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# Behavioural economics: essence and stages formation

## ABSTRACT

At the turn of the millennia, a conceptually new economic theory, behavioral economics, appeared and was significantly entrenched in subsequent years. Like everything new, it caused some suspicion and opposition of the scientific economic community. This article aims to somehow reduce the detrimental effects of aforementioned trends. It examines the origins, the main actors and the long history of formation of behavioral economics. At the same time, the essence of its main provisions is revealed, their transformation over time and prospects of practical application are analyzed.

**KEY WORDS** game, risk, the subjective value of wealth, value function, rejection rate of losses, architecture of choice.

## INTRODUCTION

Almost 20 years ago, a conceptually new economic theory emerged, behavioural economics. Since then, successes in this field of economic science have been awarded to two Nobel Prizes - D. Kahneman in 2002 and R. Thaler in 2017. Behavioural economics has significantly squeezed and, in the future, may replace the currently dominant neoclassical concept of economic theory. Most of the profile publications have so far been translated from English, many national economists perceive the behavioural economics as an exotic hobby and do not hurry up to expand the subject field of economic science by introducing the relevant specialty (or field of study) in the list of scientific economic specialties and to the curriculums of modern economists and manager training.

This article reflects the main milestones in the development of this new direction of economic science, essence of fundamental provisions in order to encourage scientific economic community to popularize the behavioural economy and applied research in this subject area is revealed

## ORIGINS

Basis of behavioral economy is the direction of psychology, which studies the relationship between soul and matter. Key challenge is to find the answer to the question of how the change in physical quantities in the external world influences their perception by the subject [Arieli D., 2010; Kahneman D., 2016; Thaler R., Sunstein K., 2018]. Initially the task was set as follows: there are measurable physical quantities (luminous intensity, sound frequency, amount of money) which are subjectively perceived by a person (brightness, pitch, value), it is necessary to find psychophysical laws linking subjective sensations in the brain of an observer with objective values of the quantities in the material world. From the point of view of system science [Garaedagi J. 2011.; Drogobytskiy I. N., 2017] it is a trivial task to transfer the values of the studied physical quantity expressed in units in accordance with one scale and in values in accordance with the other.

Investigating a similar question in relation to the value of money from the point of view of psychology, the Swiss scientist D. Bernoulli, in 1738, came to the conclusion that the value (utility) of money is a logarithmic function of their quantity (wealth). Guided by this principle, Bernoulli argued

that is preferable to measure the overall outcome of the game as an average one of the subjective value of the outcome, accessed by their realization frequency, whereas his contemporaries continued to calculate the average weighted results of the game in money equivalent. He offered a logarithmic scale (see table), according to which it is necessary to determine the psychological value of each outcome of the game, and then summarize these estimates, correcting them for the probability of a particular outcome. So, choosing between the options "equal chances to get 1 million or 7 million» (value: (10 +84)/2 = 47), and «… get guaranteed 4 million» (value 60), a normal player would prefer guaranteed money.

That would be the case for the overwhelming majority of people. A normal average person does not like to take risks, because there is a chance of getting the worst possible outcome. In the context of a reduction in the marginal value of wealth, as in our case (see the table), the person making decision will avoid risk. If there is a choice between game and guaranteed amount equal to the expected value of the game, he/she will prefer a guaranteed amount. Moreover, a person who is not risk-averse will do the same even if the guaranteed amount is certainly below the expected value of the game.

Bernoulli's offered psychophysical approach to how decisions are made under risk conditions has made it possible to find weighty arguments for the economic justification of a number of obvious but difficult to interpret phenomena, things and deeds. In particular, using the value function of wealth, it is easy to explain why poor people buy insurance and why the rich sell it to the poor. The loss of one million equals only 4 points of value for a person with 10 million, and is 18 points (48-30) for a holder of 3 million. Therefore, a relatively poor person willingly pays for insurance, and then the risk will be transferred to a wealthier economic agent [Bertrand, 2006]. Such a harmonious combination of interests of both parties is a good basis for the development of insurance business.

## FORMATION

At the end of the twentieth century, Bernoulli's theory of the subjective value of wealth was further developed [Kahneman, D., 2016; Tversky A., Kahneman D., 1991]. As studies of choice in a risk situation have shown, the value of wealth depends not only on the current state, but also on the history of its achievement (formation), which for some reason Bernoulli did not notice. For example, one economic agent has a wealth of 1 million and the other has got 4 million. If you offer them a choice of "equal chances to have as a result 1 million or 4 million" or the guaranteed amount of 2 million, then, from the standpoint of the theory of subjective value, they face the same choice: if they decide to play, the expected wealth will be 2,5 million ((1 + 4)/2), if they choose a guaranteed amount, it will be 2 million. According to Bernoulli's theory, agents have to make the same choice, but such prediction is incorrect. Theory does not work, because it does not take into account different reference points for different agents when evaluating options. The first agent argues as follows: «If I choose the guaranteed money, then my capital will double; but I can play, and if I'm lucky, I'll get four times more, and if not, I'll stay with what I have». The second agent thinks otherwise: «If I choose the guaranteed amount, I will lose a half of the capital, which is very bad. If I try my luck and play the offered game, then, if I succeed, I will not lose anything, and in case of failure, there is nothing for it, I will lose three quarters of my capital". So, the first agent thinks about winning, and the second thinks about the loss. Psychological outcomes, which they consider, are completely different, although the possible sizes of wealth are the same. Since Bernoulli's theory lacks the notion of a reference point, it does not reflect the obvious fact, the outcome, which is favorable for the first agent, turns out to be bad for the second. Theory can explain why risk for the first agent is unacceptable, but does not explain why the second agrees on the risk and prefers the game. It turns out that it is only necessary to shift the focus, as a recognized non-acceptance of risk gives way to a desire for risk. Guaranteed loss causes rejection and causes the agent to take risks.

Assuming that both agents chose the game and were successful: they acquired the same wealth (4 million each) at the current time, then, according to Bernoulli's theory, they should have the same satisfaction. But remember that the day before the first had 1 million, and the second had 4 million, then it's easy to guess that the first is exulting today, and the second is, at best, unperturbed. Subjective perception of value by agents [Stevens S., 1961] is determined by recent changes in their wealth relatively to different reference points (1 million for the first and 4 million for the second). If we use the table data, the jubilation of the first agent is determined by 50 points of positive emotions (60-10), and the equanimity of the second preservation of the status quo, unless, of course, he is not upset because of the success of the first agent.

Study of opposing views on risk taking into account favorable and unfavorable prospects allowed Kahneman and Tversky to make a significant step in understanding the nature of human choice. It turns out that a reasonable person (Homo sapiens) just likes to win and does not like to lose, and the reluctance to lose is stronger than the desire to win. The roots of this asymmetry between the strength of positive and negative expectations should be sought in human evolution: an organism that reacts to a threat more than a pleasant prospect, has more chances of survival and reproduction of offspring.

In the final analysis, Kahneman and Tversky succeeded in substantially developing the theory of the subjective value of Daniel Bernoulli, introducing a starting point in it, regarding which the outcomes of the game are judged. Thus, they introduced a temporary dimension to the initial formulation of the problem, ensuring the coverage of the immediate past and the immediate future. As a result, it allowed to significantly expand the scope of practical application of the theory of subjective value and to start a new direction in economic science, behavioural economics. Final result of this integration

Value of wealth by Bernoulli

| wealth, million units | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Value | 10 | 30 | 48 | 60 | 70 | 78 | 84 | 90 | 96 | 100 |

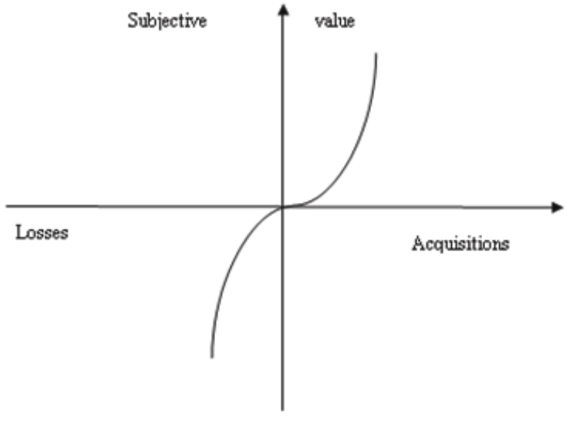
development was called "theory of prospects." For it in 2002, the Nobel Committee awarded the Nobel Prize in economics to D. Kahneman (by then A. Tversky passed away).

Theory of prospects rests on three principles:

- fixation of reference point: outcomes of the game are evaluated relative to the neutral starting point, which as a rule is fixed status quo (results, which are above the referenced position, are interpreted as the wins, and the ones below – as the fails;
- reducing the sensitivity of the model: with the growth of wealth, its marginal value and sensitivity to the subjective perception of the difference between neighboring values on the scale of wealth decreases;
- rejection of losses: there is a natural asymmetry between the subjective perception of acquisitions and losses, losses always seem larger than acquisitions.

Fig. 1 shows the hypothetical function of subjective value of Kahneman - Tversky, which reflects the content of theory of prospects and is a reference model, how to determine the psychological value of acquisitions and losses of economic agents in the process of their life. Reference point is at the intersection of coordinates. To the left of it, losses are fixed, and to the right, acquisitions are fixed. Logarithmic curves show a decrease in sensitivity to subjective perception of both acquisitions and losses. Different inclination relative to y-axis (subjective value) reflects the asymmetry of perception of acquisitions and losses. Suppose that in the mailbox you found a notice of a fee of 10,000 RUB for the published scientific article and utility bill for 8000 RUB. Most likely, you will attach a much greater importance to the need to spend 8,000 rubles than the income of 10,000 rubles, since, according to Kahneman-Tversky value function (Fig. 2a), the subjective value of income V (10,000) is much less than the value of the expense V (- 8000). Being evaluated as a whole, marked by events clearly improves your property, but the value of the sum of individual events gives a negative result, which leads to a sense of disappointment.

**Fig. 1. Kahneman - Tversky value function**




## PRACTICAL APPLICATION

In everyday life, Kahneman-Tversky value function explains not only the stereotypical behavior of people, but also many other typical preferences that contradict the rational logic of choice. If you bought a pair of fashion shoes for 50 000 rubles and suddenly found that they are tight and uncomfortable to you, most likely, you will continue to wear shoes so that your investment in your image was not lost. The fact is that the purchase of shoes is associated with costs. If you stop wearing them, you will have to recognize these costs as irreversible losses, more preferable to walking with a certain discomfort (Fig. 2b). In other words, a person is not ready to ignore the sunk costs, return to the state preceding the purchase of V (0), and put on old shoes.

In similar situations, most often the decision-makers (DM) participate: investor, which accesses the prospects of new company; barrister, which thinks of filing a lawsuit against the Company breaking the contractual conditions;

Politician, who takes the decision if to join political rally or not and so on, to some extent, each of them deals with the probability of victory or defeat. Degree of rejection of losses for each DM is different [Novemsky N., Kaneman D., 2005; Sokol-Hessner P. Hsu M., Curley N. G. et al., 2009]. Experimental estimates show that the loss rejection ratio (ratio of the winning amount to the fixed loss amount, reflecting the balance of the player's subjective sensations) fluctuates in the range [1,5: 2,5]. For example, for traders professionally working in financial markets, the value of the loss aversion coefficient shifts to the left margin of the range [List J., 2003], while for a doctor's council deciding whether to perform a unique operation, the coefficient can reach a maximum value.

Judgments, preferences, and, consequently, decisions of real people essentially depend on the context, that is, the specific way of formulating the problem. In the experiment, doctors were asked to choose one of two possible strategies, surgical intervention or radiation therapy, for the treatment of patients suffering from cancer. Compulsion to choose a treatment strategy was carried out through two different contexts, formulation of survival and formulation of mortality.

Formulation of survival. In surgical intervention 90 of every 100 operated patients will survive, including 68 people will be alive one year after the operation, and 34 people will be alive five years after the operation. A year after radiotherapy, all 100 patients who underwent irradiation will remain alive after a year, and 22 after five years of treatment. Only 18% of subjects expressed their opinion for radiation treatment.

Formulation of mortality. During the surgical operation and during the postoperative period, 10 out of 100 patients will die, another 32 die within a year, and 66 during the next five years. During the treatment of radiation therapy, none of the 100 patients who underwent irradiation course will die, within a year after treatment 23 patients die, and within five years - 78 patients. Number of supporters of radiation therapy has increased to 44%.

From the formal point of view, both formulations are absolutely identical. This phenomenon is called the design effect. If formulation of survival was offered, doctors considered the salvation of life as a gain (acquisition) and therefore they were not for the risk: surgery was chosen between surgery and radiotherapy (Fig. 3a). In the case of the formulation of mortality, the same doctors considered the loss of life as a loss and chose more risky radiation therapy (Fig. 3b).

Organization of the context in which a person makes a decision, Richard Thaler called the architecture of choice, and the person who forms such a context is the architect of choice [Thaler R., Sunsteik K., 2018]. In modern conditions, many real decisions of people concentrate around alternatives that the architect of choice has foreseen at the stage of forming a set of acceptable alternatives [Drohobytskiy I. N., 2016]. It turns out that the architects of choice are empowered to influence people's behavior so that they lead a healthier lifestyle, improve their financial situation or provide themselves comfortable living conditions. Stated terms of reference are completely within the jurisdiction of modern management, and therefore, the formation of a favorable structure of choice should be considered as a new function.

Authorities of administration of all economic agents or unions resort to it: heads of families, management of enterprises and organizations, administration of municipalities and regions, government of the countries, when it is possible to push people towards a choice that will improve their life. At the same time, the choice is not limited, not imposed, and people have the right to make mistakes. If someone wants to smoke, drink alcohol, lose money and not think about the future, architects of choice are not going to either persuade him or complicate his life. Thus, the formation of structure of choice is rather weak, soft, unobtrusive, nothing prohibiting or making a noticeable change in economic habits, the function of organizational management, which, nevertheless, predictably affects the behavior of people.

For example, in good school cafeterias, they substantially increase the consumption of healthy food by using the layout of dishes on the self-service shelves (within the approved menu and the acceptable range of confectionery): at the beginning of the shelves, fruit and vegetable salads are delivered, at the eye level there are cereals, stewed vegetables and other useful second dishes with boiled fish or natural meat, traditional first dishes (borscht, soups, broths) are bottled in immediate availability and in attractive serving plates and the desserts are at the end of the shelves.

Talking about high-tech, it's worth noting the very convenient organization of the user environment by the architects of iPad and iPhone: each of their functions has a lot of options, and the user can choose the most suitable one (ringtone, time of forwarding to voice mail, etc.), but few use these options and change the standard settings set by the manufacturer. There is a successful experience in the formation of a selection architecture at the level of administrations and governments: the most effective way to encourage negligent taxpayers to pay taxes in Minnesota was information that 90% of the state's residents had already paid all taxes. To combat game addiction in many US states, self-prohibition is introduced (people voluntarily put themselves on the "black list") to visit casinos and other gaming establishments; in order not to carry out the dubious orders of the higher-ranking authorities, in our country they are successfully postponed in the long box.

As studies at the junction of psychology and economics have shown, the fundamental concepts of statistics (distribution of a random variable, mathematical expectation, variance, etc.) are not among the intuitively used tools for judgments. In the neoclassical economic theory Homo economicus is described as a being not only rational, but hyper-reflexive: not only that it is endowed with ordered preferences, phenomenal memory, ability to calculate the probabilities of the occurrence of various events and to compare them with the implementation of a choice, it is still organically incapable of acting by instinct, making mistakes, estimating the most desirable of the available options, and making logically contradictory judgments. However, the description given does

**Рис. 2. Применение функции ценности Канемана – Тверски**
**а – оценка событий; б – необратимые потери**

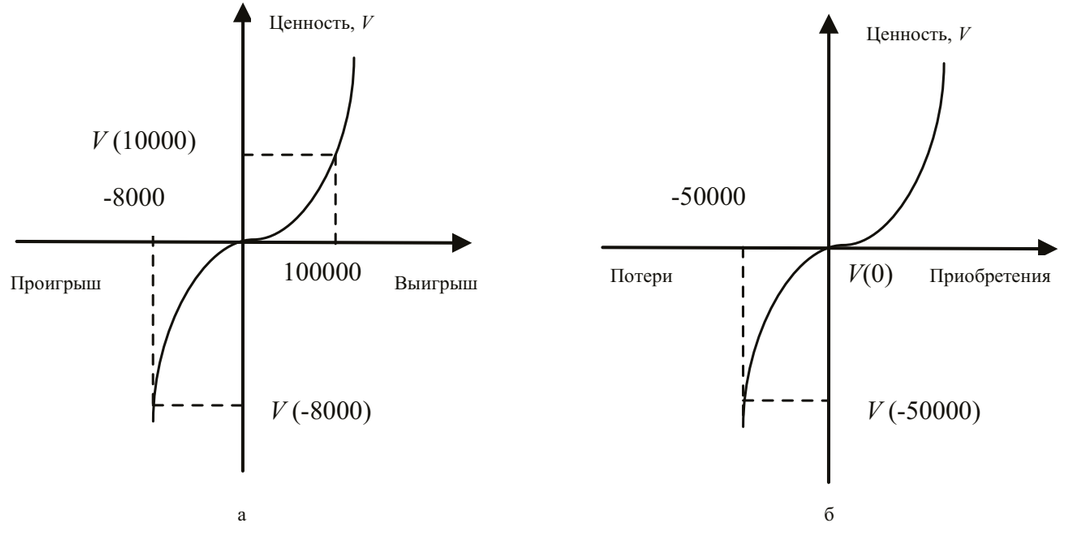
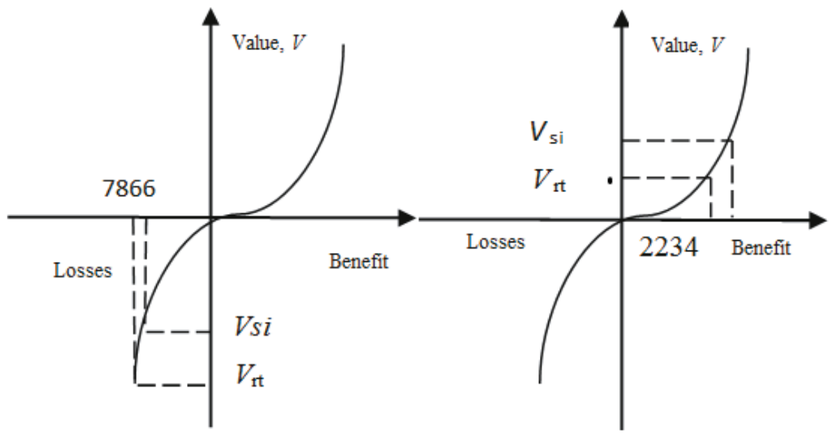


**Fig. 3. Effect of registration:**
**a – formulation of survival; b – formulation of mortality;**
**$V_{si}$ – value (psychological) of surgical intervention; $V_{rt}$ – value of radiation therapy**




a b

not correspond to reality. The noted virtues are not typical for the majority of living people who are inclined to systematically make decisions, guided not by rational, but by intuitive considerations, which are called heuristics. Architects of choice, designed to create a convenient environment for each heuristic procedure, can significantly improve the quality of people's lives. For great successes in this field, the American scientist R. Thaler was awarded the Nobel Prize in 2017 in the field of economics. With the advent of his applied works, the behavioral economics finally acquired quite concrete outlines.

## CONCLUSION

Становление поведенческой экономики растянулось на целых три столетия. Ее основные теоретические положения, сформулированные Даниэлем Бернулли, долгое время лежали «мертвым грузом» в закромах знаниевой кладовой человеческого сообщества. В конце XX века они получили серьезное развитие в работах Амоса Тверски и Даниэля Канемана, а с началом XXI века благодаря усилиям Ричарда Талера и его коллег нашли широкое практическое применение. Наметившиеся прикладные направления развития поведенческой экономики очень перспективны, а получаемые результаты позволяют надеяться на успешное решение многих злободневных задач человечества. Отмеченные моменты являются вескими основаниями для того, чтобы учредить специализированные кафедры поведенческой экономики в национальных учебных заведениях и открыть соответствующую научную специальность в рамках существующей системы экономических наук.

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