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Research on the Mathematical Application in Economics

Shurui Yu[1,a,*]

[1]*Shenzhen College of International Education, ShenZhen, Guangdong, China, 518043*
a. s21898.yu@stu.scie.com.cn
**corresponding author*

Abstract: In the field of economics, the research and description of the basic laws of economic operation and economic phenomena should be fully combined with the current relevant mathematical ideas and methods to ensure the standardization and scientificity of the entire economic operation. Mathematics belongs to an important theoretical discipline, which is abstract and logical, and also belongs to a strong tool discipline. Through the analysis of mathematical learning and the actual attributes of economics, we should use certain mathematical methods to carry out quantitative and qualitative analysis on the knowledge points of the whole economy, so as to provide important tool resources for the development of economics. At present, mathematics has become an important part of life, and the relationship between mathematics and the economy is becoming more and more close. In real life, many economic problems need to be solved with mathematical knowledge. This paper summarizes the important role of numbers in economics, and analyzes their specific applications, so that we can have a deeper understanding of mathematical knowledge. In the field of economics, the research and description of the basic laws of economic operation and economic phenomena should be fully combined with the current relevant mathematical ideas and methods to ensure the standardization and scientificity of the entire economic operation. Mathematics belongs to an important theoretical discipline, which is abstract and logical, and also belongs to a strong tool discipline.

Keywords: economic operation, mathematics, mathematical methods

1. Introduction

As a discipline to explore spatial models, numerical measurements, structures and changes, mathematics is well known. In the development process of mathematics, the main characteristics of contemporary mathematics are the mutual penetration between its internal parts, the mutual penetration between it and other disciplines, and the advent of electronic computers [1]. Mathematics observes the shape and operation of objects, calculates and measures them, and abstracts them for processing and logical reasoning. It has deeply and widely penetrated into all fields of social science, and the role of mathematics in economics is even more unusual. It has expanded the breadth and depth of economics and provided a scientific methodology for its breakthrough development. The research questions in this paper mainly include the importance of applying mathematics to economics, how to make economic research more rational, and the position and role of mathematical methods in economics. With the help of mathematical thinking,

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we can make the relevant research objectives of economics and the actual relationship between economic variables more clear, and then improve the standardization and preciseness of the implementation of logical reasoning so that the resulting theory will be more clear and explicit, so as to moderately reduce the probability of the occurrence of uncertain factors and meet the actual development needs of economics. For example, in economics, elastic analysis, cluster analysis, an economic growth model, marginal analysis, regression analysis, and other knowledge points have been widely used, and these knowledge points are used to explain and solve economic problems with mathematical methods.

2. The Necessity of Applying Mathematics to Economics

2.1. The Inevitable Requirement of Economic Development

Mathematics plays a more and more important role in economics, and the mainstream of economic research is inseparable from mathematics. In addition to the special issue of the annual meeting of the American Economic Association, almost every article in internationally renowned economic magazines, such as the American Economic Review, contains mathematics [2]. Since the promulgation of the Nobel Prize in Economics in 1969, there have been many winners who do not use mathematics, but the number is much smaller. As of 2007, the Nobel Prize for Economics has been issued for 39 times, with 62 winners, while only 5 economists do not use mathematics at all.

Before neoclassical economics, from the 1930s, some scholars adopted mathematics; During the period of marginal revolution, mathematics was further used; However, after the neoclassical economics, the application of mathematics in economics has been strengthened in at least three different aspects: first, the development of econometrics and its role in empirical research of economic theory; Second, the development of mathematical economics; Third, game theory rewrites economics. From the perspective of linguistic economics, the mathematical instrument is only a language for expressing economic thoughts or principles [3]. It must conform to the principle of economy, that is, the least or the most concise language should be used to express the same thoughts or ideas, and as many views or ideas as possible should be expressed under the same language and words. To be sure, as a practical tool, mathematics plays an irreplaceable role in explaining economic theory. For example, marginal analysis, a tool originated from calculus, is widely used in the research fields of economics such as econometrics, macroeconomics, linear analytical programming, etc. Through this example, we can draw a conclusion that it is essential to flexibly apply mathematical principles when elaborating economic theories. As a tool for demonstration, analysis and research, whether mathematics can produce effective results depends on whether there are errors in the mathematical theory applied in the economic field. Although mathematical methods can help the development of correct theories, they may also become the cornerstone of wrong theories. Therefore, the application of mathematics in economics must be cautious and not trifle with. In the field of economics, the research and description of the basic laws of economic operation and economic phenomena should be fully combined with the current relevant mathematical ideas and methods to ensure the standardization and scientificity of the entire economic operation. Mathematics belongs to an important theoretical discipline, which is abstract and logical, and also belongs to a strong tool discipline. Through the analysis of mathematical learning and the actual attributes of economics, we should use certain mathematical methods to carry out quantitative and qualitative analysis on the knowledge points of the whole economy, so as to provide important tool resources for the development of economics.

Today, in the process of economic development, people's knowledge of economic theory has been constantly improved, and their economic awareness has been constantly enhanced [4]. Facing the test of the new era, when carrying out research on economic knowledge, if only the past words

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are used to express and implement speculative reasoning, the standardization, preciseness, logical consistency, etc. of economic discussions cannot be fully guaranteed, and the accuracy, precision, etc. of conclusions cannot be guaranteed, This is not conducive to the accuracy of economic knowledge points.

2.2. Make Economic Research and Reasoning More Accurate and Rigorous

A series of behaviors and breakthroughs in the field of economics are closely related to mathematics. The transition from classical economics to new classical economics, as well as from the marginal revolution to the Keynesian revolution, is critical to the application of mathematical knowledge [5]. Applying mathematical knowledge points to the field of economics can clarify the close relationship between economics and mathematics, which also has a great impact on people's economic thinking and thinking mode, making people more quantitative in their behavior and thinking. Mathematics is a rigorous and logical discipline. When many people use language to express logical relations, it often happens that the language is not rigorous, making the whole mathematical thinking full of holes. In the face of such problems, it is necessary to transform the less rigorous written language into professional mathematical language in a timely manner under the condition of economic exchange and discussion. When using mathematical language, it makes the language more concise, rigorous, and more accurate and precise in expression.

2.3. The History of the Application and Development of Mathematics in Economics

The development of mathematical economics in the 20th century was driven by many events. Among them, the most important may be the proof of the general economic equilibrium theory. After Vallas put forward the general economic equilibrium, he did not give an accurate mathematical proof. Since then, many scholars have devoted themselves to proving the theorem. In the West, many economists have tried to apply a lot of mathematics to economics. They just hope to explain the world in a more explicit way, and they hope to develop western modern economics into a more accurate science. In general, the application of mathematics in economics can be divided into three different stages: before the marginal revolution, mathematics began to be used in economics; Between marginal revolution and neoclassical economics, mathematics began to show its importance in economics; After neoclassical economics, mathematics has been widely used in economics. In the economic system, the earliest examples of the application of mathematical methods are believed to be the Political Arithmetic by Petit in the middle of the 17th century. But in fact, it was in the middle of the 19th century that mathematics and economics were really closely linked. In other words, in the middle of the 19th century, the application of economics to mathematics began. After the middle of the 19th century, the trend of mathematization of economics began to appear, and the field of economics began to accept the all-round penetration of mathematics. In particular, differential calculus and other advanced mathematics have been integrated into the field of economics.

After the 1960s, Deborah applied the axiomatic method of mathematics to economics, opening up a wider range for the application of mathematics in the field of economics. However, economics constantly puts forward various problems to mathematics according to its own needs. In 1969, a great event happened, that is, the establishment of the Nobel Prize in Economics, which effectively promoted the mathematization of the economy. After careful observation, it is not difficult to find that more than half of the people who have won the Nobel Prize in Economics are economists or mathematicians who have studied mathematics. From 1969 to 2006, a total of 58 mathematicians or economists won the Nobel Prize in Economics. They have one thing in common, they basically

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combine economics and mathematics effectively, and develop modern economic theories through some mathematical tools and methods.

For example, the first Nobel Prize in economics was awarded in 1969 to Norwegian economist Frisch and Dutch economist Dimbergen [6]. They effectively used dynamic models in the process of analyzing economic activities and created econometrics. In addition, Tymbogen also put forward the famous "cobweb model" and successfully completed the dynamic analysis through the difference equation, and used mathematical methods to verify it in the cyclical movement of the capitalist economy.

From the perspective of the development of mathematical application in economics, mathematics either deepens economic research or facilitates the expression of economic theories, propositions and hypotheses. The development of economics from the primary to the intermediate to the advanced has deepened and refined the process of research questions and argumentation, because only by using mathematics as a tool for reasoning and expression can we more accurately and deeply explain the theory and proposition of economics. From the perspective of people's acceptance of the mathematical language of economics, it also reflects the function of mathematics as an economic language for communication and transmission of information. Language has network characteristics; that is, with the gradual increase in the number of recipients, its role will become greater and greater, and its effectiveness for the recipients will also become greater and greater. When Cournot first used mathematical language to express wealth theory, no economist accepted it. It was because other economists did not know Cournot's mathematical language to express economic theories and ideas; At the time of the marginal revolution, Menger, Vallas and Jervens used mathematics in economics. Although most economists did not use mathematics, the degree of resistance was significantly reduced; After the 20th century, with the development of game theory and econometrics, Hicks published Value and Capital in 1939, and Samuelson published Fundamentals of Economic Analysis in 1947. There was less resistance and opposition; After the 1950s, more and more economists used mathematical language to establish economic models and analyze economic problems. Mathematics became the tool and language used by most economists, so that it was impossible to integrate into mainstream economics without using mathematics as a basic tool and language. To publish papers in the world's top economic journals, mathematics must be used as a tool and language. Thus, economics has become inseparable from mathematics.

2.4. The Role of Mathematical Methods in Economics

In terms of breaking through the existing theoretical barriers in economics, mathematical methods have made great contributions. It can not only promote the research of economics, but also show the scientific methodology for it. As one of the important tools for analyzing economics, mathematical methods play an extremely important role in updating economic theories. As a methodology or tool, mathematical methods are indispensable, whether in simple operational algebraic expressions, in many applications of higher mathematics in mathematical economics, or by reference to econometrics, or even in the close relationship between modern economic theories and modern mathematics. Through the application of mathematical methods, we can get the economic theories that can not be described by specific words and language, thus breaking through the existing economic theories.

First of all, through the application of mathematical methods, the breadth and depth of the economic discipline have been improved, and the process of its analysis and reasoning has become rigorous. Mathematics has been widely used. However, due to the application of mathematics in economics, emerging disciplines such as probability theory and mathematical statistics, econometrics, stochastic processes, time series analysis, numerical analysis and optimization theory

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are emerging in endlessly. Therefore, mathematical methods can greatly extend the economic discipline. In addition, generally speaking, the expression of words is often uncertain and fuzzy, while the mathematical expression is more definite and accurate. When analyzing economic problems, the combination of economic and mathematical models will make the logical analysis and reasoning process more accurate.

Secondly, the qualitative analysis of economics is carried out with mathematical methods. The rise and development of non-linear economics has opened up a new field of qualitative analysis of methods in economic research, indicating that the instability of the market economy and the complexity of economic behavior are the essential manifestations of economics. The application of fuzzy mathematics has produced a mathematical method of fuzzy decision-making that can combine human knowledge and experience. It can computerize complex problems through mathematical modeling and become a powerful tool for economic research. Thus, the essence of economic phenomena can be revealed and grasped by people through quantitative mathematical analysis.

Finally, through the application of mathematical methods to make economic policy scientific and economic theory practical, because mathematics is logically rigorous, the conclusions of economics are generally clear. For example, the relationship between various economic factors can be clearly and intuitively expressed through a simple formula, so that the quantitative relationship between economic variables can be analyzed and used as an effective basis for formulating new economic policies.

5. Conclusion

For economic research, mathematics plays a very important role in the derivation of propositions or hypotheses, because the logic of mathematics is very strict, but as a tool or rational logic, mathematics is different from the real objective world. In mathematical economics, game theory and econometrics, there are a lot of assumptions. For example, game theory assumes that all Boben subjects are homogeneous and completely rational. Under this assumption, all subjects are the same as "lifeless", "irrational" or "unable to exist individual rationality" objects in nature, which is really applicable to the research of natural science. However, it is also a question of how applicable or to what extent the rational thinking ability is to individuals with differences in the study of the complex world. However, it is also a question of how applicable or to what extent rational thinking ability is to individuals who differ in their approach to studying the complex world. As a result, economics derived or expressed in mathematical language inevitably deviates from reality, and the use of mathematical language is critical for research, discovery, and expression of economic propositions or hypotheses, so a trade-off must be made, that is, the distortion of economic real propositions or hypotheses caused by mathematics must be weighed against the importance of mathematics to the derivation or discovery of economic propositions or hypotheses. In fact, it also reflects that the problem of how to select or apply mathematical language in economics also requires economic analysis. As both a tool and a method, mathematics has been widely used in the study of economics. Chinese economists are also increasingly adopting mathematical methods. But after all, mathematics is only a tool and a language of economic expression and reasoning. Its application in economics must also implement the basic principles of economics, namely, saving, allocating limited time and resources to the most efficient place, rather than using mathematics without limitation and purpose, let alone mathematics for mathematics. Otherwise, it will be divorced from the original purpose of economic research. Economics is a practical science, which serves to explain practical problems and predict the future. If economics is divorced from the basis of reality, it will violate the basic principles of economics. As a discipline to explore spatial models, digital measurements, structures and changes, mathematics provides a solid foundation for breaking

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through the existing theories of economics. In the process of economics marching towards science, mathematical methods will exist as an important means. At the same time, it can also make the economic policy scientific and the theory practical, and provide a solid theoretical support for China's economic development.

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