Acta Psychologica Tyrnaviensia

21

25. výročie Katedry psychológie FF TU
na obnovenej Trnavskej univerzite (1992-2017)

TRNAVA 2017

ACTA PSYCHOLOGICA TYRNAVIENSIA 21

EDITOR
Doc. PhDr. Marián Špajdel, PhD.

VYDAVATEĽ A TLAČ
Spolok Slovákov v Poľsku
v spolupráci s Filozofickou fakultou
Trnavskej univerzity v Trnave

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ISBN 978-83-8111-026-6

The behavioral economic approach in consumer decision analysis

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Abstract · Analysis of the behavioral economy literature on information situations suggests that the behavioral economic approach could be a methodological inspiration for research and applied analysis on consumer decision-making and rational consumer policy making. The analysis in this paper assumes that there is a systemic relationship between economic behavior and consumer behavior in particular areas, such as consumer economic behavior and consumer policy making. This systemic relationship is an intentional, rational attitude towards decision making, which is the basis for human economic behavior. This paper aims to show which kind of conditions and requirements should be considered from the behavioral economy approach in order to qualify consumer and environmental policy as rational decision making.

Key words · economic behavior, information seeking, decision making, consumer choice, consumer policy, rationality of consumer behavior, rationality of consumer policy, sozo-psychology, eco-decision, eco-information.

The paper is divided into three parts, addressing the following issues: Firstly, the decision situations of the consumer and consumer policy maker in an environmental endeavor may be considered as an ordered triple, an ordered quadruple and an ordered 5-tuple. Secondly, the economic behavior of consumers acting in the market should be interpreted as rational, as consumers optimize their real consumer needs in the defined environment. This is even true when the consumer behavior is recognized to have cognitive bias. And, finally, an environmental issue arises if the utility function contains a satisfactory estimate of environmental impact (or not) in a consumer's choice or in consumer policy decision making; i.e., if the environmental impact is considered in terms of cost-benefit analysis, and if so, if this analysis is taken into consideration to minimize negative impact. In order to develop

the environmental issue the paper presents the concept of *sozopsychology* originally introduced by Biela in 1984. Examples of sozo-psychological research are summarized which have direct or intermediate connections with consumer choices and policy making decisions.

Analysis of the behavioral economy literature suggests that decision making and information seeking is the essence of social, economic, environmental and consumer behaviors. Moreover, it is quite obvious that there is a systemic relationship between economic behavior and consumer behavior in particular areas, such as social, economic, environmental and consumer policy making (Biela, 2012). This systemic relationship is an intentional, rational attitude towards decision making, which is the basis for human economic behavior in the above areas.

It follows that we can ask the following question: What kind of rationale forms the basis for the systemic linkage between consumer decision making (i.e. consumer behavior) in the domain of environmental protection and the decisions of policy makers in consumer and environmental endeavors, interpreted as economic behavior?

The above-formulated question states the theoretical assumption that environmental and consumer policy is a rational decision-making process if it is based on the behavioral economy approach of consumer decision analysis. This paper aims to show what kind of conditions and requirements should be considered from the behavioral economy approach in order to qualify consumer and environmental policy as rational decision making.

A second assumption of the author is that both policy makers and consumers try to be as rational as possible in their decision making in the domain of environmental protection. However, the three following issues concerning the behavioral approach in solving the optimization (i.e. rationality) problems of human decision making must be taken into consideration: 1. Human rationality in decision making is bounded; 2. Human decision makers operate in their decision analysis with a multidimensional utility scale specific to the individuals themselves, rather than with a one-dimensional scale, assumed in game theory axioms and in normative models; 3. Market participants as consumer decision makers rather use their own heuristics, biases and cognitive schemas in information seeking, which enables them to solve their optimization problems as rational actors.

This paper will be divided into the three following parts: 1. The decision making situation of the consumer as a market participant and the environmental and consumer policy maker; 2. Some research findings regarding information-seeking in a dynamic decision situation and their application to

research on consumer behavior; 3. Concluding remarks on the rationality of consumer choices.

1 The Decision-Situation of the Consumer as Market Participant, and of the Consumer Policy Maker in the Environmental Protection Endeavor

To begin, one of the main concepts of the behavioral economic approach is the *decision situation*. This concept – like the decision theory as such, arose as the result of the cooperation between three disciplines: economics, psychology and mathematical logic (and more precisely, set theory).[1]

Economists created the concept of a *decision situation* in an economic approach to human behavior, while psychologists, in turn, extended this concept, giving it a relational character, as an interaction between the subject, called the *decision maker,* and the current or hypothetical environment of the subject. In this part of our analysis we will have in mind two types of decision making. The first type is the decision situation of a consumer as a real participant in a market where he or she is a decision maker. The second type of decision situation takes place when a defined policy maker on a local, regional or global level addresses consumer policy from an environmental perspective.

Decision theory was primarily developed by economists cooperating with psychologists, both engaged in solving theoretical-conceptual problems as well as conducting applied research. A classic example would be the MIT psychology professor H.A. Simon, who specialized in the psychology of thinking, including his *General Problem Solver* (*GPS*), bounded rationality and artificial intelligence (Simon, 1969) and decision-making problems in economics and behavioral sciences (Simon, 1959). Among the authors who contributed to the development of decision theory were the American authors George A. Akerlof, A. Michael Spence and Joseph E. Stiglitz – who jointly received the Nobel Prize in 2001 for enriching market analysis with the elements of decision-making and information processing, and particularly with a behavioral analysis of market decision-making in the conditions of asymmetry of information available to market participants. A year later, in 2002, other American authors were awarded parallel prizes: Daniel Kahnemann – for integrating the results of psychological research on so-called cognitive abnormalities (cognitive biases) with economic analysis, and Vernon Smith – for introducing behavioral experiments on a larger scale as a tool

[1] The latter term has been the source of a well-ordered set, i.e. one where the order of the elements in the set is determined by definition and cannot be changed. The fixed sequence of elements of a well-structured set is a feature belonging to its nature, i.e. to the essence of the set in question.

for empirical analysis in economics. The next two Nobel prizes awarded in economics were: in 2005 – to Robert Auman and Thomas Schillong, for their contributions to game theory, and in 2007 to Leonid Hurwicz, Eric S. Maskin and Roger B. Myerson – for their contributions to theories of economic planning through tools derived from decision theory. These facts clearly indicate that decision theory, decision analysis and behavioral economics are the leading trends in the development of modern economic theories, methods of economic analysis and empirical research in the economic sciences.

We can also mention European advances that developed the concept of the decision situation. These include works on optimizing decisions (Lange 1971), the theory of a decision-making situation (Kłosiński 1983), the pragmatic concept of information (Szaniawski, 1974), the development of decision-making (Walesa, 1975), the concept of momentous decisions in life (Walesa 2005, 2011), the concept of a group decision (Chlewiński 1975), application of decision theory concepts to economic problems, environmental protection, new technologies, organization and management (Sjöberg, Tyszka, Wise, 1983; Vlek, Cvetkovich, 1989). One may now speak of the broad "entrance" of the decision-making trend in European research in the following areas: decision-making in managers (Gaugler 1962, 1993; Kirsch 1988; Mączyński 1996), multidimensional decision-making strategies and multi-criteria decision support (Łukasik-Goszczyńska 1974, Skulimowski 2009,), multidimensional data analysis (Adamus and Rzońca 2008), decision making and implications for career guidance (Ertelt and Ruppert 2011), creativity of managers (Szopiński 2004), goal-oriented behavior (Zaleski, 1991), the functioning of the labor market (Rożnowski 2009), border lines of risk taking (Makarowski 2008), international economic relations (Kłosiński 2006) and financial decisions (Jajuga 2004).

With such broad interdisciplinary collaboration the boundaries between the particular disciplines not only did not disappear, but the methodological awareness deepened the need for further cooperation in the broad area of research on human decisions in work situations, social systems, economics and political activity. How should the decision-making situation be understood in the context of the cooperation of psychologists and economists with logicians?

The decision situation is a mental state of the decision maker (e.g. consumer, supplier, consumer policy maker) in his or her particular motivational and environmental conditions. He or she often experiences behavioral difficulties on a macroeconomic scale (e.g. a policy maker may consider how to determine the structure of the state budget, how to shape the tax system in

the coming year, what relations to enter into with neighboring countries, or whether it is profitable to maintain relations with only one supplier of natural gas or rather to diversify the sources) or on a microeconomic scale (e.g. how to restructure the company in the current market situation, which consumer or target group market to focus on in a company's production profile, what kind of investment to make to improve company image in a consumer market), as well as on the level of an individual household (e.g. how to meet the housing needs of one's family, how to deal with commutes of the working family members, where to spend the family holidays, etc.).

1.1 The decision situation of the consumer and consumer policy maker in an environmental endeavor as an ordered triple

Let us continue our discussion about decision situations, where we propose adopting the approach of the logical theory of sets, which has the advantage that, apart from the actual content of decision, it enables generalization in a manner convenient for our purpose. In Polish logic and psychology literature on decision theory, a decision-making situation (*DS*) was originally defined as an ordered triple (Szaniawski, 1971; Kozielecki, 1981): $DS^{df} = \langle D, H, u_{ij} \rangle$, whose elements are: $D = \{d_1, ..., d_i, ..., d_n\}$ – a finite set of possible actions of the consumer or consumer policy maker as decision maker; $H = \{h_1, ..., h_j, ..., h_m\}$ – a finite set of possible environmental events that determine the outcome of the defined actions; – u_{ij} the real-valued function, called utility, determined with a Cartesian product defined as $D \times H$ (the *u* symbol should not be confused with *U,* which often designates the decision problem itself. *U* may be used interchangeably with the *DS,* since *DS*=*U*).

The decision problem *DS*=*U* is usually presented with a corresponding payoff matrix of $n \times m$ fields, where the rows can be the consumer options, the consumer policy maker's strategies, or alternative decision actions (1...*n*), and the columns are hypothetical states of the environment envisaged by the decision maker (1...*m*). The corresponding values of the utility function u_{ij}, defined with the Cartesian product of *DxH* are located on the intersections of the rows and columns, as shown in Table 1.1.

Table 1.1. Payoff matrix *U* of a decision situation *DS*, determining the usefulness of the various alternatives of the decision maker's actions (d_i) in a case when a certain hypothetical state of affairs occurs (h_j) where the decision maker is the consumer or consumer policy maker.

D \ H	h_1	h_2	...	h_j	...	h_m
d_1	u_{11}	u_{12}	...	u_{1j}	...	u_{1m}
d_2	u_{21}	u_{22}	...	u_{2j}	...	u_{2m}
...	...	...	...	...	...	...
d_i	u_{i1}	u_{i2}	...	u_{ij}	...	u_{im}
...	...	...	...	...	...	...
d_n	u_{n1}	u_{n2}	...	u_{nj}	...	u_{nm}

However, the above definition recognizes only formal elements of the consumer and consumer policy maker's decision situation. Therefore, one can pose the question: How does the constitution of the semantic content of the decision situation as an ordered triple take place $\langle D, H, u_{ij} \rangle$? In order to answer this question, we should indicate which variables determine the elements of this ordered triple, if we have in mind the real market environment and their participants.

The human decision situation is identified with the external determinants of the decision, i.e. with concrete environmental stimuli. If that be the case, in a macroeconomic environment these are global stimuli (e.g. the collapse of certain markets, an international banking crisis, etc.). However, such an understanding of the decision situation is not the most accurate, as it ignores the role of the subjective (i.e. not so-called objective but the internal) determinants of the decision situation.

Considering the decision situation of a real consumer or consumer policy maker, we always have in mind a person who co-creates his or her situation. In the case of economic decisions it is important to define who is the actual decision maker in a certain situation, i.e. in a macro- or microeconomic context, in a local, regional or global market. The decision maker is not always indicated clearly enough in each context, but it is almost always possible to define who is the subject (decision maker: consumer or consumer policy maker) of a certain market situation of the more or less precisely defined environmental impact.

The decision-making situation should, therefore, be understood as a function of two variables: 1) the set of the subject's determinants, which are the competencies and other dispositions of the decision maker, and 2) the set of external determinants of the economic situation. What are, then, these sets of determinants? The elements of the sets of subjective determinants may be interpreted as disposition systems available to the macro- or microeconomic decision-maker (talents, abilities or personality traits). They are structures that may be recognized by factor analysis or other statistical methods (e.g. Guilford, 1961, Cattell, 1957). The examples of such systems of available dispositions may be: the ability to reason convergently and divergently (on behavioral, numerical or semantic material), emotional and motivational dispositions, personality traits, etc.

This understanding of the determinants of subjective factors (i.e. the decision maker's disposition systems) may be interpreted in the sense of S. Leśniewski's (1930) system of logic, called mereology. Indicating the mereological nature of the set of the decision maker's dispositions seems to be closer to economic theory and practice than the distributional understanding of this set (i.e. stated according to classical set theory). Namely, the mereological understanding permits the interpretation of the set of the decision maker's available dispositions as a system with a structure which acts as an integrated whole while its individual elements have a relative functional autonomy.[2] The integrating function in this system seems to be played by certain groups of abilities, e.g. the so-called factor of general intelligence (Raven, 1995), the factors of social or emotional intelligence.

In Bayesian decision-making situations (Jeffrey, 1965), we should also distinguish the ability to determine the probability distribution on set *H*. The above dispositions of the decision maker must be understood as systems with a hierarchical structure, where each ability (e.g. perceptual ability, analytical thinking, etc.) is independent from the other ones, but is also subject to the integration function within the whole system. This function lies in the fact that the given entities of abilities, without losing their functions to manage specific systems, are also subordinated to higher groups of dispositions. For example, the abilities of perception, analytical thinking, etc., without losing their specificity, are also subject to the superior group of abilities responsible for establishing the set of possible actions or states of affairs, or for assessing

[2] Mereological interpretations of a set available to the decision maker sufficiently explain the holistic nature of the behavior of the decision maker in a situation of economic decisions, as opposed to the atomistic treatment of its structure.

the usefulness of action considering the possible states of affairs. Through the integrating activity of the brain, the superior groups of abilities are in turn subordinated to the central system of dispositions which is responsible for the decision maker's functioning (Biela 1976).

The concept of competence by J. Raven (1985,1995) is also valuable theoretically and useful in application in research on economic decision making. This author draws attention to the need to integrate the decision maker's competencies and behavioral economic analysis, understanding competencies to be an combination of intelligence and related cognitive processes with the emotional-motivational attitude and values accepted by the decision maker.

In order to direct our interpretation of the decision maker's factors, the external determinants of the decision situation in question should be understood according to $DS^{df} = \langle D, H, u_{ij} \rangle$ as a set of environmental stimuli on the given decision situation that allow the decision maker to: 1) define the set D of possible actions which could be of some environmental impact – such as what kinds of consumer goods to buy, what social and economic consumer policies to accept; 2) establish the set H of possible states of affairs that determine the results of environmental actions – e.g. predictable conditions on the global, national, regional or local market; 3) evaluate the usefulness of consumer actions due to the hypothetical states of environment - $u\ (d_i, h_j)$ - for example, what may be gained or lost by a business taking certain actions when certain events occur at the concrete environmental conditions.

The set of environmental stimuli of the given decision situation, which constitutes the field of economic activities, may generally be interpreted as a mereological one (i.e. where each part of a given element is also an element of the set), as each part of a stimulus possible to be distinguished, available to environmental perception, e.g. visual perception, auditory perception, olfactory and flavor perception (i.e. chemoreception of the environment) is also an element of the given set of stimuli, as it is also available to perception at the level of the whole set.[3] An example here may be natural resources (oil, natural gas, coal, marble, gold, sand, drinking water), where each part of the set of the given resource is also an element of this set. It should be underlined here, however, that natural resources processed through investment and work generally become designates of names of manufactured goods no longer belonging to mereological sets, but rather to collective ones (e.g. chair, car, hair

[3] The concept of *mereological* set is understood in terms of K. Leśniewski's conception of mereology (Leśniewski, 1930).

dryer), because no part of such goods is by itself an element of the set of the given type of goods (e.g. car wheels are not yet obviously a car).

As we can see from the analyses conducted, the elements of the ordered triple $\langle D, H, u_{ij} \rangle$ are a function of a specific set of abilities of the decision maker and a strictly defined set of environmental stimuli elements, which are in a specific interaction with the decision maker as the subject of the decision situation when he or she is the consumer acting in the consumer market or as consumer policy maker designing the structure of the local or global market. Therefore, the formation of the consumer decision situation or the consumer policy making situation should be understood as the formation of elements of this triple in the decision maker's mind as a cognitive representation of this situation. Following J. Dewey's (1997, first ed. 1910) classic conception of problem-solving phases in decision analysis, the primary phase initiating the decision situation would here be the state defined by an individual as the "sensation of difficulty;" the second phase is identifying the decision problem. The course of this phase of identifying the problem depends on the specific group of abilities called "sensitivity to problems" (Guilford,1961). A condition for the primary phase to take place is a set of environmental stimuli whose perception: 1) justifies stating the decision problem of the consumer or consumer policy maker, and 2) enables noticing this problem. This phase initializes the mental and behavioral reality of the decision situation. A more detailed description of these subsequent stages constituting the decision situation are found in Biela (2012).

1.2 The decision situation of consumer and consumer policy maker in environmental endeavor as an ordered quadruple and an ordered 5-tuple

Decision-making literature distinguishes various types of decision situations regarding the characteristics of the given sets D and H. According to Jeffrey (1965), if the conditions of the decision situation permit the decision maker to determine the probability distribution on the set of H and the utility function u_{ij} defined on the Cartesian product of $D \times H$, then the situation may be labeled Bayesian, and the decision problem formulated in this situation is also called Bayesian. Thus, the decision situation in these conditions may be described as an ordered quadruple $<D, H, \{p(h_j)\}, u_{ij}>$, where D, H and u_{ij} denote the same as in the case of an ordered triple, and $\{p(h_j)\}$ is the probability distribution determined by the decision maker on the set of hypothetical

states of the environment h_j, belonging to set H (where j ranges from 1 to m from the set H). Therefore, the balance of gains and losses predicted by the decision maker concerning the choice of a given alternative action as the consumer or as the consumer policy maker depends on the defined probability distribution.

Under the environmental conditions of a Bayesian decision situation, the decision maker can define an objective probability distribution of the set H in the case when there are objective statistics or there exist logical or content-related reasons which undoubtedly enable the determination of such a distribution. In the case of macroeconomic consumer policy making, for example, there may be, data generally available from a consumer market statistical yearbook. From such sources an average consumer can also seek information regarding his or her choice of consumer goods. For an insurance company deciding on the price of the premiums for vehicle owners, statistical data is collected by institutions on road accidents, taking into account the drivers' age, marital status, etc. This data helps to differentiate the premiums according to the risk categories of the insurance holders.

If it is impossible for the decision maker to determine an objective probability distribution on the set of hypothetical states of the world in an economic decision situation, like consumer choice or consumer policy making, this distribution may be determined by an expert (or experts) familiar with the analyzed decision-making situation from their professional or personal experience. These experts may be people who have participated in or observed decision situations (like various kinds of consumer markets: car markets, food markets, real estate markets, etc.), analogical to the current one. There are special situations when the decision maker him/herself may be regarded as an expert, qualified to assess the probability of hypothetical events as a consequence of the decision, if he or she has already made similar decisions before, participated in their making, or was their observer. In the case of an assessment of the probability of events by an expert or experts, the probability distribution on the set H determined in this way will be referred to as *subjective probability.* In order to distinguish the objective probability from the subjective probability, the latter is called φ (*psi*) in contrast to p.

However, there are also decision-making situations when each expert of an expert team independently estimates the probability of the environmental events. Thus a methodological question arises: how to integrate the individual expert estimations? There is a methodological suggestion in such case, to determine the weighted sum by weighing the probability of each individual assessment of an expert by the level of competence attributed to the

expert – which may be represented as: $\varphi h_j = \sum_{e=1}^{l} p\left(h_j\right)_e \; w_e$, where e is any individual expert (numerical values attributed from 1 to l), while w_e is the weight of the given expert's competence in assessing the probability distribution of hypothetical states of the world belonging to the set H in the decision situation DS. The weight of an expert's competence may be determined by evaluating his or her competence on an interval rating scale or by the method of multidimensional scaling (Biela 2001).

A necessary primary stage of any decision analysis is the definition of the utility payoff matrix U by the decision maker (consumer, consumer policy maker), which gives him or her the basis for formulating the decision making problem (e.g. what commodity to buy among the ones offered on the market, what consumer policy making strategy to apply in the concrete environmental condition). However, solving the decision making problem requires taking the defined criterion for optimizing (i.e. rationalizing) the decision-making (i.e. the procedure or principle of making the decision). Szaniawski (1971) states that, when the decision problem is formulated, the decision-making criterion enables the determination of the subset D' of optimal actions, i.e. the best action or actions in terms of this criterion.

In Bayesian type decision situations where the utility function has been established and the probability distribution on the set of hypothetical states of affairs $\{p(h)\}$ is known, a decision maker is able to modify the original distribution, called an *a priori distribution*, with additional information. Thus, the modified distributions of probability are called *a posteriori distributions*, thanks to the addition of new information.

The decision-making situations where the decision maker (e.g. the consumer as a decision maker or consumer policy maker) is able to modify the probability distribution on the set of environmental states are called *dynamic decision situations* (*DDS*) by Edwards (1971) and Kozielecki (1981). Such situations permit the search for new information to reduce the uncertainty of the decision (Edwards and Slovic 1965).

In formal language, the dynamic decision situation may be defined as an ordered 5-tuple in the following way: $DDS^{df} = \langle D, H, \{p(h_j)\}, u_{ij}, I \rangle$. Thus, from the formal perspective, a condition necessary to constitute a dynamic decision situation from the ordered quadruple is the addition of the finite set $I = \{i_1, ..., i_r\}$, which elements are activities involving the attainment of new information. Therefore, based on this information, the consumer or consumer policy maker in a dynamic decision situation may modify the set of alternative actions, the set of hypothetical states of environment, the probability

distribution of the states of environment, or the utility matrix. Thus, let us assume the following convention: the primary utility function and the probability distribution $\{p\ (h_j)\}$ is defined as *a priori,* and after modification, influenced by new information – as *a posteriori.* We define as *informational activity* every activity of the decision maker seeking information to modify any of the elements of the definitional set in a dynamic decision situation, as an ordered 5-tuple.

The relationships when consumer or consumer policy maker is searching for information in a decision making situation as an ordered 5-tuple may be schematically presented as seen in Figure 1.

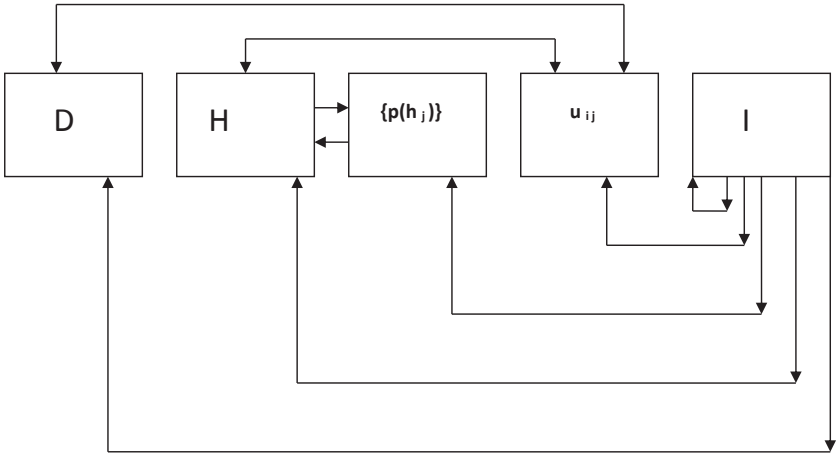

Figure 1. Scheme of relations present when consumer or consumer policy maker seeks information in a dynamic decision situation.

From the illustration presented in Figure 1 one can learn that new information in a dynamic decision situation may refer to any item of the definitional ordered five. However, the decision maker (or a team of consultants, analysts or an IT system) must integrate this information in a way that allows for the eventual modification of the utility functions u_{ij}, hence, the modification of the structure of the payoff matrix *U,* which requires the modification of the calculation of the Cartesian product *D* x *H*. This illustration also suggests that the relationship during information seeking in this situation may be a reflexive one, i.e. the decision maker may obtain new information on the

information system itself (e.g. its accuracy and reliability, the relevance of new sources of information, the availability of information processing, etc.).

It has to be mentioned that in some decision situations, a necessary initial stage is that the decision maker makes cognitive efforts to "discover" elements of a communication model existing in reality. It requires the identification of a specific system of code, i.e. the relationship between the signals and the corresponding states of environment (states of the source).[4] However, the communication model: source-signal – decision-maker does not exist de facto in all situations. Thus, in such situations, the decision maker aims to "construct" a communication model that would allow him or her to obtain information.[5] However, in certain cases, "constructing" a communication model with an information source allowing the decision maker to continually update information about the situation of decision-making is more complex than the decision problem itself.

2 Limited rationality and the cognitive fallacies (biases) in decision making situations

In this part of our analysis we will present some results from the selected research findings concerning the information process in dynamic decision situations. First, we will introduce the concept of *limited rationality,* and then cognitive fallacies (biases) as applied in decision making situations of consumers and consumer policy makers in a real market environment.

The conception of limited or bounded rationality was empirically grounded in cognitive psychology and in behavioral economics by H. A. Simon (1959). The model of bounded rationality, which uses so-called normative models (also known as ideal models) in experimental studies on the search for information, has resulted in several studies on how real decision makers actually get to know the reality of economic decisions.

The most frequently described and best known phenomenon among researchers is the *cognitive conservatism,* observed in situations with a source of probabilistic information, where decision makers underestimate the

[4] 'Discovering' a code system is, among others, the exploration of the reality of the regularities of macroeconomics and microeconomics. For example, a market analyst "discovers" code when understanding the relationship between the size of advertising costs for a product and the effects of the sale of this product on the market.

[5] For example, a market analyst who uses the test apparatus in the form of empirical tools (questionnaires, surveys) and tools of statistical inference "constructs" the communication system with the tested reality (Biela, 1976).

obtained information as compared with the normative Bayesian model at the first phase of information seeking. This kind of cognitive conservatism is observed when the decision maker underestimates the value of the following *a posteriori probability* of the hypothesis with relation to that provided for by the normative Bayesian model.

However, there also exists a broader understanding of cognitive conservatism, considered as a general underestimation of objective probability. That means, this concept may also refer to a situation where the participants do not receive signals successively, but estimate the probability events only once.[6]

Cognitive psychology literature also indicates the phenomenon of cognitive radicalism, which is the opposite of conservatism in certain cases of the search for probabilistic information. The decision maker is cognitively radical in terms of assessing the probability if this assessment is higher than that predicted by the Bayesian model. Kozielecki (1981) states that the phenomenon of radicalism is more typical for situations where the determination of objective probability is almost impossible. However, Biela (1976) indicated that both conservatism and radicalism may become cognitive biases within the same situation of the sequential search for probabilistic information: at the beginning, cognitive conservatism prevails, while in the final phase of searching for information decision-makers behave more radically.

One of the most frequent cognitive biases is known as a *conjunction fallacy* and a *disjunction fallacy*. In many information seeking situations there are often two (or more) random events in a conjunctive or disjunctive (alternative) relationship that allow the observer to recognize the symptoms of the hypothetical state of environment. The rules of probability theory allow for the prediction that the probability of the conjunction of two independent events is a product of the probabilities of both of these events. In turn, the probability of a regular disjunction (also called an alternative), according to the normative model of probability theory, equals the sum of the probabilities of the single events which state this disjunction.

How do decision makers behave assessing the conjunction and disjunction of events? Tversky and Kahneman (1982, 1983) indicate that the percentage of assessments of the likelihood of the conjunction violates the normative rule of conjunction in 73% to 100% cases. Such behavior is called

[6] The phenomenon of conservatism in such cases is discussed by Bujak (1972), Kietliński (1972), and Strojna (1974) who stated that the result of assessing the likelihood of events (and hence, the degree of conservatism) in static decision-making situations depends on whether the decision maker has an impact on the outcome of an event or not.

a *conjunction fallacy.* Biela (1986) shows in his experiments that slightly fewer decision makers (66%) violated the probabilistic rule of conjunction. However, in his experiments the predominant way of assessing the conjunction of events was not a fallacy, where the probability of the conjunction is rated higher than the probability of one of its components. Biela identified a more specific behavioral pattern related to the assessment of the likelihood of conjunctive events by the decision makers. The dominant deviation from the normative model was that the decision makers assigned the probability of the less likely compound of the conjunction to the conjunction event as a whole. So, adding the other compound of the conjunction was virtually ignored when assessing the likelihood of the whole conjunction itself (*non-conjunction effect*).

A similar fallacy was observed in the assessment of the likelihood of the regular disjunction (also called alternative) of two elementary events, where only 12.2% of decision-makers proved to be consistent with the probabilistic theory normative model. Very often (61.5%), decision makers in this case used the rule of ignoring in assessing the likelihood of the disjunction compounds, and the assessment of the probability of the disjunction itself was recognized as the probability of its less likely compound (*non-disjunction effect,* see: Biela 1986).

A *conjunction fallacy* and a *disjunction fallacy* are known as the most frequent cognitive biases in cognitive and behavioral literature. In many market situations consumers often seek two (or more) features of consumer goods which *could* exist separately (i.e. independently of one other) but the consumer's intention is to find them in a conjunctive or disjunctive (alternative) relationship in one market good. In that context an open question arises: How do far the rules of probability theory allow the consumer to predict that the probability of the conjunction of the two independent features of the concrete market goods is a product of the probabilities of both of these features of market goods preferred by the consumer of this market? In turn: How far does the probability of a regular disjunction of the two independent features (also called an alternative features), according to the normative model of probability theory, equal the sum of the probabilities of the single features which state this disjunction – describe the behavior of the real consumer at market?

Keeping in mind the findings of cognitive and behavioral literature one can ask the question: How do consumers as the decision makers behave assessing the conjunction and disjunction of market goods features? Moreover, one can ask whether and in what shape the conjunction fallacy and disjunction fallacy exists in consumer behavior. Similar research could be designed

on consumer behavior taking into consideration the other cognitive biases presented in our paper like: *effects of leveling inconsistencies* or *contradictions,* the *diversification effect, the tendency to overestimate new information* (*information overweight bias*) and the *overrepresentation fallacy.* All of them can be named as the tendency to confirm the knowledge resources possessed and other behavioral trends.

Research designs on the cognitive and behavioral tendencies in information seeking of consumers can consider the impact of the following independent variables on human behavior: (1) the *a priori* probability of the considered hypotheses, (2) the conditional probability of events, (3) the probability distribution of the signals in a sequence, (4) the way of expressing probability of the events, (5) the structure of the payoff matrix, (6) group factors, (7) sex, (8) such individual differences among the decision-makers like: personality factors, cognitive and decision making styles, (9) cultural factors, (10) kinds of markets.

3 Concluding remarks

To conclude the section of our analysis on consumer information seeking in decision situations, we should underline that their behavior in the real market tends to be rational. A need for rationality motivates them to seek new information in order to be up-to-date regarding market changes. However, this rationality does not fit the prescriptions for normative models for many reasons. The first reason is that consumers are human beings who are limited in their cognitive capacities; that is why their rationality can be called bounded. Another reason is that consumers usually apply a multidimensional scale in decision making while the normative models very often assume a one-dimensional assessment. Therefore, the economic behavior of consumers acting in the market should be interpreted as rational if their decisions optimize their real consumer needs in the defined environment. This is even true when the consumers behavior is recognized as cognitive bias. Consumers want to be rational decision makers and they more or less intuitively conduct their decision analysis before buying goods. They are also aware of advertisement noise which limits their degree of freedom in rational decisions, and try to diminish its impact.

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