

## RELATED EXTENSION OF THE EVENTOLOGICAL SCORING METHOD

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At the present time eventological scoring method is obtained sufficient greatly semination itself. It's used in sport, banking management, psychology, philosophy and many other fields of the people's vital activity. When attempt of using it's method to problem risk enterprise bankruptcy valuation was made, after that it's necessary of obtained new method eventological scoring formulas was acknowledged. That formulas would allow to calculate risk level upon condition of set expert's opinion existing (it's fuzzy event, questionnaire event interpreting). Also necessary of development of new method was occurred. That method is join of existing methods, there are generalized eventological scoring method and eventological scoring method for extended questionnaire. In this work the formulas e-scoring method, which expand generalized e-scoring method, taked into account consideration of existing of extended questionnaire and fuzzy event, interpreting questionnaire event, is presented for the first time.

It is necessary to present some definition of eventological theory of fuzzy event [1] for formal description method of eventological scoring for fuzzy event, interpreting questionnaire event.

Definition 1. M-fuzzy elementary event  $\tilde{x}$  is

$$\tilde{x} = \{x_\mu, \mu \in M\}, \omega_\mu \in \Omega.$$

Definition 2. Each selected event  $x \in X$  is separated of elementary space events  $\Omega$  on the two nonintersecting events, there are  $\Omega = x + x^c$  – event  $x$  and its logical complement is event  $x^c = \Omega - x$ . All set events  $X$  divides the space simple events into intersect events-terraces:

$$ter(X) = \bigcap_{x \in X} x \bigcap_{x \in X^c} x^c,$$

where  $X^c = X - X$  is addition of subset events  $X$  to  $X$ .

Definition 3. Conditional probability of event  $s$  under conditions adventing of M-fuzzy event  $\tilde{x}$  is calculated as:

$$P(s | \tilde{x}) = \frac{P(s \cap \tilde{x})}{P(\tilde{x})}.$$

Definition 4. The set of random events  $X$  is called  $s$ -independent in aggregate [1] if

$$(1). P\left(\bigcap_{x \in X} (x \cap ter(S))\right) = P\left(\prod_{x \in X} (x \cap ter(S))\right), X \in X, S \in \Psi,$$

If events from set  $X \in X$  are  $s$ -independent in aggregate, then events from set  $\{(x \cap s^c), x \in X\}, X \in X$  and events from set  $\{(x \cap s^c)^c, x \in X\}, X \in X$  are independent in aggregate.

Eventological scoring (e-scoring method) is mathematical (statistical) model. It's helped to calculate distribution of probability events (which were defined before), using some database.

Eventological technologies differ from many mathematical, also from methods of probabilities that allow to receive result on the database which usually have in the conditions of real economic activities It is caused by that eventology suggests to consider structure of dependencies of event [1, 2, 3, 4].

**Generalized e-scoring method for dependence nonlocal structure for extended questionnaire.** This method is combination of more simple e-scoring method: e-scoring method for extended questionnaire and generalized e-scoring method. Such constructing method is

applied to wider problem class in contrast to each of simplest named method. This fact is explained with appeared possibility to calculated distribution of set target events (estimator isn't unattached to pare of target events only, which added mutually). Addition, experts are not unattached to questionnaires, which requirement existing of two target events only (it's advantages of using extended questionnaire). To the present day the building of such method are not occurred.

Let's  $(\Omega, F, P)$  is the probability space,  $X \subseteq F$  is finite set of basis random events, chosen their algebras  $F$ , and  $\Psi \subseteq F$  is finite set of target random events set also chosen from  $F$ . Let's define the target event-terraces  $ter(S)$  next:

$$ter(S) = \bigcap_{s \in S} s \bigcap_{s \in S^c} s^c. \quad (1)$$

Next, let's define of the set of variant-event off response is  $D$ , which consist of all possible variant off response  $d$  on question form;  $D_x \subseteq D$  is – set of variant-event off response on  $x$ -question.

Let's calculate events are favorable to advent of target event-terraces  $ter(S)$ . For this purpose we should to hold fix  $x$ -question. For all  $d \in D$  we should to calculate probability  $P(d \cap ter(S))$  for all  $S \subseteq \Psi$ . Let's put on next: event-response  $d$  is favorable to appeared of target event  $ter(S)$ , if

$$P(d \cap ter(S)) = \max_{S \in \Psi} P(d \cap ter(S)),$$

and is not favorable in the other case.

Make a note of next: in case, when  $P(d \cap ter(S)) = \max_{S \in \Psi} P(d \cap ter(S_0))$  for some  $S, S_0 \in \Psi$  we should used additional method of expert estimation or make of related extensions of "teaching" selection for achieve more exact probability values. Let's carry on such procedure for all  $x \in X$ .

Thus, we will define  $D_x^S \subseteq D$  is set of event-response on  $x$ -question, which are favorable to appeared of target-event  $ter(S)$ .

It's necessary point out, that  $\sum_{S \in \Psi} \sum_{x \in X} D_x^S = X$  (due to each response variant on each question of questionnaire is favorable to appeared of only one target-event). Then experts questioning result  $\tilde{t}_s(X)$  is described as:

$$\tilde{t}_s(X) = \sum_{S \in \Psi} (ter(S) \cap T\tilde{e}r_{X(S)}), \quad (2)$$

where  $T\tilde{e}r_{X(S)} = \{Ter_{X_\mu(S)}, \mu \in M\}$ ,  $Ter_{X_\mu(S)} = \bigcup_{x \in X_\mu} \bigcup_{d \in D_x^S(\omega)} d$ ,

$$X_\mu(S) = \{x_\mu, x \in X, x \cap ter(S) \neq \emptyset\}, X_\mu = \{x_\mu, x \in X\}.$$

Definition 5. Generalized e-scoring method for extended questionnaire is method of calculation of on known probabilities of events  $P(d)$ ,  $d \in D$  and the known conditional probabilities

$$P(ter(S) | d) = \frac{P(d \cap ter(S))}{P(d)}, d \in D,$$

unknown values

$$P(ter(S) | \tilde{t}_s(X)) = \frac{P(\tilde{t}_s(X) \cap ter(S))}{P(\tilde{t}_s(X))}, X \in X, \quad (3)$$

– conditional probabilities distribution of random of target events  $ter(S) \in \Psi$  : upon condition appeared random M-fuzzy event  $\tilde{t}_S(X)$ , it's determined with (2).

**Lemma** (about formula of generalized e-scoring method for dependence nonlocal structure for extended questionnaire) In determined labeling, formula of generalized e-scoring method upon condition presence of extended questionnaire and fuzzy event, interpreting questionnaire event, is next:

$$P(ter(S) | \tilde{t}_S(X(S))) = \frac{\sum_{\mu \in M} P\left(\bigcup_{x \in X_\mu(S)} \bigcup_{d \in D_x^S(\omega)} (ter(S) \cap d)\right)}{\sum_{\mu \in M} \sum_{S \in \Psi} P\left(\bigcup_{x \in X_\mu(S)} \bigcup_{d \in D_x^S(\omega)} (ter(S) \cap d)\right)}, X_\mu(S) \subseteq X. \quad (4)$$

Proof is presented in [4].

Next, formula of generalized e-scoring method upon condition presence of extended questionnaire and fuzzy event, interpreting questionnaire event, for nonlocal dependence structure will be present.

It's necessary to invented labels. So, let's

$$u_x(d \cap ter(S)) = \begin{cases} \sum_{d \in D_x^S} (d \cap ter(S)), d \in D - \text{nonintersecting}; \\ \Omega - \bigcap_{d \in D_x^S} (\Omega - (d \cap ter(S))), d \in D - \Psi - \text{independent}; \\ \max_{d \in D_x^S} (d \cap ter(S)), d \in D - \text{enclosed}. \end{cases} \quad (5)$$

So, bearing in mind (4) and (5), total e-scoring method formula of e-scoring method upon condition presence of extended questionnaire and fuzzy event, interpreting questionnaire event is presented as (6).

$$P(ter(S) | \tilde{t}_S(X(S))) = \frac{\sum_{\mu \in M} P\left(\bigcup_{x \in X_\mu(S)} u_x(d \cap ter(S))\right)}{\sum_{\mu \in M} \sum_{S \in \Psi} P\left(\bigcup_{x \in X_\mu(S)} u_x(d \cap ter(S))\right)}, X_\mu(S) \subseteq X. \quad (6)$$

Consequently, if response-events has nonintersecting structures, then with according to formulas (5) and (6), formulas of generalized e-scoring method upon condition existing extended questionnaire and fuzzy event, interpreting questionnaire event is (7).

$$P(ter(S) | \tilde{t}_S(X(S))) = \frac{\sum_{\mu \in M} \sum_{x \in X_\mu(S)} \sum_{d \in D_x^S} P(d \cap ter(S))}{\sum_{\mu \in M} \sum_{S \in \Psi} \sum_{x \in X_\mu(S)} \sum_{d \in D_x^S} P(d \cap ter(S))}, X_\mu(S) \subseteq X. \quad (7)$$

If response-events has s- independence structures, then with according to formulas (5) and (6), formulas of generalized e-scoring method upon condition existing extended questionnaire and fuzzy event, interpreting questionnaire event is (8).

$$P(ter(S) | \tilde{t}_S(X(S))) = \frac{\sum_{\mu \in M} \sum_{x \in X_\mu(S)} \left(1 - \prod_{d \in D_x^S} (1 - P(d \cap ter(S)))\right)}{\sum_{\mu \in M} \sum_{S \in \Psi} \sum_{x \in X_\mu(S)} \left(1 - \prod_{d \in D_x^S} (1 - P(d \cap ter(S)))\right)}, X_\mu(S) \subseteq X. \quad (8)$$

If response-events has enclosed structures, then with according to formulas (5) and (6), formulas of generalized e-scoring method upon condition existing extended questionnaire and fuzzy event, interpreting questionnaire event is (9).

$$P(\text{ter}(S) | \tilde{t}_S(X(S))) = \frac{\sum_{\mu \in M} \sum_{x \in X_{\mu}(S)} \sum_{d \in D_x^s} \max_{d \in D_x^s} P(d \cap \text{ter}(S))}{\sum_{\mu \in M} \sum_{S \in \Psi} \sum_{x \in X_{\mu}(S)} \sum_{d \in D_x^s} \max_{d \in D_x^s} P(d \cap \text{ter}(S))}, X_{\mu}(S) \subseteq X. \quad (9)$$

**Application of e-scoring method** Problem risk enterprise bankruptcy valuation is popular at all times. However, such problems acquire special actuality at unstable economically period. Bankruptcy doesn't occur suddenly, due to enterprise's condition of, credit standing, relation with partner and client doesn't go down all at once, on account of plural presence. Accordingly with it, coming stage of bankruptcy is needed predict.

Question of choice of the method and techniques, there are allowed predict of advent of enterprise bankruptcy is obtained of itself actuality at the present time.

Plural different ways and method for risk enterprise bankruptcy valuation are existing in present day. However all of them advantages as well as essential disadvantages. Due to its and also because of significant role is allocated to minds in during of process valuation of risk enterprise bankruptcy and eventology presents scientific theory about large evented variety of subject (mind) and objective, their evented building and functions, origin, expansion and advanced, connection with each other [1], so application eventology theory is possibility on considering class of problem.

So, risk enterprise bankruptcy valuation is carried out by expert group through different indexes. Description of enterprise condition is conclusion of evaluation processes. In this context it is proposed to compose of extended questionnaire (with the aim of obtained more detail description of enterprise condition).

Building of model e-scoring method in detail is presented in article [2, 3, 4].

## References

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