Economic decisions in risk conditions

Belu, Nicoleta and Albici, Mihaela

University "Constantin Brancoveanu", Rm. Valcea, Romania

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ECONOMIC DECISIONS IN RISK CONDITIONS

Belu Nicoleta, University „Constantin Brancoveanu", Rm. Valcea
Albici Mihaela, University „Constantin Brancoveanu", Rm. Valcea

Abstract. *"Decision making always and necessarily implies human actions, which, when facing an external event (information) must identify the event's future status and set up the potential action ways leading to suggested goal accomplishment"[4].*

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Decision making results from the occurrence of a troubling issue which requests a certain solution. Decision making must start when the issue is rightly posed which involves the analysis of available data, the selection of significant ones and the necessary formalization. The next step is solving the issue by means of operations, instruments and logical, algorithmic and heuristic techniques. Decision making iteself intervenes in the selection of solutions obtained which can be unique – optimal or interval solutions – sub-optimal solutions. The last step means assessing and upgrading the solution.

A decision's objectiveness is assimilated with a risk situation when it is objectively obvious that there are chances that potential nature's states[1] might occur as well as regarding the results associated to each state. As far as risk situation is concerned, decision's subjectivity corresponds to uncertainty, when either the chances of nature states' occurrence cannot be objectively appreciated, or one does not have any data about nature states.

Decision theory involves three premises that ensure judgments' convergence [3]:

- Currency utility's being linear for various decision makers. In 1738, Bernoulli showed in Petersburg "paradox" that the economic significance of an additional currency unit is inversely proportional to the number of currency units held. M. Kalecki stated an increasing price law of risk where he showed that if a price goes up, the cost of assuming it goes up even faster;
- A decision maker does not disagree or agree with risk – accepting a risky situation is not due to agreeing with risk, and avoiding it is not the cause of disagreement;
- In any circumstances, a decision maker tries to maximize the value or anticipated utility of reward.

If there are two or more nature states, the way to make decisions depends on the information about the prospects to accomplish nature states.

Risk is a social, economic, political or natural category whose origin lies in the uncertainty that may or may not generate a damage because of hesitation and unconsciousness when making decisions.

[1] " A nature state is a potential configuration of decisional environment which along with the knowledge about individual actions entirely generates all consequences", Bogdan-Constantin Andronic, *Performanţa firmei*, Ed. Polirom, Iaşi, 2000, p. 157

Analyzing decisional issues in risk conditions involves the assessment of decision alternatives and their consequences as decisions' effects are not surely known. In such cases, the optimal action way is the one maximizing anticipation, respectively showing a result's potential or anticipated value.

Decision making in risk conditions means several nature states have accomplishment probabilities comprised between 0 and 1.

If p_1 probability when accomplishing N_1 state and p_2 probability when accomplishing N_2 state are known, decision making takes place in risk conditions and solving means the set-up of ***utilities' mathematical hopes*** for each alternative and the choice of alternative to which maximum utility mathematical hope corresponds.

Mathematical hope is the well-balanced average size of an activity's results, the shares being equal to the probabilities of events or nature states.

$$S_{(V_i)} = \sum_j r_{ij}\, p(x_j) \qquad i = \overline{1, m},\ p_i(x_j) \in [0,1],\ \sum_j p(x_j) = 1$$

where:

x_j – random phenomena typical of an issue;

$p(x_j)$ – probabilities of their production;

$S(v_i)$ – mathematical hope of results in V_i variant.

The optimal variant is the one meeting the relationship:

$$V_{opt} = \max\{S(v_i)\}$$

Application. A trade company launches a new product on the market. The market conjecture may be favourable, relatively favourable or unfavourable to the new product. The company has set up three strategies referring to the launching lot size estimating the economic results for each, according to the market situation.

The aim is to find out the launching strategy that might lead to a maximum profit using mathematical hope.

Market **Lot**	**Very favourable**	**Relatively favourable**	**Unfavourable**
L_1 1500	48	23	- 10
L_2 1300	34	18	- 8
L_3 1100	20	14	- 5
Nature state probability	0.3	0.5	0.2

$$S(L_1) = [(0,3 \cdot 48) + (0,5 \cdot 23) + 0,2 \cdot (-10)] = 23,9 \cdot 10^6$$

$$S(L_2) = [(3,4 \cdot 0,3) + (18 \cdot 0,5) + 0,2 \cdot (-8)] = 10,2 + 9 - 1,6 = 17,6 \cdot 10^6$$

$$S(L_3) = [(20,3 \cdot 0,3) + (0,5 \cdot 14) + 0,2 \cdot (-5)] = 6 + 7 - 1 = 12$$

Using the method of mathematical hope, the strategy bringing maximum profit is the first one, namely launching a lot of 1,000 products.

When developing complex economic actions which are sequences of decisional processes and non-decisional economic processes, it is often necessary one should decide not only according to variants' immediate consequences, but also to the remote consequences of a set of future decisional processes. Such decisional sets can be modelled by means of ***decisional tree***.

Decisional trees are an instrument to approach decisional matters with multiple uncertain results. Tree structures are made up of branches – symbolizing decision makers' action variants and also nature states - , and knots – marked by "O" when a decision belongs to a manager and by "" when a decision belongs to nature. Intermediary decisions are conditioned by the estimated results of decisions in final knots. In order to find the best solution, a way in the tree is searched starting from the final knot or knots towards the first knot [5]. For the calculation of various values or utilities, one usually resorts to conditioned probabilities. If the solution is ambiguous, one can try to detail an intermediary knot.

Application. Avon Company manufactures and markets the "Ever" deodorant spray product. The company staff analyzes the need to perform a marketing survey and therefore they resort to a specialized company. The cost of such a project is 75 thousand u.m.

The marketing company receives information regarding the opportunity of market launch:

- if the market is favourable, the product will be launched;
- if the market is unfavourable, the project will be ceased.

The product is estimated to have a growth potential of about 10% of the market in the context of significant competition.

As far as the sale method is concerned, there are two types:

- V_1 – selling the entire production obtained through intermediaries (they get a fixed revenue of 375 thousand u.m.);
- V_2 – selling by own efforts (stores and employed sales agents).

The following situations may arise in the latter variant:

- R_1 – maximum product sales;
- R_2 – average condition sales;
- R_3 – poor sales.

Potential strategies:

- S_1 – selling through intermediaries without asking for the marketing company's help in order to make up the market survey;
- S_2 – marketing the product on their own expenses without testing the market;
- S_3 – surveying the market and then using either of the two selling ways.

Solution:

The estimation of revenues and the probability of the three situations' occurrence:

Nature states	Manifestation probability	Estimated revenues
R_1	0.6	1050
R_2	0.2	700
R_3	0.2	400

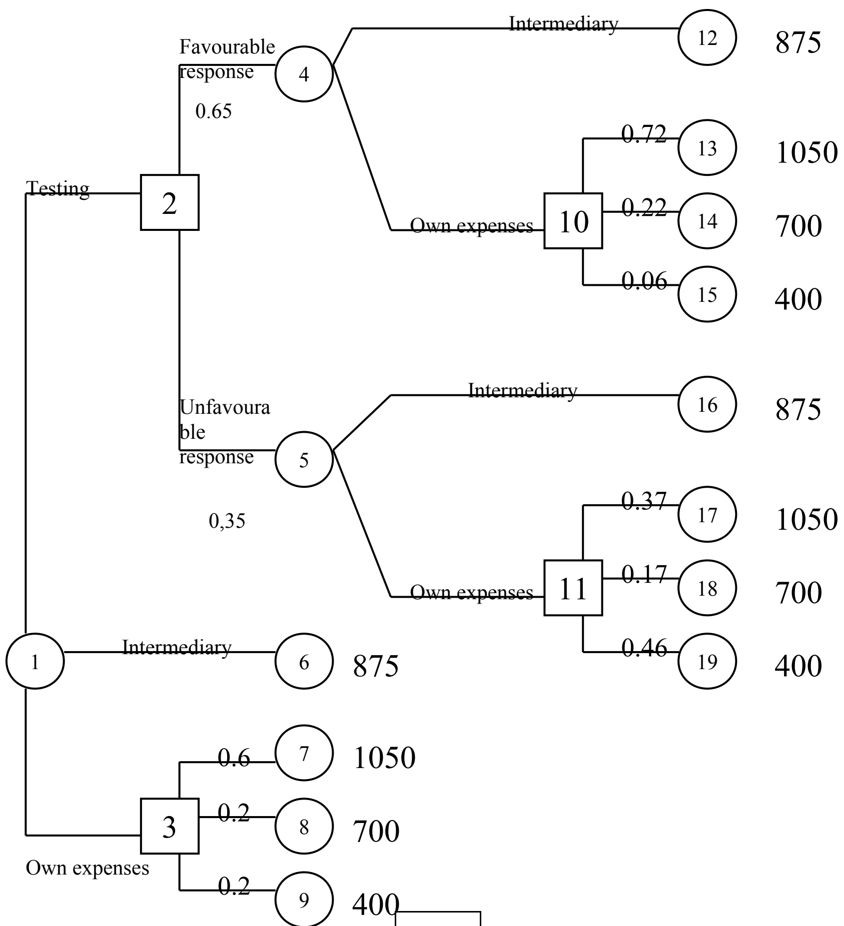
- The probability of the market's being 0.65% product favourable and 0.35% product unfavourable has been reached by means of the marketing survey.
- The probabilities to simultaneously accomplish various nature states are rendered.

Nature states	Favourable market	Unfavourable market	Absolute probabilities
R_1	0.47	0.13	0.6

R_2	0.14	0.06	0.2
R_3	0.04	0.16	0.2
Absolute probabilities	0.65	0.35	1.00

According to the table data, the probabilities of R_1, R_2, R_3 situations conditioned by favourable or unfavourable market can be calculated:

P (R_1 /favourable market) = 0.47/0.65 = 0.72;
P (R_2 /favourable market) = 0.14/0.65 = 0.22;
P (R_3 /favourable market) = 0.04/0.65 = 0.06;
P (R_1 /unfavourable market) = 0.13/0.35 = 0.37;
P (R_2 /unfavourable market) = 0.06/0.35 = 0.17;
P (R_3 /unfavourable market) = 0.16/0.35 = 0.46.



- mathematical hope for knot 10

$$(0,72 \cdot 1050) + (0,22 \cdot 700) + (0,06 \cdot 400) = 756 + 154 + 24 = 934$$

- mathematical hope for knot 11

$$\left(0{,}37\cdot 1050\right)+\left(0{,}17\cdot 700\right)+\left(0{,}46\cdot 400\right)=338+119+184=691$$

Assessing the consequences in decisional knot (4)

$$\max\left(875;934\right)\longrightarrow 934$$

Assessing the consequences in decisional knot (5)

$$\max\left(875;691\right)\longrightarrow 875$$

- mathematical hope for knot [2]

$$\left(0{,}65\cdot 934\right)+\left(0{,}35\cdot 875\right)=607+306=913$$

- mathematical hope for knot [3]

$$\left(0{,}6\cdot 1050\right)+\left(0{,}2\cdot 700\right)+\left(0{,}2\cdot 400\right)=630+140+80=850$$

Assessing the consequences in decisional knot (1)

$$\max\left\{(913-75);875;850\right\}=875$$

Optimal decision: selling by intermediaries without testing the market.

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