

# *Influence of behavioral factors on decision making by individuals and nudge concept: theoretical and experimental analysis*

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**Abstract** – The subject of the scientific research is a set of economic relations arising from the implementation of rational behavior of citizens. In the framework of the scientific work, a research of behavioral factors of economics and public policy is suggested. Based on an extensive list of references, the authors have developed and proposed nudge methods in the areas of taxation, public health, environmental protection, and education. In recent years, the ideas of behavioral economics have increasingly been used to preserve and improve social welfare. Economic models of individual decisions will help to understand how and why the behavior of most people deviates from the traditional economic model of rationality. This interpretation can lead to a more effective state policy, predicting what influences individual decision making. When the state uses effective levers of control, it is possible to influence the decisions of individuals without limiting their choice. The relevance and controversial character of theoretical foundations of behavioral factors for decision-making by individuals, high practical significance of the nudge concept in the modern economic system predetermined the goal and objectives, specifying the choice of the object of research.

The purpose of the research: an experimental analysis of behavioral factors of students' progress in order to improve subsequently the position of Russian universities in the rankings.

The methodological basis of the research includes the methods of systemic and structural, functional, factor and comparative analysis with the construction of analytical models based on the synthesis of modern scientific methods of inquiry of economic and social phenomena. The methodological tools of research are graphic, analytical, statistical, economic and mathematical methods of information processing.

**Keywords** – *experimental economics, the nudge concept, decision-making, behavioral economics.*

## I. INTRODUCTION

The program of behavioral economics emerged in the 1970s as an independent subdiscipline, arising at the intersection of economics and psychology [11]. The ideas of

behavioral economics turned out extremely attractive to politicians in many countries in various parts of the ideological spectrum. Barack Obama used them extensively in his election campaign and often referred to them during his presidency. British Prime Minister David Cameron was also very interested in the ideas of a new behavioral science. He created behavioral teams, special units for developing behavioral strategies, and nominated a candidacy of Richard Thaler [9] as an informal advisor. According to Cameron, the nudge policy is a perfect mechanism. Economic behavior is represented by actions, methods, direction of people's behavior in certain conditions connected with economic activity. That is, all people are participants in the economic life of society. The economic behavior of a person is directly related to his needs, opportunities and knowledge about the essence of the processes that will lead him to achieve the goal [10].

Economic models have traditionally presupposed that people have consistent preferences that follow the principle of expected utility maximization. Over the past few decades, a large amount of behavioral research has shown that these assumptions do not always correspond to actual human behavior. Hundreds of experiments have shown that economic behavior differs from complete rationality and is subject to various prejudices. Given these findings, alternative models have been developed, out of which the Prospect theory may be the most outstanding one. The Prospect theory explains well-documented choice preferences, which could not be explained by the standard economic models, relying on psychological principles such as loss aversion (weaver's loom losses are greater than profits) and dependence on references.

The contribution of traditional economic models that have attempted to create an integrated, logical and accurate model of economic behavior is undeniable [12]. These models are particularly successful in explaining the results of market interaction, but prejudices in individual behavior do not often affect the overall level of markets due to market forces.

However, the decisions made at independent levels may be interesting as such, while individual prejudices are sometimes distinguishable at the overall level. To explain or predict the behavior and results in these cases, it is necessary to take into account the psychological and social motives underlying any economic behavior.

In addition to the above, explanations of individual behavior in economy should be based on the same motivational assumptions that guide economic analysis of market behavior. And the system processes that generate economic results should be taken as those reflecting the interaction of supply and demand.

In its standard (neoclassical) version, the alignment of motivational assumptions means the representation of agents as those maximizing their expected utility not only in the market, but also in public policy. As Brennan emphasizes, it is necessary to take into account weak incentives to invest in rational decision-making that prevail in the field of collective decision-making. Based on the above, we can expect that cognitive prejudices are extremely important not only in the market, but also in public policy.

Public policy and economy are the areas that are most likely to benefit from behavioral ideas application. However, it is striking that behavioral approaches in public policy and economy are a relatively recent phenomenon in general.

In the new work, D. Kahneman suggested the concept of «double-circuit» decision-making psychology, which the author calls «System 1» (fast, intuitive, heuristic) and «System 2» (slow, rational, exact) [5].

The first one is triggered automatically and very quickly, without requiring much effort from the consumer, and does not produce the sensation of intentional control; the second one focuses attention, which is necessary for conscious mental efforts, requires energy input. The actions of the second system are connected, according to the scientist, with the subjective feeling of activity, choice and concentration. The instinctive use of the first system leads to the fact that many decisions made turn out irrational, both from the point of view of formal logic and for the consumer activity of the individual himself.

Illusion of validity. Another behavioral trait of uncertainty is overconfidence. Economic agents often believe that they are inclined to obtain a better result from some actions than the average expected result. For example, if it is said that 20 % of customers have benefited from a particular product, they will be inclined to believe that they will definitely be included in this group. Unreasonable confidence, which is a consequence of the successful coincidence of a predictable result, scientists call the «illusion of validity».

Effect of relativity. An interesting point in the selection process is the relative probability. The effect of relativity is closely related to the demonstrative effect of consumption, consumers often imitate neighbors, friends, TV stars. As a result, consumers impose a demand for benefits not only in accordance with their functional qualities, but also with their symbolic value. Scientists have found out [1, 2, 3, 4, 6] that people make purchases more actively using electronic cards, they spend virtual money more easily than cash.

The effect of presence is the tendency of people to overestimate the likelihood of events, of which they become direct participants or witnesses. Thus, a person who has been robbed in a certain district of the city will consider it very dangerous, although objectively, in terms of crime rates, this district may be in no way more dangerous than others. Under

the influence of the effect of presence individuals can reject projects even with very moderate, reasonable levels of risk, in such a way causing damage to their well-being (in this sense, its action is opposite to that of the error of optimism).

Dependence on context can have two main forms. First, there is a framing effect, making the individual choice dependent on minor aspects of the situation in which it finds itself. Secondly, evaluations of available alternatives based on a comparison with some basic level. The previous experience can be the standard for comparison.

The presence of public goods makes it necessary for the state (or an appropriate public institution) to intervene in the process of ensuring public goods, because the problem of «stowaways» alone can lead to the fact that no public good will be produced at all. One of the possible mechanisms to ensure the production of public goods consists in a «compulsory» solution of a problem. The state forces its citizens to act rationally, which, as a rule, causes a huge number of protests. But in this paper, we plan, with the help of an experiment, to find a mechanism by which the population will independently make a choice in favor of rational behavior without «compulsory» intervention of the state, but only by «nudging».

## II. RESEARCH METHODOLOGY

The scientific work considers by example of Russia such areas of government regulation as education, public health, environmental pollution and tax evasion.

Public health is the most important indicator of a nation's well-being. Constant impact on the population of chemical, biological and physical environmental factors as a result of unsatisfactory economic activity, psycho-emotional stress, poor quality of life, led to a decrease in the adaptive capacity of human body and its ability to resilience and, as a result, poor health of the population and dismal prognosis. Figure 1 shows the dynamics of sickness rate of socially important diseases, as we see every year the number of cases is increasing. It is known that the prevention of diseases through a healthy lifestyle costs 25 times less than treatment, not to mention the moral and psychological side. In developed countries people have realized that a lot depends on their personal lifestyle, therefore individual activities to preserve and strengthen their health came to the fore, a healthy lifestyle has become the standard for the majority of people. The result is well known: a high health standard, a significant increase in life expectancy.

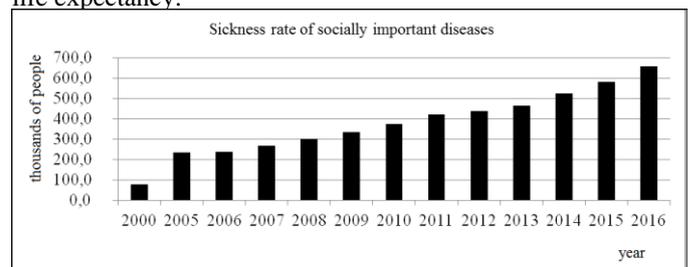


Figure 1. Sickness rate of socially important diseases [14]

Nudge-strategy: we suggest placing the information on side effects for the body from the use of the goods on the labels of fast food, semi-finished products and those harmful to health.

The problem of air pollution is very relevant in the Russian Federation and other countries and causes concern among

environmentalists, as it can lead to sad and irreparable consequences. The environmental problem of air pollution is particularly relevant at present time. For example, Figure 2 shows the dynamics of aggregate greenhouse gas emissions. As we can see, the indicators are frightening and it is necessary to deal with this.

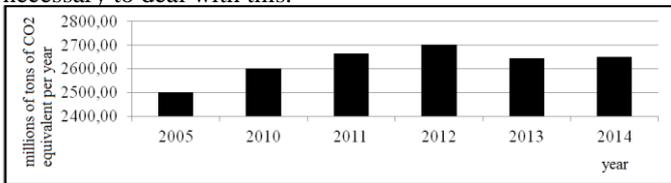


Figure 2. Aggregate greenhouse gas emissions [14]

Nudge strategy: to create an instruction leaflet for all the inhabitants of the planet, with the information on why CO<sub>2</sub> emissions are dangerous and how everyone can reduce this figure, without making much effort. For example: the daily consumption of meat leads to an increase in the carbon footprint, since the process of meat production involves the use of large amounts of energy and fuel. Avoiding meat consumption on some days will reduce your carbon footprint.

The use by taxpayers of various kinds of tax concealment schemes and mechanisms has occurred since the formation of the Russian system of taxes and fees. At the same time, in the early years, dishonest taxpayers almost did not bother to create any special schemes or use special mechanisms. In the context of unclear tax legislation, insufficient training of tax officials many taxpayers pay taxes «whenever possible», and often «at will».

Figure 3 shows the debt on taxes and fees in the consolidated budget of the Russian Federation, as we see every year the debt grows. Tax policy and taxation are a powerful tool in the hands of the state to influence the economy, while being an indicator of the state’s dependence on taxpayers. Since most indicators of economic security relate to the state budget, formed on the basis of tax revenues, it can be said that the tax mechanism is both a means of ensuring security and a threat and risk to the state.

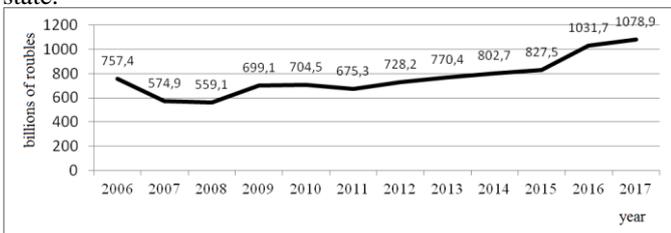


Figure 3. Debt on taxes and fees in the consolidated budget of the Russian Federation [14]

Nudge strategy: to increase tax collection it is necessary to indicate in receipts (in personal account) what was done at the expense of taxpayers for the last reporting period and what is planned to be done during the present one. In table 1, Russian universities have low positions in the world ranking of universities. One of the reasons of this problem is the students’ poor progress, and as a result, the low demand for the graduates among employers.

TABLE 1 – WORLD UNIVERSITY RANKING [15]

Ranking position	University	Location
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1	Massachusetts Institute of Technology, MIT	USA
2	Stanford University	USA
3	Harvard University	USA
4	California Institute of Technology (Caltech)	USA
5	University of Cambridge	Great Britain
6	University of Oxford	Great Britain
7	University College London, UCL	Great Britain
8	Imperial College London	Great Britain
9	University of Chicago	USA
10	Swiss Federal Institute of Technology	Switzerland

95	Lomonosov Moscow State University, MSU	Russia
240	Saint Petersburg State University	Russia
250	Novosibirsk State University	Russia
291	Bauman Moscow State Technical University	Russia
323	Tomsk State University	Russia

Nudge strategy: to improve progress, it is proposed to draw the examination sheets correctly –to indicate opposite to each task the maximum possible number of points that can be obtained for completing the task. This is necessary so that the students could rationally distribute their efforts and the time to complete the work.

Understanding when and how people make an effort is crucial for many issues in the economy. A sufficiently large amount of literature on experimental economic research provides various approaches to the use of experimental operationalization.

Experimental economists [4, 7, 8] basically used two methodological paradigms: the declared efforts and the real efforts. A laboratory experiment was conducted: «Student behavior in conditions of certainty and uncertainty». Therefore, we will dwell on this method of research.

Laboratory experiments [13] were first suggested as the tools for economists almost 70 years ago. Since then, they have been increasingly used to research market efficiency and improve our understanding of economic behavior. As a result, beyond all doubt modeling and analyzing decisions that were made under artificial and controlled conditions are useful for economists to such an extent that experimental economics has become a reference point for comparing and testing disciplines like psychology, which occurred as an experimental science.

### III. THE RESULTS OF THE RESEARCH

The key objective of the laboratory experiment is to take advantage of the controlled environment to study an economically interesting phenomenon. We identify several aspects that are important when making a decision about the measurement of efforts, such as the time to decide whether to make an effort, the presence of purposeful decision-making, and the special features of making decisions on effort and money. One of the central problems of such an experiment is the correct introduction to the experiment, the correct instruction:

- explanation of the goals of the experiment (what all this is done for),
- explanation of the objectives of those being tested (what they should do),

- a request for normal calm daily behavior.

The laboratory experiment has a number of advantages, which consist in obtaining more accurate results by using special rooms, measuring equipment, simulators; opportunities to simulate conditions that are rarely found in everyday life; achieving the highest accuracy of registration of the actions done by those being tested in comparison with the observation, etc.

The disadvantage of the laboratory experiment is that the conditions created for those being tested are artificial, which significantly influence the manifestation of their psyche. It is necessary to take into account the fact that not all mental phenomena can be learned. Following the tradition of positivism, many scientists consider a laboratory experiment to be the most relevant to the spirit and subject of objective, scientific, materialistic and psychological research.

The relevance of the experiment is the need to improve student progress in order to subsequently improve the position of Russian universities in the rankings. The rational behavior for a student is to write all the papers and pass exams as well as possible. The objective of the experiment is to understand how it is better to draw the exam tasks so that the student could make as much effort as possible, allocate time efficiently and thereby improve the average quality point.

**Design:**

- The students of the Institute of Graduate School of Economics and Management of the Ural Federal University take part in the experiment.
- The motivation is to get points on the subject of econometrics.
- 2 groups each consisting of 21 students participate.
- For the purity of the experiment, the groups write tasks separately.

The groups have the same sheets with 11 tasks except that the sheets of the first group has indication of the number of points given for the implementation of the tasks; the second group has ordinary sheets.

The work includes 11 tasks of varying difficulty, the distribution of points between the tasks is random. Runtime is 20 minutes. Before performing the tasks, the following condition was announced: «Do not use additional sources of information».

TABLE 2. DISTRIBUTION OF WINNINGS AMONG THE PARTICIPANTS OF THE EXPERIMENT:

Percentage of the tasks done correctly	Winning of a participant
90-100 %	10 points
80-90 %	9 points
70-80 %	8 points
60-70 %	7 points
50-60 %	6 points
40-50 %	5 points
30-40 %	4 points
20-30 %	3 points
10-20 %	2 points
0-10 %	0 points

Next, it is necessary to compare the average number of points and scores in different groups.

TABLE 3. THE ADVANTAGES AND DISADVANTAGES OF THE FIRST AND SECOND VARIANTS OF THE EXPERIMENT

The advantages and disadvantages of the first and second variants of the experiment
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Advantages:	Disadvantages:
+ one can plan the work procedure and distribute the efforts correctly;	- probability to stop in a difficult task with a high number of points assigned;
+ a student distributes the efforts according to the real ability to solve the tasks and not according to the number of points assigned for the task by someone;	- probability that a student who has completed a certain number of tasks might lose motivation, as he/she will see that, most likely, he/she has already got points for the required grade;
+ A student tries to solve as much as possible, since at each moment he/she very vaguely estimates how many points he will get.	- One can spend a lot of time and effort to solve the problem with a small number of points assigned.

42 students were interrogated during the experiment.

Figures 4-5 show the dynamics of fulfillment of every task.

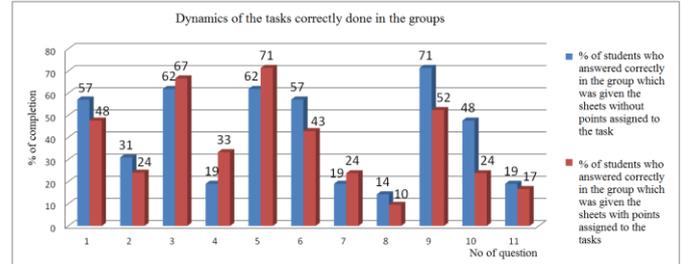


Figure 4. Dynamics of the tasks correctly done in the groups

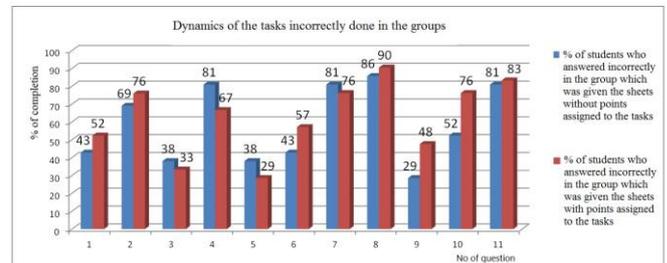


Figure 5. Dynamics of the tasks incorrectly done in the groups

Figures 4 and 5 show that in the group which was given the sheets without points assigned to the tasks 64 % of the students gave correct answers to the proposed questions, and in the group which was given the sheets with the points assigned to the tasks only 36 % of the students solved the tasks correctly.

Further, table 4 shows the indicators of the results of distribution of average points for correctly solved tasks in the groups, the maximum number of the points obtained by the groups and the minimum number of the points obtained by the groups. After that, in table 5 the correlation coefficients between the proportion of people who solved the task and the number of points assigned to it in the groups were calculated, and table 6 shows the significance of the differences between these coefficients.

TABLE 4. THE RESULTS OF THE EXPERIMENT

Criterion	Results	
	First group (tasks with the known number of points assigned to them)	Second group (tasks with an unknown number of points assigned to them)
Maximum possible number of points	60	
Average number of points	38,6	37,2

obtained		
Best result in the group	58	53
Second best result in the group	55	47
Worst result in the group	16,5	10
Second worst result in the group	24	21

TABLE 5. CORRELATION COEFFICIENT BETWEEN THE PROPORTION OF PEOPLE WHO SOLVED THE TASK AND THE NUMBER OF POINTS ASSIGNED TO IT

	First group (tasks with the known number of points assigned to them)	Second group (tasks with an unknown number of points assigned to them)
Correlation coefficient between the proportion of people who solved the task and the number of points assigned to it	0,2	0,41

TABLE 6. SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE CORRELATION COEFFICIENTS

P	0,51
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As follows from table 7, there is no statistically visible difference between the coefficients at the significance level of 5 %.

TABLE 7. CORRELATION COEFFICIENT BETWEEN THE ORDER OF SOLVING THE TASKS BY THE STUDENTS AND THE RANK OF THE LEVEL OF POINTS ASSIGNED TO IT

Indicator	For the first group (tasks with the known number of points assigned to them)	For the second group (tasks with an unknown number of points assigned to them)
Correlation coefficient between the order of solving the tasks by the students and the rank of the level of points assigned to it	-0,12	0,22

Also table 7 shows the correlation coefficient between the rank of the number of points assigned to the task (the higher the rank – the more points assigned to the task) and the ordinal number of the task (the smaller the number – the earlier the student completed the task). Despite the small value of the correlation coefficient in the group who received the sheets with specified points, we see that it is negative and significantly differs from the correlation coefficient in the group who received the sheets without specified points.

TABLE 8. SIGNIFICANCE OF DIFFERENCES BETWEEN CORRELATION COEFFICIENTS

P	0,0002
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Table 8 clearly demonstrates that at a significance level of 5 %, our correlation coefficients between the order of solving a tasks by the students and the rank level of points assigned to it are really different.

TABLE 9. 95 % CONFIDENCE INTERVALS FOR THE CORRELATION COEFFICIENTS IN TWO GROUPS

Limit criterion	For the first group	For the second group
Lower limit	-0,245	0,094
Upper limit	0,009	0,339

Table 9 shows the calculated 95 % confidence intervals of the regression coefficient; with the first group barely covering 0 (the upper limit is 0.009), which indicates that the true value of the coefficient is most likely negative: that is, the more points are assigned to the task, the earlier the student is trying to complete it.

Thus, given the data, we were unable to confirm or refute our hypothesis, but the fact that the data rather indicate its refutation is a disturbing result that requires further research on a larger sample. But what if we assume that our hypothesis is wrong, how could that be explained?

The following thoughts count in favor of the hypothesis:

The desire to get more points and solve tasks with maximum points.

But, perhaps, other factors that favor the opposite hypothesis influence as well, for example,

- The desire to solve as many tasks as possible, and in this case, the tasks with low points assigned to them are perceived as easier ones – so the student solves them first.

This fact may be the consequence of the fact that most students have no self-believe, and besides this, they have a fear of not coping with the task which all the others will cope with

We can apply this conclusion not only in the field of education, but also in any other areas. It is possible to influence on the distribution of human forces in several tasks, for example, at work –specifying first how much award fee one can earn by completing one or another task (different winning for each task). Behavioral economics is a new advanced field of research, which largely changed the modern economic theory.

#### IV. RESULTS DISCUSSION

Thus, summing up, the overall results of the work are:

- 3 nudge strategies for the following areas of public policy: health, taxation and ecology;
- a design of the experiment was developed to research how efforts aimed at solving a task depend on the specified points for a successful result;
- the experiment was conducted on the basis of the Institute of the Graduate School of Economics and Management of the Ural Federal University;
- the results were ambiguous because:
  1. Statistically, we did not see the difference between the correlation coefficients of the proportion of people who solved the task and the number of points assigned to it at a significance level of 5 %.
  2. The correlation coefficient between the rank of the number of points assigned to the task and the sequence number of the task, despite the small value of the correlation coefficient (-0.12) in the group which was given the sheets with the specified points, turned out to be significantly less than the correlation coefficient in the group which was given the sheets without the specified points (0.33).
  3. As for 95 % confidence interval of the regression coefficient, it is evident that in the first group it barely covered 0 (the upper limit is 0.009), it shows that the true value of the coefficient is most likely negative: that is, the more points are assigned to the task, the earlier the student tries to complete it. In the second group, this indicator is much higher, which is not surprising, because the student solves the tasks only in accordance with his efforts, and not relying on the winning distributed by someone (in our case, points).

From all of the above, it can be concluded that we did not manage to confirm or disprove the hypothesis based on our data, but the fact that the data most likely indicate its refutation is an alarming result and provides an interesting basis for reflection on the continuation of research on a larger sample.

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