

## MONTE CARLO SIMULATION: IMPORTANT MANAGEMENT TOOL IN EVALUATING DECISIONS UNDER RISK. CASE STUDY: LAUNCH A NEW PRODUCT OF SHOES

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**Abstract:** *Decisions are a result of choices made between several alternatives and will affect all participants in the decision-making process. In this paper we analyze the Monte Carlo simulation as an important management tool in evaluating decisions under risk. The method is particularly useful in simulating decision problems. For example, the profit that could be achieved if a company launches a new product may depend on a number of factors (market share, advertising, production costs, launch costs, the lifetime of the product, etc. The company manager should identify all factors that could affect profit and then to consider the large number of ways in which these factors may interrelate. In such situations it is recommended company manager to divide the problem into smaller parts, asking him to estimate the probability distribution for market share, for advertising, for the cost of launch. Once they were obtained it can be determined their combined effect in order to obtain the probability distribution of profit. Through computer can generate a large number of possible combinations of situations where you choose a particular course of action. Upon completion of the simulation possible combination will be generated mostly while the least possible combination will be generated less frequently. For exemplification we selected a company producing shoes in Cluj market who wants to launch a new model for autumn-winter 2013-2014. In the current period the company has limited production capacity, has a number of additional contracts honored and general economic crisis situation makes money availability to be extremely limited. Accordingly, the company will have to choose a single product to be launched next season. The company will have to decide which of the two new products to be launched on the market: a model of boots for men in business class or a new model of women's boots of the same class business. The company is not sure either production costs or sales level. Profit estimate involves going through several phases, and the first of these relates to the identification of factors that may or may influence the profit for both products.*

**Keywords:** *decision-making, simulation, Monte Carlo method, launch a new product.*

**JEL classification:** *D81*

## 1. Introduction

Because Monte Carlo simulation allows estimating the risk associated with a particular course of action often the studies in the field refer to this method as a method of risk analysis in the decision-making process.

Decisions are a result of choices made between several alternatives and will affect all participants in the decision-making process (Lazăr, Suciu, 2009).

In the opinion of specialists practicing and those in academia - U.S. Environmental Protection Agency (1997) and Vose, D. (2008) - Monte Carlo simulation method has a number of advantages over other methods of quantitative analysis of risk. In this sense, this paper focuses on explaining the Monte Carlo simulation method. By using this method, the distribution of all possible outcomes of an event is generated by analyzing a model several times, each time using input values selected by chance from the probability distributions of the components that make up the pattern.

The method is particularly useful in simulating decision problems. For example, the profit that could be achieved if a company launches a new product may depend on a number of factors (market share, advertising, production costs, launch costs, the lifetime of the product, etc. In this context, a decision maker will face a serious problem in making estimates of the profit that could be obtained. If the decision maker would be put in a position to answer the question "what is the probability that the launch of a new product record annual profit?", it would have great difficulty and would provide a relative response.

To answer this question, the company manager should identify all factors that could affect profit and then to consider the large number of ways in which these factors may interrelate.

In such situations it is recommended company manager to divide the problem into smaller parts, asking him to estimate the probability distribution for market share, for advertising, for the cost of launch. Once they were obtained it can be determined their combined effect in order to obtain the probability distribution of profit.

Due to the large number of factors and because many values that each of these factors can take, there could be an infinite number of possible combinations that may affect company profits (Ionescu and Cazan, 2007).

Such a problem can be solved successfully by using Monte Carlo simulation. The simulation assumes the existence of three main elements: real system (the real problem of decision maker), a computer system and conceptual model.

Through computer can generate a large number of possible combinations of situations where you choose a particular course of action. Upon completion of the simulation possible combination will be generated mostly while the least possible combination will be generated less frequently.

Using Microsoft Excel to perform simulations can be complemented with tools that can simulate in Excel, popular being @ Risk, an add-on program for Microsoft Excel and MS Project, developed by Palisade and available at [www.palisade.com](http://www.palisade.com) and Crystal Ball, that is available at <http://www.oracle.com/us/products/applications/crystalball/index.html>.

There are also available free tools that can be used to perform a Monte Carlo simulation, for example SimulAr is an add-on program for Microsoft Excel and is distributed as "emailware". The program was developed by Luciano Machine at the National University of Rosario, Argentina, and is available at [www.simularsoft.com.ar](http://www.simularsoft.com.ar). It adds probability distribution functions for performing

Monte Carlo simulation and risk analysis under uncertainty. It also provides the ability to correlate variables and adjust distributions to data.

So profit is calculated for each possible combination and then will quantify the frequency of profits that were generated, and finally the manager will determine the likelihood of profit expectation. To use the simulation in a decision problem it is necessary to go through the following steps:

- 1) Identify each factor that may influence the profit for each course of action;
- 2) Development of a model, noting how these factors relate;
- 3) Take a sensitivity analysis to identify factors that need to obtain probability distributions;
- 4) Establishment of probability distributions for the factors that were identified in the previous paragraph;
- 5) Making Simulation;
- 6) Application of sensitivity analysis of results obtained from simulation;
- 7) Comparison of results for various alternative courses of action and identify preferred course of action.

## **2. Case study: Using Monte Carlo simulation for the election of a new product that will be launched on the market.**

A risk decision situation is a company producing shoes in Cluj market who wants to launch a new model for autumn-winter 2013-2014.

In the current period the company has limited production capacity, has a number of additional contracts honored and general economic crisis situation makes money availability to be extremely limited. Accordingly, the company will have to choose a single product to be launched next season.

The company will have to decide which of the two new products to be launched on the market: a model of boots for men in business class or a new model of women's boots of the same class business.

Since the company has launched such products on the market and there are similar products on the market, means that information is available (which may be collected by the company) for making the decision. Consequently, decision-making situation is closer to risk than uncertainty. The company is not sure either production costs or sales level.

Profit estimate involves going through several phases, and the first of these relates to the identification of factors that may or may influence the profit for both products.

### **2.1. Identifying influencing factors**

Economic analysis conducted by the company's management led to the identification of the following factors which affecting profit:

- Estimated quantity of products sold (units);
- The estimated price for each product marketing (RON/ piece);
- The fixed costs of the company (their size is independent of actual production work and includes training costs of production, with utilities, salaries of management staff, to the service etc.).
- Variable costs (these costs depend directly on the size and production activities include: costs of raw materials, direct labor, etc.).<sup>1</sup>

In any analysis of this type, variable costs are easier to estimate both per unit and overall, while fixed costs are more difficult to spread, as the company produces a

