the case of the writing process, we have the following steps: identifying the needs, searching for leads, data gathering case plan preparation, second interview, writing the case, case release, experimentation in the classroom, final draft and teaching notes.

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"The Electrification of a Railway Segment" – Case Study

The project includes the electrification of a railway segment in order to extend the traffic and cut down the operation and maintenance expenses. The cost of this project (new equipments (C1), materials (C2), labor (C3)), is about 12300 monetary units (m.u.) and the working time is 1 year. The actual operation expenses are 6350 m.u./year and the operation expenses of the project (when this project is operational) will be roughly 3800 m.u./year and the operation expenses of the new project in 8 years, and the last stage rate of return is 12%. We need to decide if this project is acceptable.

We observe that the differences between old operation expenses and the new ones signify the net profit of this project. The new project achievement is simultaneous with the utilization of the

actual railway system. Consequently the total cost in the first year is: 6350 + 12300 = 18650 m.u. The data of this project are presented in table 1.

Table 1. Financial analysis

YEAR	NET BENEFIT	NET BENEFIT UPDATE	
		Rmin = 10%	Rmax = 12%
1	-12300	-11181.82	-10982.14
2	+2550	2107.44	2032.84
3	+2550	1915.85	1815.04
4	+2550	1741.68	1620.57
5	+2550	1583.35	1446.94
6	+2550	1439.41	1291.91
7	+2550	1308.55	1153.49
8	+2550	1189.59	1029.90
TOTAL	5550	104.06	-591.45

Cost/Benefit Indicators

1. Rate of Return (RR) :

$$RR=\sum_{j-1}^{N}\frac{\sum_{j-1}^{N} Bij-\sum_{j=1}^{N1} Cij}{(1+0.01R)^{i-1}} \quad =0 \tag{1}$$

where the equation (a polynomial of (n-1) degree) is solved by successive approximation for the range -20% to 100%. R is the discount rate the project in years.

2. Benefit/Cost Ratio (BCR) :

Benefit /Cost Ratio (BCR) is defined as ratio expressed as a decimal fraction, between the present value of total benefits and the present vale of total costs of a project:

$$BCR = \frac{\sum_{i=1}^{N}\frac{\sum_{j=1}^{N2} Bij}{(1 + 0.01R)^{i-1}}}{\sum_{i=1}^{N}\frac{\sum_{i=1}^{N1} Cij}{(1 + 0.01R)^{i-1}}} \tag{2}$$

where all symbols have the same meaning as in (1).

3. The Cost Parametric Analysis(CPA)

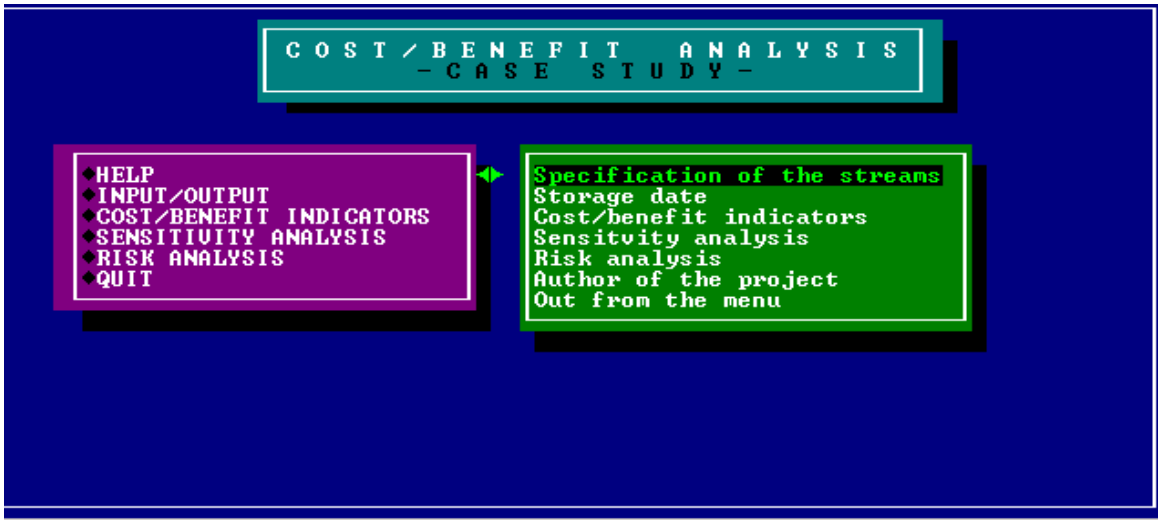
CPA explores the effect of changes in construction costs or in benefit streams on the internal rate of return and timing of the project. The analysis is performed for the changes of each benefit stream or cost stream (between -15% and +15%) or the changes of a combination of benefit and/or cost streams.

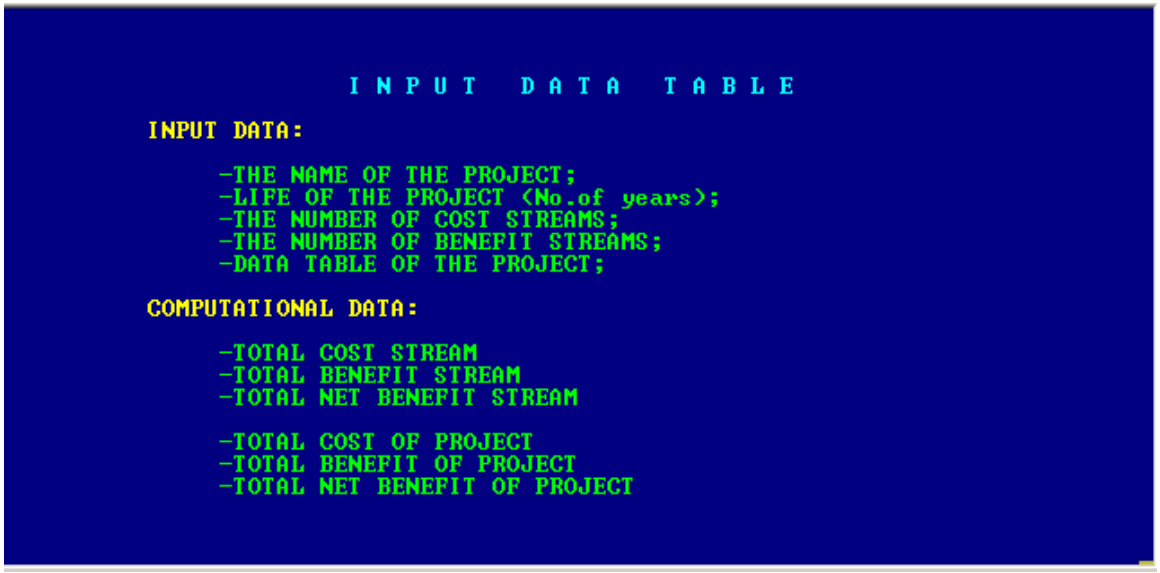
4. Risk Analysis

Risk Analysis can be performed over any cost of benefit streams. Every stream have a probability distribution associated (uniform, normal, beta, discreet, step rectangular, triangular). The streams affected by uncertainty are designed by the user. The generation of a randomly distributed according to a given probability density function and the perform these procedures is made by CBA package.

CBPACK Package

The CBPACK package is a running task operational under PC, 10MB RAM, Color Display, S-VGA.





The objectives are the following:

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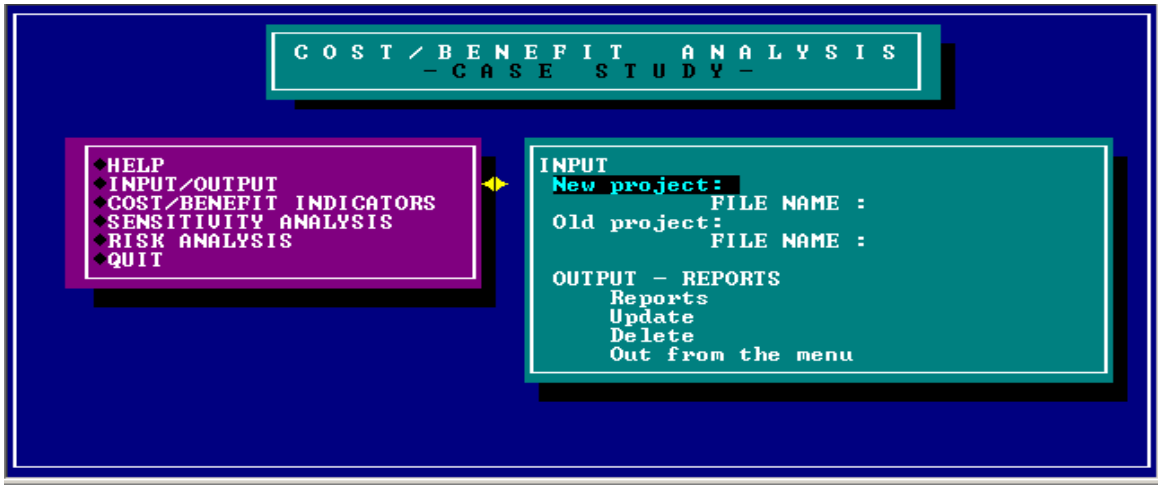
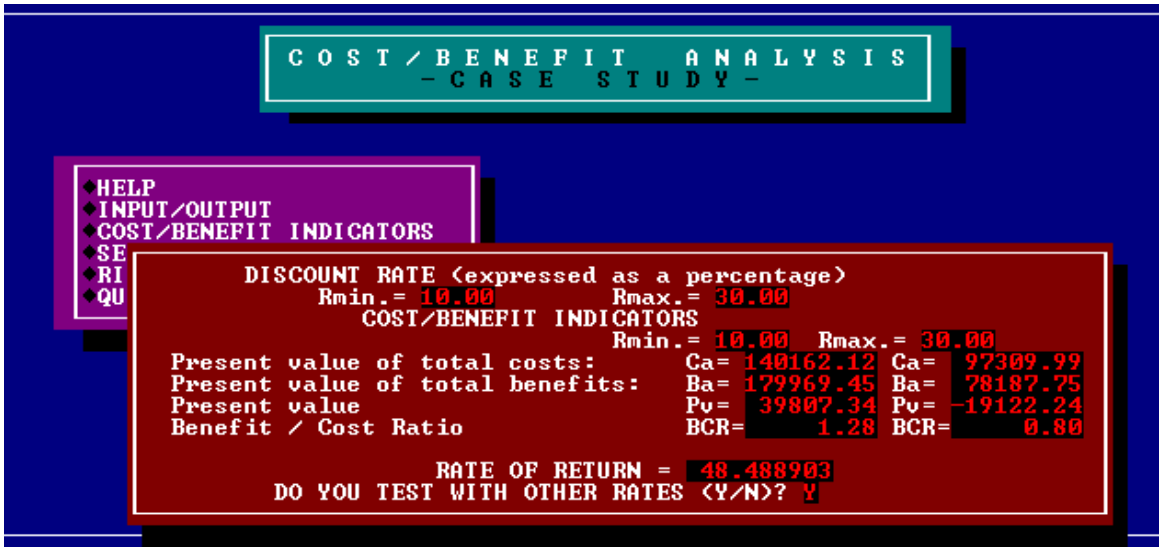
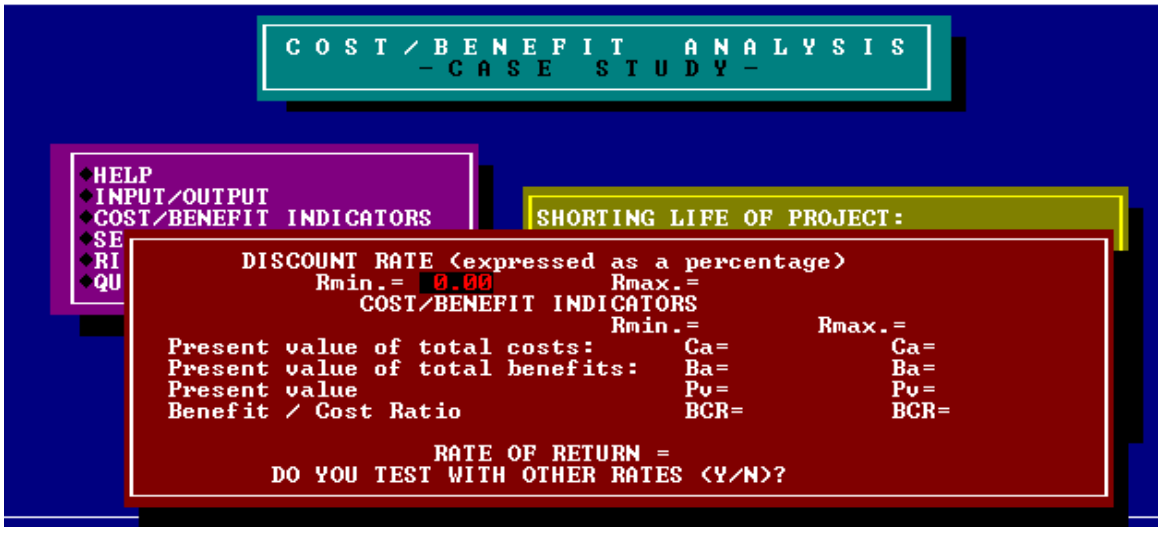


The demo software illustrates the type of problems that may be solved with CBA package - for instance - specification of streams and storage data (the cost and benefits streams have a probability distribution associated: Uniform, Normal, Beta, Discrete, Step – Rectangular, Triangular). The input data are stored in this file; we can run the computing, updating, printing or deleting procedures by using the menu of options.





From this case study, we can obtain the report:

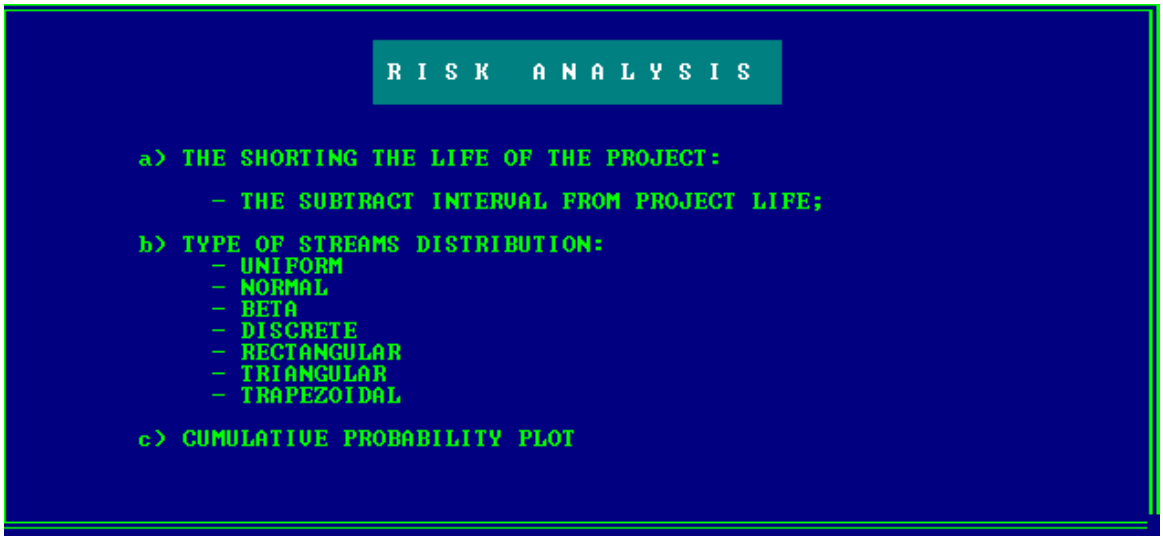
PRESENT VALUE:	104.06	: -591.45
BENEFIT/COST RATIO:	1.00	: 1.02

RATE OF RETURN = 10.28125

Concluding Remarks

The cost/benefit indicators from the case study presented, computing by CBPACK package are: BCR = 1.00, PV = -591 < 0, RR = 10.28 < 12.

Cost Parametric Analysis and Risk Analysis confirm the idea of rejecting this project. In this context the management team researches new technical solutions (new projects) for investment.



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Abordarea bazată pe studii de caz în instruirea privind proiectele de fezabilitate utilizând analiza cost/beneficiu

Rezumat

În prima parte a articolului se prezintă un studiu de caz în care se utilizează metoda de analiză cost-beneficiu, prin care se ilustrează aspectele practice legate de memorarea datelor proiectului, calculul indicatorilor, analiza de sensibilitate şi analiza de risc. În partea a doua se prezintă pachetul de programe CBPACK, disponibil pe PC, proiectat pentru a efectua analiza economică şi financiară a proiectului de investiţii (calculul de indicatori ACB, analiza de sensibilitate şi analiza de risc, împreună cu aspecte legate de gestiunea datelor proiectului).