Eventological Theory of Decision-Making

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Abstract. *The eventological theory of decision-making, the theory of event-based decision-making is a theory of decision-making based on eventological principles and using results of mathematical eventology [1]; a theoretical basis of the* practical eventology *[2, 3, 4]. The beginnings of this theory which have arisen from event-based representation of the reasonable subject and his decisions in the form of eventological distributions (E-distributions) of sets of events [5] and which are based on the eventological H-theorem [6] are offered. The illustrative example of the eventological decision-making by the reasonable subject on his own event-based behaviour in the financial or share market is considered.*

Keywords. *Eventology, event-based decision-making, eventological H-theorem.*

1. Event circumstances

The reasonable subject makes a decision at the *coincidence of a set of events-circumstances* which is generated by his surrounding events. The reasonable subject looks at his surrounding events through a prism of the set of events $\mathfrak{F} \subseteq \mathcal{F}$, chosen by him from the algebra of events $\mathcal{F}$ of the eventological space (E-space) $(\Omega, \mathcal{F}, \mathbf{P})$. Then during some moment $t \in T$ coming this or that event-terrace $\mathrm{ter}(F_t)$, $F_t \subseteq \mathfrak{F}$ will be always unequivocal to correspond to any coincidence of a set of events-circumstances. Therefore we shall agree to name these events-terraces $\mathrm{ter}(F_t)$ as *coincidences of a set of events-circumstances during the moment* $t \in T$ *generated by the set of events* $\mathfrak{F}$ which in turn we shall name the *set of events-circumstances* for brevity.

2. Event decisions

Let's assume also that at the full order of the reasonable subject there is *a set of events-decisions* $\mathfrak{D} \subseteq \mathcal{F}$ chosen by him from the same algebra of events $\mathcal{F}$. Each subset $D \subseteq \mathfrak{D}$ corresponds to this or that *set event-based decision (the E-set-decision)* of the reasonable subject. Approaches or non-approaches of separate events-decisions $d \in \mathfrak{D}$, generated by a choice of the reasonable subject, mutually unequivocally characterize each his E-set-decision $D \subseteq \mathfrak{D}$. Making by reasonable subject the E-set-decision D means, that the reasonable subject *chooses* separate events-decisions $d \in D$ in such a manner that there come all events-decisions from D and any of $D^c = \mathfrak{D} - D$. The reasonable subject *creates* all events-decisions from D and any of $D^c = \mathfrak{D} - D$. Differently, the reasonable subject *creates* one of events-terraces $\mathrm{ter}(D), D \subseteq \mathfrak{D}$, generated by the set of events-decisions $\mathfrak{D}$.

Choosing or not choosing[1] separate events-decisions $d \in \mathfrak{D}$ during each moment $t \in T$, the reasonable subject as a result gets an ability make an *eventological choice* — an ability to choose events-terraces $\mathrm{ter}(D)$, $D \subseteq \mathfrak{D}$ according to the E-distribution of set of events-decisions $\mathfrak{D} \subseteq \mathcal{F}$, i.e. gets an ability to make the E-set-decisions $D \subseteq \mathfrak{D}$ included in $\mathfrak{D}$ according to the E-distribution of $\mathfrak{D}$.

3. The assumption of the stationarity of sets of events

In the beginning we shall assume for simplicity that the set of events-decisions $\mathfrak{D}$ and the set of events-circumstances $\mathfrak{F}$ do not depend on time. In other words, we shall assume a stationarity of E-distributions of $\mathfrak{D}$ and $\mathfrak{F}$, i.e. — their invariance in time.

4. A problem of eventological decisions-making (E-decisions-making)

The problem of eventological decisions-making (E-decisions-making) by the reasonable subject consists in his choice (for the set of events-circumstances $\mathfrak{F}$) of a such set of events-decisions $\mathfrak{D}$ of which E-distribution represents for the reasonable subject the *greatest value* as his event-based answer to a call of $\mathfrak{F}$ generated by surrounding events. An ability of the reasonable subject to choose the set of events-decisions $\mathfrak{D}$ with that or other E-distribution is equivalent to him ability *to choose the E-set-decision $D \subseteq \mathfrak{D}$ eventologically (event-based probabilistically)*, i.e. — *to choose* a way of his own event-based behaviour within the limits of the set of events-decisions $\mathfrak{D}$ *in eventological manner*; — to choose a way which is his event-based answer to the call of any coincidence of events-circumstances $F \subseteq \mathfrak{F}$ of his surrounding events.

4.1. The choice of events-decisions

The choice by the reasonable subject of an event-decision $d \in \mathfrak{D}$ at the coincidence of a set of events-circumstances $\mathrm{ter}(F)$ is eventologically fixed by the special indicator function of two arguments: an event-decision d and an event-terrace $\mathrm{ter}(F)$, which is defined on $\mathfrak{D} \times \mathcal{F}$ through the Riemann's[2] zeta-function ζ defined on $\mathcal{F} \times \mathcal{F}$:

$$\mathbf{1}_d(\mathrm{ter}(F)) = \zeta\big(\mathrm{ter}(F), d\big) = \begin{cases} 1, & \mathrm{ter}(F) \subseteq d, \\ 0, & \text{otherwise.} \end{cases}$$

For any pair $(d, F) \in \mathfrak{D} \times 2^{\mathfrak{F}} \subseteq \mathfrak{D} \times \mathcal{F}$ we shall use the abbreviated designation:

$$\mathbf{1}_d(F) = \mathbf{1}_d(\mathrm{ter}(F)),$$

[1] according to that or other coincidence of a set of events-circumstances to which an event-terraces $\mathrm{ter}(F_t)$ corresponds.

[2] *Riemann, Georg Friedrich Bernhard* (1826–1866) was a German mathematician who made important contributions to analysis and differential geometry, some of them paving the way for the later development of general relativity.

and shall keep this abbreviation as well for the so-called *set-indicator function*

$$\mathbf{1}_d(F) = \begin{cases} \Omega, & \mathrm{ter}(F) \subseteq d, \\ \emptyset, & \text{otherwise}, \end{cases}$$

hoping, that the context in which it will be used, will help us to avoid misunderstanding.

The just entered set-display function allows us to construct each event-decision $d \in \mathfrak{D}$ from events-terraces $\mathrm{ter}(F)$, $F \subseteq \mathfrak{F}$ mathematically by the formula:

$$d = \sum_{F \subseteq \mathfrak{F}} \mathrm{ter}(F) \cap \mathbf{1}_d(F), \tag{1}$$

which can be written down in equivalent form by means of the indicator function in more bulky kind however:

$$d = \sum_{F:\ \mathbf{1}_d(F)>0} \mathrm{ter}(F). \tag{1'}$$

Remark 1. Formulas (1) and (1′) define each event-decision $d \in \mathfrak{D}$ as a union of this or that set of events-terraces $\mathrm{ter}(F)$. In other words, events-decisions $d \in \mathfrak{D}$ appear combined of events-terraces $\mathrm{ter}(F)$, generated by the set of events-circumstances $\mathfrak{F}$, in such a manner that each event-terrace $\mathrm{ter}(F)$ or is completely contained in the event-decision d, or is not intersected with it. This fact allows to enter one more indicator function:

$$\mathbf{1}_D(\mathrm{ter}(F)) = \zeta\big(\mathrm{ter}(F), \mathrm{ter}(D)\big) = \begin{cases} 1, & \mathrm{ter}(F) \subseteq \mathrm{ter}(D), \\ 0, & \text{otherwise} \end{cases}$$

which we shall designate in abbreviated form

$$\mathbf{1}_D(F) = \mathbf{1}_D(\mathrm{ter}(F)),$$

hoping that it also will not cause misunderstanding.

If to take advantage of more correct, but bulky writing

$$\mathbf{1}_D(\mathrm{ter}(F)) = \mathbf{1}_{\mathrm{ter}(D)}(\mathrm{ter}(F)),$$

then $\mathbf{1}_D(F)$ can be considered as the indicator function as original generalization of $\mathbf{1}_d(F)$. These functions are connected by a relation:

$$\mathbf{1}_d(F) = \sum_{\mathrm{ter}(D) \subseteq d} \mathbf{1}_{\mathrm{ter}(D)}(\mathrm{ter}(F)) = \sum_{d \in D} \mathbf{1}_D(F)$$

by virtue of that

$$\{\mathrm{ter}(D) \subseteq d\} \iff \{d \in D\}.$$

Remark 2. Formulas (1) and (1′) define the set of events-decisions $\mathfrak{D}$ through the set of events-circumstances $\mathfrak{F}$. The inverse formulas are possible when there is a one-to-one correspondence between the set of nonempty events-terraces $\mathrm{ter}(D)$, $D \subseteq \mathfrak{D}$ and the set of nonempty events-terraces $\mathrm{ter}(F)$, $F \subseteq \mathfrak{F}$.

4.2. The eventological choice

The choice by the reasonable subject of events-decisions, which all together form the set $\mathfrak{D}$, enable him an eventological choice of any E-set-decision $D \subseteq \mathfrak{D}$ which is interpreted (by one-to-one way) as *creation* of event-terrace by the reasonable subject:

$$\mathrm{ter}(D) = \bigcap_{d \in D} d \bigcap_{d \in D^c} d^c$$

where events-decisions $d \in \mathfrak{D}$ are defined by formulas (1) or (1′) in full correspondence with his eventological choice.

Let's designate

$$\boldsymbol{p} = \Big\{ p(F) = \mathbf{P}(\mathrm{ter}(F)),\ F \subseteq \mathfrak{F} \Big\}$$

E-distribution of the set of events-circumstances $\mathfrak{F}$. Then the E-distribution

$$\boldsymbol{q} = \Big\{ q(D) = \mathbf{P}(\mathrm{ter}(D)),\ D \subseteq \mathfrak{D} \Big\}$$

of the set of events-decisions $\mathfrak{D}$ is connected with the E-distribution $\boldsymbol{p}$ by formulas:

$$q(D) = \sum_{F \subseteq \mathfrak{F}} p(F) \mathbf{1}_D(F), \quad D \subseteq \mathfrak{D}, \tag{2}$$

which allow to speak that the reasonable subject (choosing separate events-decisions $d \in \mathfrak{D}$, in other words, choosing this or that E-set-decision $D \subseteq \mathfrak{D}$) shows his ability of the eventological choice — his ability of the E-decisions-making answering on a call of the E-distribution of $\mathfrak{F}$, the set of events-circumstances.

5. E-decisions-making methods

5.1. Value of an event

A *value of event* [1, 5] is a one of essential properties of event, co-being of the reasonable subject; a propensity of event to have the importance, to be important for the reasonable subject; that is inherent in event, makes its concrete existence; without a value an event cannot exist; characterizes a degree of value for reasonable subject «to be with», to perceive and/or to create an event as an outcome of the being; opens a value of dual event in concepts of a *value of perception* and a *value of creation* of event by the reasonable subject; reflects two opposite basic relations between mind and Being; underlies the eventological laws describing the nature of objective and subjective uncertainty; mathematically it is connected with Kolmogorov's[3] probability by the relation value∼probability [1].

5.2. The greatest value principle

We shall make bold to approve that so called the *greatest value principle* serves as a basis of an *eventological choice*. Differently, making the *eventological choice*, the reasonable subject recognizes that the event-based outcome of his choice should possess the *greatest value* from his point of view. Thus a sense of the *greatest value* of eventological choice in details to specify there is no necessity: the reasonable subject defines it for himself.

[3] *Kolmogorov, Andrey Nickolaevich (1903–1987)* was the great Russian mathematician; the founder of modern probability theory; worked in the field of topology, logic, the theory of turbulence, the theory of complexity of algorithms and in many others.

5.3. The matrix of a joint E-distribution for $\mathfrak{D}$ and $\mathfrak{F}$

Let's consider the matrix of a joint E-distribution for the set of events-decisions $\mathfrak{D}$ and the set of events-circumstances $\mathfrak{F}$:

$$\|\pi(D,F)\| = \Big\{\pi(D,F), \quad D \subseteq \mathfrak{D},\ F \subseteq \mathfrak{F}\Big\}, \tag{π}$$

where[4]

$$\pi(D,F) = \mathbf{P}(\mathrm{ter}(D) \cap \mathrm{ter}(F))$$

is a probability of joint coming events-terraces $\mathrm{ter}(D)$ and $\mathrm{ter}(F)$.

5.4. The greatest valuable conditional E-distributions of $\mathfrak{D}$

For each event-terrace $\mathrm{ter}(F)$ (which has a positive probability $p(F) > 0$) conditional probabilities

$$q(D|F) = \mathbf{P}\Big(\mathrm{ter}(D)\ \Big|\ \mathrm{ter}(F)\Big) = \frac{\pi(D,F)}{p(F)}$$

of reasonable subject choice of the E-set-decision $D \subseteq \mathfrak{D}$ at coincidence of a set of events-circumstances $F \subseteq \mathfrak{F}$ are defined. Conditional E-distributions

$$\Big\{q(D|F), \quad D \subseteq \mathfrak{D}\Big\}, \quad F \subseteq \mathfrak{F} \tag{$\star$}$$

are those *the greatest valuable (for the reasonable subject) E-distributions* which are formed[5] by him when he eventologically chooses E-set-decisions $D \subseteq \mathfrak{D}$, answering coincidence of a set of events-circumstances $F \subseteq \mathfrak{F}$. We shall designate

$$\|q(D|F)\| = \Big\{q(D|F), \quad D \subseteq \mathfrak{D},\ F \subseteq \mathfrak{F}\Big\}$$

a matrix of conditional probabilities of E-set-decisions $D \subseteq \mathfrak{D}$ answering coincidence of a set of events-circumstances $F \subseteq \mathfrak{F}$. This matrix has the greatest valuable conditional E-distributions ($\star$) as its lines.

Each of us has more or less sufficient experience of E-decisions-making valuable for us which answer on a call of daily events-circumstances. We shall take advantage of this experience for designing two methods of E-decisions-making which any reasonable subject can quite apply in his own event-based practice.

5.5. The first method

Let's assume that the matrix

$$\|\mathrm{val}(d,F)\| = \Big\{\mathrm{val}(d,F),\ (d,F) \in \mathfrak{D} \times 2^{\mathfrak{F}}\Big\},$$

is known and made of values $\mathrm{val}(d,F)$ of a real function

$$\mathrm{val}\ :\ \mathfrak{D} \times 2^{\mathfrak{F}} \to \mathbb{R},$$

[4]Here the reduced designations for events-terraces, generated by various sets of events $\mathfrak{D}$ and $\mathfrak{F}$, are used: $\mathrm{ter}(D) = \mathrm{ter}_{\mathfrak{D}}(D),\ \mathrm{ter}(F) = \mathrm{ter}_{\mathfrak{F}}(F)$.

[5]On the basis of *the greatest value principle*.

which are interpreted as *a degree of value* (by the reasonable subject) of an eventological choice of event-decision $d \in \mathfrak{D}$ at coincidence of a set of events-circumstances $F \subseteq \mathfrak{F}$. Thus positive values val are interpreted as a degree of value of outcome, and negative — as a degrees of absence of value of the outcome for the reasonable subject.

When $\mathrm{val}(d, F) > 0$ an event-decision $d \in \mathfrak{D}$ can be valuably chosen by the reasonable subject at coincidence of a set of events-circumstances $F \subseteq \mathfrak{F}$. In other words, events-decisions combine from corresponding events-terraces $\mathrm{ter}(F)$, for which $\mathrm{val}(d, F) > 0$ and are defined by formulas consequently:

$$d = \sum_{F:\ \mathrm{val}(d,F)>0} \mathrm{ter}(F), \quad d \in \mathfrak{D}.$$

Let's designate

$$D_F = \{d :\ \mathrm{val}(d, F) > 0\} \subseteq \mathfrak{D}$$

is a set of events-decisions for which val is positive at the given coincidence of a set of events-circumstances $F \subseteq \mathfrak{F}$. Then conditional E-distribution of all set of events-decisions $\mathfrak{D}$ at the coincidence of a set of events-circumstances $F \subseteq \mathfrak{F}$ is a singular E-distribution

$$q(D|F) = \delta(D, D_F) = \begin{cases} 1, & D = D_F, \\ 0, & \text{otherwise}, \end{cases} \tag{$\circ$}$$

where δ is the *delta-function*, or the *Kronecker's*[6] *symbol*.

5.6. The second method

For each set of events-decisions $D \subseteq \mathfrak{D}$ and each coincidence of events-circumstances $F \subseteq \mathfrak{F}$ we shall define value of function val by formulas

$$\mathrm{val}(D, F) = \sum_{X \subseteq D} \mathrm{val}(X, F) = \begin{cases} \mathrm{val}(\emptyset, F) + \sum\limits_{d \in D} \mathrm{val}(d, F), & D \neq \emptyset, \\ \\ \mathrm{val}(\emptyset, F), & \text{otherwise}, \end{cases}$$

which together taken form a matrix of values

$$\|\mathrm{val}(D, F)\| = \big\{\mathrm{val}(D, F) :\ D \subseteq \mathfrak{D},\ F \subseteq \mathfrak{F}\big\}. \tag{val}$$

Let's designate

$$\mathrm{val}(F) = \sum_{D:\ \mathrm{val}(D,F)>0} \mathrm{val}(D, F)$$

the sum of all positive values of function $\mathrm{val}(D, F)$ for data $F \subseteq \mathfrak{F}$. We shall define now for everyone $F \subseteq \mathfrak{F}$ a conditional E-distribution $q(D|F)$ as follows: at $\mathrm{val}(F) = 0$ by the formula:

$$q(D|F) = \begin{cases} 1, & D = \emptyset, \\ 0, & \text{otherwise}, \end{cases} \tag{$\circ\circ$}$$

[6] *Kronecker, Leopold (1823–1891)* was a German mathematician; the basic works on algebra and theory of numbers.

and at $\mathrm{val}(F) > 0$ by the formula:

$$q(D|F) = \begin{cases} \mathrm{val}(D, F)/\mathrm{val}(F), & \mathrm{val}(F) > 0, \\ 0, & \text{otherwise.} \end{cases} \qquad (\circ\circ')$$

Thus the second method unlike the first one suggests to describe E-behaviour of the reasonable subject at each coincidence of events-circumstances as a non-singular conditional E-distribution. The second method considers the situation which is more general and offers such way of an eventological choice of the reasonable subject when at each coincidence of events-circumstances the reasonable subject chooses his E-behaviour how a conditional E-distribution of the general character «prompts» to him. Thus his own E-distribution (defining his eventological choice within the limits of a set of events-circumstances $\mathfrak{F}$) is defined by formulas of full probability

$$q(D) = \sum_{F \subseteq \mathfrak{F}} q(D|F)p(F), \quad D \subseteq \mathfrak{D}.$$

5.7. The eventological H-theorem

The eventological H-theorem [5] is an eventological generalization of the Boltzmann's[7] H-theorem from the statistical mechanics; a mathematical substantiation of the eventological law uniting eventological analogue of the second law of thermodynamics: «increasing entropy in the closed thermodynamic non-alive system» with its eventological contrast: «decreasing entropy (increasing *negentropy* [7]) in the open living system»; proves application of *Gibbsean* and *«antiGibbsean» E-distributions* [1] of sets of events (minimizing a *relative entropy*[8]) as statistical models of event-based behaviour of the reasonable subject aspiring an equilibrium eventological choice between his *event-based perception* and his *event-based activity* in various spheres of his co-being; the formulation and the proof of the eventological H-theorem essentially base on *eventological principles* [6] with which the eventology [1] begins.

Theorem (the eventological H-theorem). *Let $(\Omega, \mathcal{F}, \mathbf{P})$ is the E-space, $\mathfrak{X} \subseteq \mathcal{F}$ is the finite set of events, $\mathcal{V}(X)$ is the limited set-function*[9] *on $2^{\mathfrak{X}}$, $p_*(X)$ is some fixed E-distribution*[10] *on $2^{\mathfrak{X}}$, and E-distributions*[11] *$p(X)$ on $2^{\mathfrak{X}}$ provide average value of the set-function $\mathcal{V}(X)$ at the given level*

$$\langle \mathcal{V} \rangle = \sum_{X \subseteq \mathfrak{X}} p(X)\mathcal{V}(X). \qquad (\mathcal{V})$$

Then a minimum of a relative entropy

$$H_{\frac{p}{p_*}} = \sum_{X \subseteq \mathfrak{X}} p(X) \ln \frac{p(X)}{p_*(X)} \to \min_{p}$$

[7] *Boltzmann, Ludwig Eduard* (1844–1906) was the great Austrian physicist famous for his founding contributions in the fields of statistical mechanics and statistical thermodynamics; he first stated the logarithmic connection between entropy and probability in his kinetic theory of gases; he stated his famous H-theorem, theoretical basis of the second law of thermodynamics.

[8] *Gibbsean* and *«antiGibbsean»* E-distributions minimize a relative entropy between two E-distributions: the E-distribution of event-based behaviour of the reasonable subject and his own E-distribution.

[9] This set-function is interpreted as a function of value (for the reasonable subject) of coming a set of events $X \subseteq \mathfrak{X}$.

[10] This E-distribution is interpreted as an own E-distribution of the reasonable subject.

[11] These E-distributions are interpreted as E-distributions of an event-based behaviour of reasonable subjects.

among E-distributions p is achieved on Gibbsean and antiGibbsean E-distributions of a kind:

$$p(X) = \frac{1}{Z_{p_*}} \exp\Big\{ -\beta \mathcal{V}(X) \Big\} p_*(X), \quad X \subseteq \mathfrak{X}, \quad \beta \geq 0,$$

$$p(X) = \frac{1}{Z_{p_*}} \exp\Big\{ \gamma \mathcal{V}(X) \Big\} p_*(X), \quad X \subseteq \mathfrak{X}, \quad \gamma \geq 0,$$

which can be copied without the normalizing multiplier $1/Z_{p_*}$ *in the equivalent form:*

$$\frac{p(X)}{p(\emptyset)} = \exp\Big\{ -\beta(\mathcal{V}(X) - \mathcal{V}(\emptyset)) \Big\} \frac{p_*(X)}{p_*(\emptyset)}, \quad X \subseteq \mathfrak{X},$$

$$\frac{p(X)}{p(\emptyset)} = \exp\Big\{ \gamma(\mathcal{V}(X) - \mathcal{V}(\emptyset)) \Big\} \frac{p_*(X)}{p_*(\emptyset)}, \quad X \subseteq \mathfrak{X}.$$

5.8. The method based on the eventological H-theorem

We form the new set of events

$$\mathfrak{X} = \mathfrak{D} + \mathfrak{F}$$

by the operation of union of the set of events-decisions $\mathfrak{D}$ and the set of events-circumstances $\mathfrak{F}$. To each pair of subsets of events-decisions $D \subseteq \mathfrak{D}$ and events-circumstances $F \subseteq \mathfrak{F}$ the subset of events

$$X = X \cap \mathfrak{D} + X \cap \mathfrak{F} = D + F \subseteq \mathfrak{X}$$

one-to-one corresponds. The E-distribution $\{p(X),\ X \subseteq \mathfrak{X}\}$ of the set of events $\mathfrak{X}$ is the joint E-distribution

$$\{\pi(D, F),\ D \subseteq \mathfrak{D}, F \subseteq \mathfrak{F}\}$$

of two sets of events $\mathfrak{D}$ and $\mathfrak{F}$, which have been defined (π) in the paragraph **5.3.**, as

$$\pi(D, F) = \mathbf{P}\left(\mathrm{ter}_{\mathfrak{D}}(D) \cap \mathrm{ter}_{\mathfrak{F}}(F)\right) = \mathbf{P}\left(\mathrm{ter}_{\mathfrak{X}}(X)\right) = p(X), \quad X \subseteq \mathfrak{X}.$$

Eventological principles [5] follows, that on all subsets of set of events $\mathfrak{X}$ the function of values is defined:

$$\mathcal{V}(X),\ X \subseteq \mathfrak{X},$$

values of which serve as elements of the matrix of values $\|\mathrm{val}(D, F)\|$ of pairs of events from sets $\mathfrak{D}$ and $\mathfrak{F}$ which have been defined (val) in the paragraph **5.6.**, as

$$\mathcal{V}(X) = \mathcal{V}(D + F) = \mathrm{val}(D, F), \quad D \subseteq \mathfrak{D}, F \subseteq \mathfrak{F}.$$

Let's designate

$$\{p_*(X),\ X \subseteq \mathfrak{X}\} = \{p_*(D + F),\ D \subseteq \mathfrak{D},\ F \subseteq \mathfrak{F}\}$$

the own E-distribution of the reasonable subject which can be estimated from his own historical statistics

$$\{\mathrm{ter}_{\mathfrak{X}}(X_t),\ t \in T\} = \{\mathrm{ter}_{\mathfrak{D}+\mathfrak{F}}(D_t + F_t),\ t \in T\}$$

received for some previous time interval T.

By virtue of the eventological H-theorem the event-based behaviour of the reasonable subject at given:

- the own E-distribution p_*;
- the function of value $\mathcal{V}$;
- the fixed level of average value $\langle\mathcal{V}\rangle$

should submit to the E-distribution of a kind

$$\frac{p(D+F)}{p(\emptyset)} = \exp\Big\{\alpha(\mathcal{V}(D+F) - \mathcal{V}(\emptyset))\Big\}\frac{p_*(D+F)}{p_*(\emptyset)}, \quad D \subseteq \mathfrak{D},\ F \subseteq \mathfrak{F}, \qquad (H)$$

where

- values of function of value $\mathcal{V}(X)$ are interpreted by a double way:
  - $\star$ $\mathcal{V}(X) > 0$ is a *value of perception* of the set of events $X \subseteq \mathfrak{X}$,
  - $\star$ $\mathcal{V}(X) < 0$ is a *value of creation* of the set of events $X \subseteq \mathfrak{X}$;
- the parameter $\alpha > 0$ characterizes the inverse average ability of the reasonable subject *to perceive* and *to create* sets of events.

In particular the E-distribution (H) follows, that at the coincidence of the set of events-circumstances $F \subseteq \mathfrak{F}$ ($p(F) > 0$) the event-based behaviour of the reasonable subject should submit to *the greatest valuable conditional E-distribution* (see ($\star$) in the paragraph **5.4.**) of a kind:

$$\left\{q(D|F) = \frac{p(D+F)}{p(F)}, \quad D \subseteq \mathfrak{D}\right\}, \qquad (H\star)$$

which serves as the eventological instruction for the reasonable subject and defines, what E-decisions have the greatest value as his event-based answer to a call of set of events of circumstances $F \subseteq \mathfrak{F}$.

6. Example of E-decisions-making

Let's consider a situation when the reasonable subject is making E-decisions on his behaviour in the financial or stock market, for example, within the limits of the tenders on currency or stock exchange. The reasonable subject is making E-decisions on the basis of his own historical E-statistics $\{\mathrm{ter}(F_t) : \ t \in T\}$ about the finite set of events-circumstances $\mathfrak{F}$. These events-circumstances selected by the reasonable subject came or did not come during the moments of time $t \in T$ from some finite set T before the moment of the E-decisions-making.

One events-circumstances $\mathfrak{F}$ are generated by technical characteristics others are generated by fundamental characteristics of the tenders and are called as *technical* or *fundamental events-circumstances* accordingly.

6.1. Technical events-circumstances

Let's designate $\{a_t, \quad t \in T\}$ a set of stock quotes of one kind or a rate of one currency in relation to another, and $\{b_t, \quad t \in T\}$ a set of volumes of their sales during the corresponding moments of time $t \in T$. We shall designate also

$$\{a_t^{(1)}, \quad t \in T\}, \quad \{a_t^{(2)}, \quad t \in T\},$$

$$\{b_t^{(1)}, \quad t \in T\}, \quad \{b_t^{(2)}, \quad t \in T\}$$

corresponding «sliding averages» of stock quotes and sales volumes accordingly for n_1+1 and n_2+1 at the previous moments of time:

$$a_t^{(1)} = \frac{1}{n_1+1}\sum_{\tau=t-n_1}^{t} a_\tau, \quad a_t^{(2)} = \frac{1}{n_2+1}\sum_{\tau=t-n_2}^{t} a_\tau,$$

$$b_t^{(1)} = \frac{1}{n_1+1}\sum_{\tau=t-n_1}^{t} b_\tau, \quad b_t^{(2)} = \frac{1}{n_2+1}\sum_{\tau=t-n_2}^{t} b_\tau.$$

On the basis of these characteristics of the tenders it is possible to define three technical events-circumstances:

$$f^{(1)} = \left\{a_t \geqslant a_t^{(1)}\right\}, \ f^{(2)} = \left\{a_t \geqslant a_t^{(2)}\right\}, \ f^{(3)} = \left\{a_t^{(1)} \geqslant a_t^{(2)}\right\}.$$

6.2. Fundamental events-circumstances

In the example fundamental events-circumstances are defined as follows:

$$f^{(4)} = \bigcup_{f\in\mathfrak{F}^{(4)}} f, \quad f^{(5)} = \bigcup_{f\in\mathfrak{F}^{(5)}} f, \quad f^{(6)} = \bigcup_{f\in\mathfrak{F}^{(4)}} f.$$

Each of these three events-circumstances corresponds to coming *even one*[12] events-circumstances $f \in \mathfrak{F}^{(i)}$ from a set of events[13] $\mathfrak{F}^{(i)}$, $i = 4, 5, 6$, coming in three corresponding spheres of a society — *economic, political and social* one and *the most valuable to increase of quotes* of the financial tool considered.

6.3. The set of events-circumstances

In the example the set of events-circumstances is made by the reasonable subject of six events-circumstances:

$$\mathfrak{F} = \left\{f^{(1)}, f^{(2)}, f^{(3)}, f^{(4)}, f^{(5)}, f^{(6)}\right\},$$

among which three: $f^{(1)}$, $f^{(2)}$ and $f^{(3)}$ are technical and three: $f^{(4)}$, $f^{(5)}$ and $f^{(6)}$ are fundamental. Thus, for the E-decisions-making the reasonable subject is going to analyze events-circumstances in the currency or stock market through a «prism» of the sextet of events $\mathfrak{F}$ selected by him. In other words, the reasonable subject is going to consider only $64 = 2^6$ variants of a coincidence of events-circumstances $F \subseteq \mathfrak{F}$, or, that is the same, a coming 64 corresponding events-terraces:

$$\mathrm{ter}(F) = \bigcap_{f\in F} f \bigcap_{f\in F^c} f^c, \quad F \subseteq \mathfrak{F},$$

where $f^c = \Omega - f$ is a complement of the event-circumstance f up to Ω, and $F^c = \mathfrak{F} - F$ is a complement of the set of events-circumstances F up to $\mathfrak{F}$.

[12]The logic statement «coming even one event» corresponds to the set-operation «union of events» which here should be considered only as popular, but rather particular variant of the any set-operation also quite admissible for definition of events-circumstances in a problem of E-decisions-making.

[13]*Economic, political and social events-circumstances*, forming sets $\mathfrak{F}^{(i)}$, $i = 4, 5, 6$, should be defined and chosen by the reasonable subject before he will start to make the E-decisions.

6.4. The set of events-decisions

In the example the set of events-decisions of the reasonable subject, where he makes E-decisions in the currency or stock market, consists of two events-decisions:

$$\mathfrak{D} = \{d^+, d^-\},$$

where

$$d^+ = \{\text{a sale of the financial tool}\},$$
$$d^- = \{\text{a purchase of the financial tool}\}.$$

In any situation the doublet of events-decisions $\mathfrak{D}$ partitions the space of outcomes of Being Ω on $4 = 2^2$ events-terraces each of which can be written down in a canonical form [1]:

$$\mathrm{ter}(D) = \bigcap_{d \in D} d \bigcap_{d \in D^c} d^c, \quad D \subseteq \mathfrak{D}.$$

According to their definition these events-terraces are easy for writing out in a form of intersection of two events and for resulting their obvious interpretation also:

- $\mathrm{ter}(\emptyset) = (d^+)^c \cap (d^-)^c$ — *to do nothing,*
- $\mathrm{ter}(\{d^+\}) = d^+ \cap (d^-)^c$ — *only to sell,*
- $\mathrm{ter}(\{d^-\}) = (d^+)^c \cap d^-$ — *only to buy,*
- $\mathrm{ter}(\{d^+, d^-\}) = d^+ \cap d^-$ — *to sell and to buy.*

Interpretation of event-terrace $\mathrm{ter}(\{d^+, d^-\})$ «to sell and to buy» can to mean, for example, that the reasonable subject sells the one part of the financial tools, and buys the other part.

If it is impossible it is necessary to assume that events-decisions are not intersected, i.e. that

$$\mathrm{ter}(\{d^+, d^-\}) = d^+ \cap d^- = \emptyset.$$

The doublet of not intersected events-decisions $\mathfrak{D}$ partitions the space of outcomes of Being Ω on three events-terraces only:

- $\mathrm{ter}(\emptyset) = (d^+)^c \cap (d^-)^c$ — *to do nothing,*
- $\mathrm{ter}(\{d^+\}) = d^+$ — *only to sell,*
- $\mathrm{ter}(\{d^-\}) = d^-$ — *only to buy.*

6.5. The matrix of values

In the example it is offered to estimate the matrix of values for the reasonable subject

$$\|\mathrm{val}(d, F)\| = \left\{\mathrm{val}(d, F), \ (d, F) \in \mathfrak{D} \times 2^{\mathfrak{F}}\right\}$$

from historical statistics

$$\left\{ \mathrm{ter}(F_t) : \ F_t \subseteq \mathfrak{F} \right\}.$$

An each element of the matrix is statistically estimated under the formula:

$$\mathrm{val}(d, F) = (-1)^{\delta(d, d^-)} \left(\frac{1}{|T_F|} \sum_{t \in T_F} (a_t - a_{t-1}) \right), \qquad (\odot)$$

where $T_F = \{t \in T \ \ F_t = F\} \subseteq T$ is the subset of the moments from T in which the coincidence of events-обстоятельств F_t coincided with $F \subseteq \mathfrak{F}$, and $|T_F|$ is a number of such moments (power of the subset T_F).

Now for each set of events-decisions $D \subseteq \mathfrak{D}$ and for each coincidence of events-circumstances $F \subseteq \mathfrak{F}$ the function val, earlier defined on $\mathfrak{D} \times 2^{\mathfrak{F}}$, is defined on greater set $2^{\mathfrak{D}} \times 2^{\mathfrak{F}}$ under formulas

$$\mathrm{val}(D, F) = \sum_{X \subseteq D} \mathrm{val}(X, F) = \begin{cases} \mathrm{val}(\emptyset, F) + \sum_{d \in D} \mathrm{val}(d, F), & D \neq \emptyset, \\ \\ \mathrm{val}(\emptyset, F), & \text{otherwise.} \end{cases} \tag{$\odot\odot$}$$

These values of val, taken all together, form the matrix of values

$$\|\mathrm{val}(D, F)\| = \{\mathrm{val}(D, F) \ \ (D, F) \in 2^{\mathfrak{D}} \times 2^{\mathfrak{F}}\}.$$

The further estimation of conditional E-distributions of the reasonable subject is spent methods using elements of the matrix of degrees of values estimated under formulas ($\odot$) and/or ($\odot\odot$) are put.

6.6. The first method

An each event-decision $d \in \mathfrak{D}$ is chosen by the reasonable subject at the coincidence of events-circumstances $F \subseteq \mathfrak{F}$ for which $\mathrm{val}(d, F) > 0$, in other words, it is defined by a formula:

$$d = \sum_{F:\ \mathrm{val}(d,F)>0} \mathrm{ter}(F), \quad d \in \mathfrak{D}.$$

Let

$$D_F = \{d : \ \mathrm{val}(d, F) > 0\} \subseteq \mathfrak{D}$$

is a set of all such events-decisions for which val is positive at the given $F \subseteq \mathfrak{F}$. Thus, the reasonable subject at the given $F \subseteq \mathfrak{F}$ creates the event-terrace

$$\mathrm{ter}(D_F) = \bigcap_{d \in D_F} d \bigcap_{d \in (D_F)^c} d^c,$$

corresponding to the set of events-decisions D_F, i.e. he creates all events-decisions from D_F and does not create any event-decision from $(D_F)^c = \mathfrak{D} - D_F$.

6.7. The second method

Let

$$\mathrm{val}_{\Sigma}(F) = \sum_{D:\ \mathrm{val}(D,F)>0} \mathrm{val}(D, F)$$

is a sum of all positive values of function $\mathrm{val}(D, F)$ for the given $F \subseteq \mathfrak{F}$. Now for everyone $F \subseteq \mathfrak{F}$ the conditional E-distribution $q(D|F)$ is defined:

- at $\mathrm{val}_{\Sigma}(F) = 0$ by the formula:

$$q(D|F) = \begin{cases} 1, & D = \emptyset, \\ 0, & \text{otherwise;} \end{cases} \tag{$\circ\circ$}$$

- at $\mathrm{val}_\Sigma(F) > 0$ by the formula:

$$q(D|F) = \begin{cases} \mathrm{val}(D,F)/\mathrm{val}(F), & \mathrm{val}(F) > 0, \\ 0, & \text{otherwise}. \end{cases} \qquad (\circ\circ')$$

This conditional E-distribution $q(D|F)$ generalizes the behaviour of the reasonable subject recommended by the first method, indicating for everyone $D \subseteq \mathfrak{D}$ probabilities $q(D|F)$ of creating the given set of events-decisions by the reasonable subject (under the condition of coming the set of events-circumstances $F \subseteq \mathfrak{F}$).

In other words the second method offers for the reasonable subject (if to use terminology of the games theory) not «pure» strategies (as the first method) but a «mixed» strategy of his event-based behaviour which is defined by the conditional E-distribution $\{q(D|F), D \subseteq \mathfrak{D}\}$. This fact that the reasonable subject is capable to carry out *an eventological choice*[14] of events-decisions according to the conditional E-distribution follows from the general E-principles [1, 5].

6.8. The method based on the eventological H-theorem

Let's

1) define on $2^{\mathfrak{D}+\mathfrak{F}}$ the function of value $\mathcal{V}$ by formulas

$$\mathcal{V}(D+F) = \mathrm{val}(D,F), \quad D \subseteq \mathfrak{D},\ F \subseteq \mathfrak{F},$$

where $\mathrm{val}(D,F)$ are calculated by formulas $(\odot)$ and $(\odot\odot)$;

2) estimate the own E-distribution $p_*(D+F)$ of the reasonable subject from the historical statistics

$$\{\mathrm{ter}_{\mathfrak{D}+\mathfrak{F}}(D_t+F_t),\ t \in T\}$$

of his event-based behaviour $\mathfrak{D}$, answered calls $\mathfrak{F}$ for some previous interval T;

3) fix some average level of valuable preferences of the reasonable subject $\langle\mathcal{V}\rangle$.

Then the eventological H-theorems (H) follows that at the coincidence of the set of events-circumstances $F \subseteq \mathfrak{F}$ ($p(F) > 0$) the event-based behaviour of the reasonable subject should submit to *the greatest valuable conditional E-distribution* (see $(\star)$ in the paragraph **5.4.**) of a kind:

$$\left\{ q(D|F) = \frac{p(D+F)}{p(F)}, \quad D \subseteq \mathfrak{D} \right\}, \qquad (H\star)$$

which serves as the eventological instruction for the reasonable subject and defines, what E-decisions have the greatest value as his event-based answer to a call of the set of events of circumstances $F \subseteq \mathfrak{F}$.

[14]The some part of reasonable subjects does not trust this ability of their reason and are convinced, that for their eventological choice they need to do nothing except for as «to throw a coin», and it is vain.

7. Conclusion

When the reasonable subject makes a decision at coincidence of *sets of events-circumstances*, submitting to the E-distribution, at his disposal as the current result of his event-based experience is available the own *set of events-decisions* with the E-distribution which defines his eventological choice. The joint E-distribution of these *two sets of events* describes event-based behaviour of the reasonable subject — making the most valuable event-based decisions by him in various circumstances of his co-being.

The offered event-based sight at the decision-making, basing on the eventological H-theorem [6], a basis of the eventological theory of decision-making which unifies and expands opportunities of the classical theory, allowing to compare situations of making the most valuable event-based decisions by various reasonable subjects at various event-based circumstances *in eventological manner*.

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