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THE CONNECTION OF MATHEMATICS AND ECONOMICS, AS WELL AS THE APPLICATION OF MATHEMATICAL METHODS IN ECONOMICS

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Abstract

Mathematics plays a huge role for all professions. It was and remains one of the most important disciplines. It has long been recognized throughout the world that the ability to acquire mathematical knowledge is an indicator of the ability to learn. If a person can study mathematics, then he can study everything. It is worth noting that the economy cannot exist without mathematics. After all, everything from the simplest calculations of interest rates to modeling complex market situations is carried out with the help of mathematical laws and tools.

Keywords: economics, mathematical economics, mathematical methods, statistics, combinations.

Introduction

Mathematics and economics are independent branches of knowledge, each of which has its own object and subject of research. Mathematics is the science of structures, order and relationships, which has historically developed on the basis of counting, measuring and describing the shapes of real objects. Economy is the economic activity of a society, as well as the totality of relations that develop in the system of production, distribution, exchange and consumption.

Mathematical economics is a method of economics that uses mathematical principles and tools to create economic theories and research economic difficulties. Mathematics allows economists to construct precisely defined models from which precise conclusions can be drawn using mathematical logic, which can then be verified using statistical data and used to make quantitative forecasts of future economic activity [1].

The combination of statistical methods, mathematics and economic principles allowed the development of econometrics. Advances in computing power, big

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data methods, and other applications of advanced mathematics have played a major role in turning quantitative methods into a standard element of economics. From ancient times until the XIX century, only a select few were engaged in mathematics. The development of mathematics, and in particular in engineering areas, was promoted by the industrial revolution, which caused the need to improve and create various mechanisms and various types of machines. A big breakthrough was made in the second half of the last century, when advances in nuclear physics led to the further development of mathematics, mathematical education and high-performance computing. Similar phenomena occur today, when there is a need to manage many social and various economic processes, which are a prerequisite for the next round in the development of mathematics. Economics as a science has not attracted the attention of mathematicians for many years, although there are isolated examples of mathematical works of the XIX century that are related to economics ([2]–[4]. Currently, in some countries, and especially in the USA, there is a process of migration of many scientists from classical applied mathematics fields to economics.

Mathematical methods based on mathematical modeling are widely used in economic research. Studies based on a statistical or probabilistic basis allow us to take into account changes in factors that are almost completely impossible to take into account. Connections in economic life, economic dynamics and the behavior of economic subjects of forecasting are based on the construction of theoretical models by mathematical method - this is the most important tool for the analysis of economic phenomena and processes. For scientists from all over the world, mathematical modeling is becoming the language of modern economic theory. For example, the task of planning the work of an enterprise is an example of the use of mathematical models in economics.

To date, extensive use of mathematical apparatus in their research contributes to achieving the greatest success in these areas. Therefore, the application of mathematics in practice makes it possible to achieve more significant results in the study of certain phenomena of nature and society.

The features of mathematics as a distinctive field of knowledge that make it unique are as follows:

– Not allowing any discrepancies in the definition of rules and the creation of relations – mathematical formulas;

– Mathematical formulas are made up of a number of axioms, based on strict conditions;

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– The ability to own certain concepts without revealing their meaning.

It is thanks to all the above features that the mathematical apparatus is made a multifunctional analytical tool for all branches of knowledge.

Little-known problems that economics poses to mathematics, contributes to its stimulation in finding ways to solve them. The needs of the economy at the moment in new mathematical methods exceed the abilities of mathematics. The origin of new directions in applied mathematics such as: game theory, programming, queuing and some others is an economic reality.

The development of highly professional knowledge of various specialists in the field of economics and management contributes to the knowledge of many mathematical methods and this is primarily a characteristic element of development. It is cadres who are users of various analytical tools created by mathematics, therefore, it is necessary to teach them mathematics as users, and not as mathematicians, explaining to them the essence of mathematical terms.

For economic analysis, statistical calculations, organization of various in-house self-financing and reduction of turnover of enterprises and organizations, matrix methods are increasingly used in economic practice, due to the simplicity of their formulas and rich economic content. Mathematical economics is a form of economics that uses quantitative methods to describe economic phenomena.

Although the economic discipline is strongly influenced by the bias of the researcher, mathematics allows economists to accurately identify and test economic theories on real data. Economic policy decisions are rarely made without mathematical modeling to assess their impact, and new articles on economics are rarely published without some mathematical elements.

Mathematical economics relies on defining all relevant assumptions, conditions, and causal structures of economic theories in mathematical terms. This provides two main advantages. First, it allows theoretical economists to use mathematical tools such as algebra and calculus to describe economic phenomena and draw accurate conclusions from their basic assumptions and definitions. Secondly, it allows economists to apply these theories and conclusions so that they can be verified empirically using quantitative data and, if confirmed, used to make quantitative forecasts on economic issues in the interests of enterprises, investors and politicians.

Until the end of the 19th century, economics relied heavily on verbal, logical arguments, situational explanations and inferences based on anecdotal evidence to try to understand the economic phenomenon. Economists often struggled with

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competing models that could explain the same recurring relationship, called an empirical pattern, but could not definitively quantify the size of the relationship between the central economic variables.

At that time, mathematical economics was a deviation in the sense that it offered formulas for quantifying changes in the economy. This has returned to the economy as a whole, and now most economic theories contain mathematical proofs of one kind or another.

When it comes to merging mathematics and economics, econometrics appears. Econometrics attempts to turn abstract economic theories into useful tools for everyday economic policy by combining mathematical economics with statistical methods. The goal of econometrics in general is to convert qualitative statements, such as "the relationship between two or more variables is positive," into quantitative statements, such as "consumer spending increases by 95 cents for every dollar of increase in disposable income."

Econometrics is especially useful when solving optimization problems, when, for example, a policy developer is looking for the best setting from a number of settings to influence a specific result. As more and more information floods us, econometric methods have become ubiquitous in the economy.

Critics warn that mathematical economics can conceal, rather than clarify, economic theory and create a false atmosphere of accuracy and confidence in both theoretical and empirical economics. The formulation of statements about economic theories in mathematical terms should always depend on the painstakingly precise definition of terms that are considered as quantities in a mathematical model.

Unfortunately, due to the unavoidable fact that economic phenomena always include subjective and unobservable elements that take place in the human consciousness of the studied economic agents, such an exact definition is never completely impossible in economics. This inevitably leads to ambiguity of interpretation and falsification of factors that cannot be easily fitted into a mathematical or econometric model.

Such ambiguity and falsification is exactly what economic mathematical practice is trying to avoid in its quest to give tough and accurate answers to the questions of decision makers and politicians. At best, this dramatically limits the level of confidence in the conclusions obtained in this way, and at worst, complex mathematics can be used to conceal fundamentally misleading results and conclusions.

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As a result, economists and those who rely on them as experts and authorities tend to gloss over these issues in the interests of confidence and certainty, promoting their preferred economic explanations and policy prescriptions.

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