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Visual Experiment Results (About the 2021 Nobel Prize in Economic Sciences)

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ABSTRACT

The article is devoted to analysing the achievements of the laureates of the Nobel Prize in Economic Sciences in 2021. The author described the methods of natural experiment used by the laureates in their research. Further, the author noted the differences between different types of experiments: laboratory, field, computer and mental (thought, imaginary). The author described details of two of their studies (which have become classic) on the consequences for the labour market of the influx of immigrants and the increase in the minimum wage. The methods and results of the laureates' research on assessing the consequences of state programs and structural decisions are also analysed. In conclusion, the author considered new experimental and econometric research methods, which the laureates have significantly improved. In particular, it concerns the method of counter samples and an example from the author's research using this method.

Keywords: natural experiment; randomisation; labour market; minimal wages; labour immigrants

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INTRODUCTION

Three professors from the United States received the Nobel Prize for Economics in 2021, each of whom relates to another country. This peculiarity of American awards is not unique to economists. Nobel Prizes in Physics, Chemistry and Medicine are very often awarded to scientists who have come to the country, and the United States should be proud to be able to attract talented people from around the world.[1]

David Card was born in Canada, where he received his first higher education and still retains Canadian citizenship. After receiving his bachelor's degree, he studied and worked in the United States. He graduated from Princeton University and received a PhD in the University of Chicago in 1983. After becoming a doctor, he returned as a teacher to Princeton University. He received the title of professor in 1987, and since 1997, he has been teaching at the University of California (Berkeley). In 1995, David Card was awarded the prestigious John Bates Clark medal.

Joshua David Angrist has two nationalities — the United States and Israel, although he lived in Israel for only three years, and was born in the United States and worked there most of his life. In 1982, he graduated from private Oberlin College in Ohio. After receiving his bachelor's degree, Angrist left for Israel and returned to the United States only in 1985. He entered at Princeton University, where he received his PhD in 1989 and then — an assistant professor at Harvard University. In 1991, the scientist again leaves for Israel, where he teaches at the Hebrew University in Jerusalem as an associate professor. Since 1996 J. Angrist works at the Massachusetts Institute of Technology (MIT), where he was appointed professor of economics in 1998 and has been teaching at the Department named Ford ever since.

Like other 2021 laureates, J. Angrist is actively collaborating with the US National Bureau of Economic Research (NBER) and with the German Institute for Labor Economics Research (IZA).

Guido Imbens of Stanford University was born and educated in Holland. After moving to the United States, he first taught at Harvard and two California universities (Berkeley and Los Angeles) before joining to Stanford University. He was admitted to the Royal Netherlands Academy of Sciences and Arts as a foreign scholar.

Guido Imbens is considered a representative of econometrics not only because of many of his publications, but also because he has been working as a magazine editor "Econometrica" since 2019.

All three laureates worked on a similar topic and have many joint publications.

EXPERIMENT SPENT AND SEEN

Thanks to the 2021 Award, the term "natural experiment" has gone beyond the narrow circle of specialists. In domestic tradition, it is contrasted with the laboratory experiment, whereas in English-language scientific literature it is compared with the field experiment and is opposed to the laboratory. The term "естественный эксперимент" in Russian is translated both as a "field experiment" and as a "natural experiment". The field experiment has all the properties of the ordinary experiment: there is its plan, along with the experimental object pre-selected control, etc. In contrast to the laboratory, in a field experiment, the researcher deals with real companies, with actual existing market players. The laboratory is applied to a certain group of people (for example, students) and creates situations in which the subjects find themselves, mostly fictional or game.

The reason for the absence in Russia of a difference between natural and field experiments seems to be hidden in the low development of cooperation between

[1] URL: www.forumdaily.com/gordost-ssha-nobelevskie-premii-vse-chashhe-zavoevyvayut-immigranty/

science and the authorities in relation to the economic experiments and reforms being carried out in our country.

The natural experiment does not plan, but rather marks out any differences between the situations in which the subjects are found. It is not easy to find a good real situation that can be classified as a natural experiment (for example, a disaster that has affected some actors and not others). It is somewhat more difficult to include in the category of natural experiments a situation where different objects have different backgrounds. The difficulty is that there are many factors intertwined in the history of the experiment that, in one way or another, are related to the variables studied in the experiment.

Applied to medicine, the natural experiment is opposed to clinical trials that are closer to experiments, conducted in the field of physics, the fact that the researcher has full control over the subject (or experimental group) and the conditions in which they are located. The field experiment, whether carried out by doctors or economists, involves only those who have agreed to participate. In this case, it is more difficult to distinguish causal relationships from the many relationships between parameters that have been identified.

If distract the view from economics, natural experiments are the basis of any scientific discovery (for example, no one picked the apple hanging over Newton — the experiment was natural). If nature had not conducted a natural carbon experiment in very early times, creating conditions in the form of high pressure and temperature, people would never have thought of how to get artificial diamonds.

Here are some examples of natural experiments that have led to discoveries that have changed the world. So, without the natural experiment with the Petri dish, which Alexander Fleming did not wash, penicillin would not have appeared. If not for the cathode-ray tube a piece of cardboard with the remains of barium salts, which glowed in the dark, Wilhelm Röntgen would not have laid the foundation for one of the most common diagnostic devices. If Konstantin Falberg, a Russian citizen, had not once forgotten to wash his hands, there would have been no traces of coal tar on the piece of bread he had bitten off and no saccharin would have appeared. If Oscar Minkowski and Joseph von Mering had not noticed the flies flying on a puddle of test dog urine, there would not have been any insulin. If Charles Goodyear had not inadvertently dropped a lump of rubber mixed with sulfur on a hot stove, there would have been no car tires. What about car glass? Would it have been if Edward Benedictus had not dropped an empty glass flask on the floor in 1903, which had not broken because a thin layer of collodion solution remained on its inner walls?

Sometimes such discoveries are a simple accident. But more — is the merit of the researcher: only his attention, observation, curiosity and a clear overview of the result allow you to notice the deviation, see the unusual.[2]

In addition to comparing the natural experiment with the field and laboratory, it is useful to consider computer (computational) and thought experiments.

In the Feynman Lectures on Physics [1] (which, according to the author of the article, every economist should skim read) the acceleration of free fall is described as follows. If you throw down two identical bricks, they will reach the ground at the same time, because they are the same and they are flying with the same acceleration. Then we combine these two bricks with a weightless chain — the result is the same.

[2] There is a special term "serendipity", which has not yet taken hold in the Russian language even among historians of science. It refers to the "ability to make deep conclusions from random observations", "to find what I did not seek intentionally", "special ability to make random inventions", etc.

In addition, even if the length of the chain is shortened to zero, "double" brick flies to the ground in the same time as the usual. The presence of a single object for all falling to the ground of the acceleration of free fall is proved by thought experiment, not real.

In the natural experiment, there is the effect of some external influence of artificial (virtual) separation of the studied groups to the one that was exposed and the one that this effect has avoided. [2]

In reviewing with the research of the laureates will have to address on another term, the meaning of which does not fit into the Russian system of terms, — "treatment". Usually it translates as "treatment", but in the context of natural experiments, its meaning is much broader. It refers to any impact, most often with good intentions, although the latter is not necessary. In one of the articles, G. Imbens gives examples of treatments: employment assistance programmers, educational programmers, vouchers, normative or regulatory acts, new technologies or medicines, environmental impact, etc. [3]

As a synonym of the term "treatment" sometimes use "intervention".

PREDECESSORS

The laureates themselves refer to Trygve Haavelmo as their predecessor,[3] who wrote back in 1944 about the "flow of experiments that Nature repeats constantly in its huge laboratory". [4] Moreover of this phrase about the possibility of using natural experiments in economic research, T. Haavelmo has nothing on this issue.

Most significantly, the predecessor of scientists the Nobel laureate in economics 2002 can be considered Vernon Smith, who laid the foundations for an experimental direction in economic research. Smith based much of the new science on laboratory experiments, although he was the one who started the field experiments. He conducted them, investigating the reaction of consumers to the level of electricity tariffs, as well as the introduction of a two-rate tariff: reduced at night and increased during the day. His practical experiments revealed, for example, the level of difference in day and night tariff where housemaker include washing machines primarily at reduced rates.

In 2019, Esther Duflot, Abhijit Banerjee and Michael Kremer won the Nobel Prize for Economics. Their research focused on the problem of poverty and finding ways to reduce it in the world. The theme is far from what the 2021 prize winners did, but the methods they used are very similar — the same randomized field experiments, similar to natural.

While in 2019, the focus of people's attention was on the problem, which they tried to solve with their research, then in 2021, came to the first place is the methods of research. There were a lot of people around me who were disappointed on the criteria by which Nobel Prize winners in economics were now selected. "There is no such level", — they complain, — like the first winners, like Jan Tinbergen or Friedrich von Hayek. Those had the swing, the flight of thought! Routine has replaced the perspective. Is it possible to compare them with modern laureates who only solve practical problems, help people overcome everyday difficulties?"

The same practical orientation should you have in mind when looking at the results of the laureates' studies in the field of labour economics. This purely economic theme is more akin to operational intervention in medicine and psychology than to theoretical research in the same field. It is no coincidence that in his Nobel lecture, David Card repeatedly mentioned the author of the theory of human capital, Harry Becker, whose research in education

[3] Trygve Magnus Haavelmo (1911–1999) was a prominent Norwegian economist, professor at the University of Oslo, and Nobel Prize winner in economics in 1989.

actually paved the way for the methods and objectives of the 2021 laureates' research.

LABOR MARKET — NOT EXACTLY THE MARKET

Before the work of the laureates, most economists took for granted that the labor market is similar to the goods and services markets. Researchers did not notice any particular differences between them. The labour market was considered competitive, regulated by demand and supply.

This myth was formed of some misconceptions, in particular, that if the salary is low, then a person can easily move to another firm where pay more. Companies focus on established pay levels and employ employees based on this level and what the company's income allows.

The research of the laureates showed that finding a new job and replacing the existing one — is a costly and long process. The labour market is more dominated by large firms than the goods and services markets and cartels (primarily wage levels) are used. But perhaps the most important difference is that there is not an abstract faceless labour force, and everyone who offers their work has their own idea of what is more suitable.

In addition, unlike the product or service market, multiple layers characterize the labour market, i.e. workers with the same qualifications may receive substantially different wages.

The income gap in the developed world decreased in the 1970s and increased since the mid-1980s, but this was not a return to past stratification. It has become more dependent on the organization or company in which man works and has been linked to the general trend of companies coexisting with low and high wages.

Companies that (for many reasons) can afford to pay high wages to their employees are fundamentally different from those with weaker financial positions. [5] This stratification of the labour market by the level of solidity of companies is gradually shifting to the markets of goods and services. Has already become an ordinary difference in the retail price of the same product in a respectable supermarket with a huge parking space and in the discount, where buyers come by public transport. Some stores attract buyers with low prices, others — with declarations of high quality.

Interestingly, this process is not taken into account by those, who study price movements or make inflation forecasts, that the food market is united, and can be measured the movement of a single commodity price by tradition.

However, even more surprisingly, such a long-established stratification of the labor market only noticed the penetration. And the two issues which will be discussed further, about next are that the 2021 prize winners originally saw the labor market as different than most of their predecessors. [6]

IMMIGRANT TO THE LABOUR MARKET

Standard comparisons between immigrants and local employees are usually limited to comparing their current earnings, as well as the extent to which migrants displace "their" in the labor market.

The 2021 laureates have given special attention to those immigrants who arrive in the country already having a higher education (at least a bachelor's degree). Earnings for this group grew at a rate 20% higher than that of local employees, and increased significantly when moving to higher-paying jobs in another company. [7] At the same time, all of them received additional training at the workplace and upgraded their skills at the expense of the employer. [8]

Despite the fact that the educational qualifications of immigrants are not taken into account, but are gradually assessed by employers their competence, ability to work and diligence. Then this assessment is transferred to their documents, which are

becoming highly appreciated in the labor market. [9]

The growing symbiosis between newcomers and local employees is redefining the problem of migrant workers, — take into account the interests of all parties involved: employees from local communities, employers, the State and migrants themselves becoming part of society. This fact drew the attention of D. Card, in particular, because his first research was devoted to immigrants from Cuba in Miami, and need to be sure, that immigrants feel better in their new homeland than in the revolutionary Cuba. Of course, each country will have its own approach to the balance of interests, but the principle of achieving it remains the same. [10]

As a result, the laureates' research on the consequences of labour immigration a new section of economic science "The economics of immigration" was formed [11], and courses have been developed and taught on this subject.[4]

MINIMUM WAGE

The second direction of research in the labour market, which served as the basis for the winners of the award, concerned the local minimum wage increase. The reason for the researchers' interest in this topic is understand. Introduction or increase of the minimum wage (MW),[5] as a rule, are associated with many undesirable consequences: rising unemployment, worsening business conditions by increasing the tax burden on employers and then restraining wage growth for the most productive employees. The list of possible negative consequences of increasing MW can be continued, but behind all of them, there is a general rejection of business of any government intervention in its activities, ignoring the interests of economic participants. If an employee only works low wages, why should an entrepreneur pay more? It is like prevent dismissals — as a measure introduced from time to time in different countries during the crisis years.

Since the division of economic science into macroeconomics and microeconomics, economic subjects have been gradually disappearing in many economists' studies. In addition, the decisions made by the authorities were presented as automatically enforceable. It is enough to take a decision on increasing tax rates when the budget starts to receive additional income. But in reality, it turns out that higher tax rates reduce tax collection, and budget revenues do not increase, but decrease.

For example, it was decided to increase the average salary of scientists in Russia, that at previous levels of funding, the actual goal is to reduce the number of researchers, to get rid of ballast, from staff not appropriate the requirements. In fact, this has resulted in some researchers being paid part-time or quarter-time while maintaining their actual monthly payments. Rates were reduced and staffing levels maintained. This decision was not considered the position of the heads institutions who regarded the reduction in the number of staff as a reduction in activities.[6]

Abroad, increases in the minimum wage were associated with the threat of unemployment. In Russia, this measure, borrowed from foreign practice, was often interpreted as one of the state's concerns for the poor. For this reason we get acquainted with the research of the laureates not only with an interest in the experiments as such, but also with a new perception for us — fear of rising unemployment. Research of the 2021 laureates showed that, by all means, companies avoid reductions, and the number

[4] Introduction to Immigration Economics. URL: https://courses.lumenlearning.com/boundless-economics/chapter/ introduction-to-immigration-economics/

[5] The abbreviations and the formulation of the term are purely Russian.

[6] These problems are partly peculiar to Russia and other countries where monthly wages are calculated and have been simplified for those countries where hourly rates are set.

of employees after the increase of the minimum wage (hourly) is not reduced. [12]

However, the most famous of their studies concerned a rather narrow group of employees of the restaurant business. It was a natural experiment to raise the minimum wage in this field in one of the bordering states. In the early 1990s, the minimum hourly wage in New Jersey was raised from 4.25 to 5.05 US$, and the neighboring state of Pennsylvania did not have that kind of increase.

According to the statements of a number of experts, the winners "dropped all charges" from the minimum wage. An interesting development of the laureates' work is the simultaneous study of the impact of the increased minimum wage and the flow of immigrants, which was carried out in a method other than that used by the laureates. [13] The new methodology examined the entry of migrants into specific groups of employees with the same level of skills as migrants. It was found that with the arrival of migrants, wages for local workers fall, but if a decision to increase the minimum wage is taken at the same time, this does not happen.

According to the plans of the Government of the Russian Federation MW in Russia in 2022 will exceed 13.6 thous. rubles. International economic organizations, in particular the International Monetary Fund and the Organization for Economic Cooperation and Development, approve such increases in the minimum wage.

EVALUATION OF PUBLIC DECISIONS, PLANS AND PROGRAMMERS

One of the issue to which life itself leads,— is an assessment of the impact of particularly interesting public decisions when they are combined into some concept, strategy or programme.

Usually, this assessment is divided into parts, each of which determines the impact of the government decision on individual categories of economic agents: households, enterprises, individuals, regions or municipalities. First, the reactions to the decision of the subjects of each category are described, and then the combinations of these reactions are examined.

The fundamental advantage of J. Angrist and G. Imbens' research, that they had proposed a method for the identification of cause-effect relationships based on natural experiments in 1994. Without this, it would be difficult for them to raise the very important issue of assessing the impact of integrated government decisions on plans and programmes.

Thus, the so-called "internal causation mechanism" is formed, which can be verified by case-studies and natural experiments. [14] Better to check the effectiveness of such a mechanism is to first formulate a question that requires an unequivocal answer. For example: "Does the flow of migrants lead to higher unemployment? Yes or no". [3] Or: "Will I earn more, if I get a master's degree?"

However, such questions do not take into account that the implications of any management decision are heterogeneous and uneven. And the answer to a one question doesn't describe the full range of these consequences. But this problem was left to the laureates for further research.

NEW RESEARCH METHODS

Many innovations made by the laureates in the methods of building experimental and control groups. Stay on one of these methods.

Counter-sample is the method by which objects are selected from the population (or respondents), similar to each other as is possible for all indicators except one, which is the experimental variable. The pairwise samples reproduce, in a certain way, the general pattern of the labour market, which consists of meetings between employees and employers. G. Imbens used counter-sampling in different areas: comparing winners and losers in the lottery, the effectiveness of support measures in the search for work,

and various training programs. [15] In another research, the pairs of test subjects were pregnant women who were similar to each other as is possible in all but one. One woman in a couple took barbiturates during pregnancy and the other did not. The psychological condition of each of them after childbirth was examined, and the psychology of the children born. [16]

I will explain the idea of "matched sampling" using the example of one of my own studies related to the 1990s. It is useful to understand that the methods of the laureates are quite suitable for use in Russian conditions. [17]

In a natural experiment, named "privatization of pharmacies", were built pairs of pharmacies in Novosibirsk. One of the pharmacies in the pair was municipal, the other — was private, and they had to be no more than 150 meters from each other. Such pairs in Novosibirsk turned out to be 20. When comparing the prices of medicines in commercial and municipal pharmacies in actual prices (i.e. without sale, discount cards, etc.), the first clearly lose: the price of medicines in commercial pharmacies is generally higher than in municipal pharmacies.

Conclusion: if the municipal pharmacy in each pair became private, it would reduce the assortment by 20% and prices increased by 11.5%.[7] The greatest price discrepancies between municipal and private pharmacies are due to the more intense traffic in municipal pharmacies.

I think we can do many such natural experiments for a variety of practical purposes.[8]

Although the Nobel Committee's formulation made no mention of the laureates' achievements in econometrics, none of their achievements could have been achieved without the development of econometric models. So, J. Angrist (author of the now well-known two-step method of least squares, as well as its own statistical criterion that superseded the Wald criterion, according to which the optimal of many solutions will be what provides the best outcome in the worst of circumstances) with Donald Rubin[9] wrote an econometrics study book, which sets out a broader view of this science than before. [18] This research would have been worthy of the attention of the Nobel Committee. Even some of it may well be recommended for study. [19]

Another innovation introduced in econometrics by J. Angrist and G. Imbens concerns quantum regressions. Many analysts consider statistical dependencies by mean values, sometimes reconciling calculations by replacing mean values with median values. Only in 2021, the Nobel Prize winners paid attention to the fact that the median — is only a private case of quantile.[10] Quantum regressions were invented long ago [20], but before the laureates, they were used solely to predict stock decline, that were resume on reaching set minimum. In the work of the laureates, quantum regressions have been incorporated into the general system of regression analysis of many economic phenomena and processes.

The first volume of the econometric forecasting handbook was published in 2006. It reviewed the sharing of several forecasting techniques in one study. [15] The most intensive joint application of several methods was used in macroeconomic

[7] As the study was commissioned by a firm intending to privatize pharmacies, it refused to pay for such findings.

[8] Although both experiments were clearly similar to the natural experiments of the laureates, at that time it was necessary to use the revolutions of "virtual" and even "mental" experiment, which is incorrect.

[9] Donald Bruce Rubin — emeritus professor at Harvard University, also teaching at Temple University (Philadelphia) and at Xinhua University in China.

[10] Median value of a variable — distribution of a random value in half. There are also quartiles (lower and upper) that divide the distribution in proportion three to one, deciles that separate 10% of the distribution and even the percentage that separates 1% of the distribution on the right (upper percentile) and the left (lower percentile).

models for forecasting GDP. J. Angrist could not get past these studies and conducted pilot tests of the effectiveness of joint and separate projection methods for forecasting GDP. [21]

Stanford University young professionals group led by J. Angrist used three statistical methods of projection, first independently and then jointly on the material one set of multi-year data from different time periods (from 10 to 270 quarters). It has been shown that joint use of techniques gives better results, especially if models have lags. The proposed methodology gives each of the methods what they deserve. If a method giving bad results, its share in the total (joint) forecast automatically decreases. Such a technique was called cross validation by the researchers.

Experimental evaluation in economists do not meet as often. Observing current events and processes more usual,— mainly econometrics works precisely on the results of monitoring. Its background reflects the natural course of events, without suspicions of any interference in the process.

Of all the dependencies between parameters (even when these dependencies are very high) need to highlight those whose changes are the reasons for the change of other parameters. Nobel Prize winners already included those who received the causality analysis award — it is Nobel Prize winners in economics 2003, Robert Angle and Clive Granger ("causation by Granger"). Laureate's winners have developed this approach in two directions in 2021.

The first of these — is experimental. Unlike passive researches, which do not divide objects into experimental and control groups, when randomizing an experiment, it is necessary to ensure that objects are randomly selected for both groups, and there were no significant differences that do not include in the experiment. Explaining the last thought, D. Card gives example from research he criticized. In the experiment, the control group is represented by people who have been treated at the clinic, and the control sample — is represented by those who have not been treated. As a result, it was concluded that the health of those treated was worse than the average of surveyed. But the conclusion is incorrect: those who were treated initially had worse health than the average person (otherwise they would not have gone for treatment). It is more correct to recruit a control group of those who had the same disease, but have not been treated. He borrowed this example from Donald Rubin, who proposed a special method of constructing a control group in which such cases would be excluded.[16]

The second direction — econometric, through the introduction to the equations of so-called instrumental variables. They are embedded in the so-called cause-effect model of the same D. Rubin. [22] The line of these causality researches begins with Jerzy Neumann's dissertation (1923). [23] But J. Neumann considered only fully randomized experiments, and D. Rubin extended his approach to both observations and partially randomized experiments. [24] D. Rubin subsequently used this method to form pairwise samples in a natural experiment. [17] G. Imbens, in his Nobel lecture, mentioned another predecessor of the laureate — F. G. Wright,[11] who first and for a very long time used the tool variable method and was the first to put the problem of identification.

To determine import duties on animal and vegetable oils and fats, F. Wright needed to know the elasticity of demand for these products. Since the least squares method gave biased estimates, he suggested introducing another variable that would affect price but would not be related (by definition) to demand. As such, he took

[11] Philip Green Wright (1861–1934) was a professor at Harvard University and a member of the United States Tariff Commission. The problem of identification in econometrics first raised in 1915, and in 1928 proposed the method of instrumental variables.

the amount of Z rainfall that occurred in the season prior to the establishment of duties. [25] By analogy with this first application, additional variables (instrumental) have been introduced into econometric equation systems for almost a century.

CONCLUSION

The Nobel Prize for Economic Research represents three trends in 2021. The first is the increasing importance attached to the practical application of research and its usefulness. The second — is that the experimental direction in economic science is becoming less exotic and more common. With regard to the third, the laureates have shown themselves as integrators, combining the results obtained in microeconomics with econometrics. The future — similar integrating interdisciplinary research.

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