

CAN NEUROECONOMICS CHANGE THE TRADITIONAL ASSUMPTIONS OF RATIONALITY?

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ABSTRACT

Adam Smith included the human psychology factor in his book "Wealth of Nations", which is accepted as the beginning of classical economics. Adam Smith also stated in his previous book "The Theory of Moral Sentiments" that the human psychology factor is not only the field of psychology but can also be subject to other fields such as economics. Traditional economic theory assumes that individuals make rational choices. However, when we examine the behaviours of the individuals, we see that individuals react to events mostly irrational and these differ from individual to individual since decision-making processes are affected by many biological mechanisms such as brain regions, neurons and genes. Even representatives of neoclassical economics, which use the concept of rational choice as an assumption have included psychological assumptions many times in their work. When we come to the beginning of the 21st-century psychologists and economists who study the development of psychology, neuroscience and decision-making have come together in a joint field of study. First, behavioral economics and then experimental economics, where both can be accepted as a sub-branch of economics, emerged. In the years following the development of these two fields, the field of neuroeconomics was born, whose purpose was to examine the neurobiological processes that affect decision-making. Neuroeconomics is an interdisciplinary field that brings together economics, psychology and neuroscience and aims to turn human behavior, specifically decision-making behavior, into a theory. Neuroeconomics, together with behavioral and experimental economics, tries to explain the points that classical economics cannot explain with the help of psychology, which classical economics ignores, but whose effects have a great impact on human behavior and can change the decisions taken. In this study, we firstly summarize the evaluation of neuroeconomics and then state our expectations about the future of neuroeconomics on the economy in the new world order of the 21st century.

Key Words: neuroeconomics, decision-making processes, behavioural economics, experimental economics

Jel Codes: D87, D90

1. INTRODUCTION

One of the most important assumptions of behavioural economics is that individuals are rational and almost all the theoretical papers are based on this assumption. However, there can be a debate whether changing this assumption by techniques of neuroeconomics can improve the analysis. The point is that one can remove this assumption and look at the individual psychological effects to build the theory of behavioural economics in an alternative way.

Early economists like Fisher, Edgeworth, and Ramsey dreamed of a "pleasure meter" that could detect physical signals, but they could not succeed in this (Colander, 2008). If this could be done, it would help the field of neuroeconomics very much. With the beginning of the

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21st century economists and psychologists started to work together to build the basics of the neuroeconomics. One can realize Zak (2004) as the first paper which gives the definition of neuroeconomics. In that paper, firstly interdisciplinary character of the field is mentioned and then the aim of the field is put as to understand neural basis of economic decisions.

Of course, technological developments of the period were very important for the field to improve. There was not a “pleasure meter” but equipment that determine which area of the brain is active in the process of decision making were invented. The relationship between mental and neural functions of people could be monitored and observed. In this process, although PET (positron emission tomography) was seen as an important method to examine the relationship between neural movements and mental functions, it was insufficient due to the need for radioactive material use. Later on, FMRI (functional magnetic resonance imaging) which was a tool that can monitor brain activities without intervention when people are busy with a cognitive task had emerged (Demirel & Artan , 2016).

At this point, the importance of the need for experimental economics should be mentioned. In order to observe the individual decisions, experiments should be desined cerefully for several different economic questions of interest. By using the technology mentioned in the perevious pharagraph data can be collected as a result of the experiment designed. Analysis of behaviours with this data can remove the assumption of rationality which is basic for most of the economic theories.

The aim of this paper is to see what exists in the fields of neuroeconomics, behavioural economics and experimental economics in the literature and to try to understand the fields in a better way for a further project in mind which is to design an experiment. The preliminary investigation gave the information of the possibility to reach the necessary equipment for measurements of brain activities in Şehir Hospital which is the application hospital of the Ankara Yıldırım Beyazıt University. This is encouraging and exiting. Moreover, as can be seen in the literature review part, there exists no experiment design paper in the literature so the forthcoming project will fill a big gap in the area.

2. LITERATURE SURVEY

In order to see what exists in the literature related to neuroeconomics, behavioral economics and experimental economics a literature survey had been done and the outcome is presented in this section in chronological order.

Posney in his 1998 study stated that there is a two-way relationship between economics and neurology. First route is from advances in neurology to the analysis of the axioms of mathematical economics on human behavior. Second route is from the mathematical models of individual behaviors developed by Game Theory to cognitive neurology.

In their 2004 study, Glimcher and Rustichini state that although completeness is uncertain, there are significant fruits of neuroeconomic approaches that combine natural and social scientific approaches to the study of human behaviour.

Neuroeconomics suggests three implications for economic behavior, according to Camerer (2005). First, it interprets the mechanism that enables rational choice in terms of issues that ensure the continuation of vital activities. Second, supporting data and parameters

in the initial phase of behavioral economics. Third, to reveal implicit and incomplete data about rational choices that are not properly emphasized.

Camerer et. al (2005) stated that although most economists view neuroscience with suspicion, some neuroscientific regulations in economic theory will help explain some of the current anomalies that have been debated especially for decades.

McCabe (2006) stated that knowledge about how the brain interacts with its environment in generating economic behaviour will enable researchers to better understand the differences among individuals and their decision-making processes and, consequently, to better predict economic behaviour.

Camerer (2007) reports that the purpose of Neuroeconomics is to understand how the brain works in decision making and thinking.

In Camerer (2008) he says that Neuroeconomics has the power to combine the experimental paradigms and statistical methods in economics to measure a range of neural and cognitive activities that economists like Edgeworth, Fisher, and Ramsey have planned but failed to realize.

In his critical approach to neuroeconomics, Harrison (2008) stated that although he is reluctant to include the data of neuroscience in economics, still it can be useful for the future of economics.

In 2009, Glimcher stated that neoclassical economics dominated the 20th century, and thus psychological analysis was substituted by mathematical equations and the ground for homo economicus was established.

According to Stanton (2009) neuroeconomists, behavioral and experimental economists can use methods and knowledge developed by psychologists, neurologists, anthropologists, biologists, geneticists, mathematicians, physicists and other experts.

Soydal et. al (2010) look at the issue from a country perspective. They mention that the concept of neuroeconomics will bring many benefits to countries and thus become a very important element. They concluded that countries that can review and implement the practices of neuroeconomics can gain a competitive advantage in many areas on international platforms.

Kent (2011) states that the methodology and techniques used by Neuroeconomics were unimaginable in the recent past. She mentions that Neuroeconomics will facilitate the developments in economics and will lead to the development of new models. In this way, the rational individual in economics will be able to get rid of the narrow patterns of the theory and develop the theoretical infrastructure that includes the behaviour of the individual in the real world.

Çiftçi (2017), includes various studies about the current situation, trying to explain why human behaviours can be distinguished from the rationality proposition.

İskender (2019) concluded that the science of economics should not be evaluated independently of psychology and that economics, which does not take psychology into account, will be insufficient in explaining important processes, and therefore researchers should evaluate economics and psychology together while examining individual behaviours.

Serra (2020) evaluated the approaches of economists to neuro-economics and emphasized the fact that knowing and explaining the reasons behind economic behaviour could be beneficial for economic analysis. Although many economists are skeptical towards

neural sciences as they are towards behavioural economics, it has been stated that there are unexplained aspects of economic decision-making processes, and these points can be elucidated with the help of this science.

3. BEHAVIORAL ECONOMICS AND EXPERIMENTAL ECONOMICS

Before examining neuroeconomics, it is useful to examine behavioral and experimental economics, which we can define as the source of this field. The term behavioral economics was first used in 1958 by Harold L. Johnson in his study "Exploration in responsible business behavior: An exercise in behavioral economics". There, he wanted from economists to use psychology in their theories (Angner & Loewenstein, 2006).

Demirel and Artan (2016) gives Richard E. Hattwick's definition of behavioral economics. It is a reaction to the limiting assumptions of the marginalist revolution and seeks to reveal realistic assumptions about the behavior of economic agents.

Simon's 1955 study of "A Behavioral Model of Rational Choice" has an important place in the behavioral economics discipline. He states that universal rationality is not possible so the understanding of rationality in traditional economic theory should change. In 1957, he introduced the concept of "Limited Rationality". According to this concept, individuals cannot always come up with logical solutions to the problems they face because they have limited time and mental power. Therefore, individuals should not always be expected to behave rationally (Tekin, 2016). Colander (2004) is another name who uses the term limited rationality.

In 1971, "Journal of Behavioral Economics" began to be published, which one can associate with the development of behavioural economics. The first scientific conference on behavioural economics was held at Princeton University in 1983. We can consider the publication of the "Journal of Economic Behavior and Organization" in 1980 and the "Journal of Economic Psychology" in 1981 as steps of the institutionalization of new behavioural economics. The realization of the conference "Behavioral Findings of Economic Theory" has great importance in the development of behavioural economics.

Physics, astronomy, and quantum static linear are some of the sciences which one can see the effects of them on economics. As a first example, the power laws of engineer V. Pareto can be given. These take the name Pareto optimal-equilibrium, or Pareto efficiency in economics. A second example is Samuelson. He studied classical physics and applied optimization techniques to the concept of maximization. Thirdly, Cobb's concepts can be mentioned as Cobb-Douglas production function is widely used in economics.

One can say that the basis of neoclassical economics is the application of thermodynamics to economics. Leon Walras and Irving Fisher's application of the first law of thermodynamics to economics can be given as an example.

From these examples, one can conclude that economics is not an isolated science. In this context, behavioral economics is related to psychology and neuroeconomics is very much connected to behavioral economics.

The first experimental study was in the field of marketing during the 1940s conducted by Edward Chamberlain with graduate students at Harvard University. Later, Vernon Smith repeated the experiment of Chamberlain with some modifications. Experiments can also be

applied to behavioral economics. The aim is to improve the explanation and predictive power of behavioural theories by testing with field and laboratory experiments (İskender, 2019). Recent experimental economics results showed that the rationality assumption is not valid (Eren, 2009).

In 1986, the Economic Science Association, which consists of economists using experimental methods, started its work under the leadership of Vernon Smith. Studies of experimental economics have received support from neurology over time. Economists from these two sciences, which interact with each other, have used neurological techniques to examine decision-making issues, while neurologists have used economic games to understand how the brain works. This common discipline has been called neuroeconomics.

4. WHAT IS NEUROECONOMICS?

Modern economics emerged with the influential book of Adam Smith named "The Wealth of Nations" in 1776. Adam Smith included the human psychology factor in his book "Wealth of Nations". Mark Skousen (2011) defines this study as a declaration of economic independence. Adam Smith also stated in his previous book "The Theory of Moral Sentiments" that the human psychology factor is not only the field of psychology but can also be subject to other fields such as economics. It is possible to see the effects of psychology even in the masterpiece of classical economics. Adam Smith also argued that economic individuals are rational in "The Theory of Moral Sentiments" published in 1759. In the same book, we see that Smith argues that individuals are rational, and thus he contradicts himself by ignoring the impact of human psychology on the economy. By individuals being rational he means that they try to maximize their own interests, emphasized sympathy and self-love. In addition, although he states that economic progress and wealth are the prerequisites of sympathy and philanthropy, it is possible to see Smith's thoughts on human psychology in the "Wealth of Nations" (Çiftçi, 2017).

Traditional economic theory assumes that individuals are rational and make rational choices. However, when examined, one can observe that the behaviours of individuals are not rational. Individuals react to events mostly irrational and different from each other (Skousen, 2011). Rational decision-making processes are affected by many biological mechanisms such as brain regions, neurons, genes (Koshovets, Olga & Varkhotov, Taras, 2019). This new field, which emerged with the inclusion of neurons and genes in economic studies, is called neuroeconomics.

Kent (2011) defines neuroeconomics as an interdisciplinary field that includes neurology and measurement techniques of decision-making processes. Since the human brain should be examined in neuroeconomics, this is a new direction in economics. It has connections with behavioral and experimental economics. Neuroeconomists monitor which parts of the brain are active in different decision-making processes and examine the interactions of these parts within the system, what their functions are and how they bring results to different problems (Kent, 2011).

Traditional economics assumes rationality for every individual in the society. However, neuroeconomic focuses on individual decisions (İskender, 2019). Ceteris Paribus assumption

of traditional economics loses its power but examining the background of individual behavior becomes more important.

5. EMERGENCE AND DEVELOPMENT OF NEUROECONOMICS

Neuroeconomics was firstly mentioned by neoclassical economics during 1930s. Milton Friedman stated that individuals do not act in accordance with rationality during 1950s. In the 1980s Daniel Kahneman expressed the inadequacy of the expected utility theory (İskender, 2019). The important names of 1990s are Paul W.Glimcher, Colin F. Camerer, Ernst Fehr and A. Russel Poldrack. Although economists such as Simon, Leibenstein and Katona questioned the limits of rationality and emphasized the importance of psychology in the second half of the 20th century, they were unable to change the direction of economics.

There are various meetings where developments in neuroscience and future of neuroeconomics are discussed. The meeting held by Colin Camerer and George Loewenstein in 1997 at Carnegie-Mellon University can be regarded as the first meeting where interdisciplinary interaction was achieved. Then, two more meetings were held in 2001. The meeting held in Squaw Valley focused on the cooperation of economics and neuroscience. This meeting was held by the Gruter Law Foundation. In the same year, the other meeting held at Princeton University by neuroscientist Christina Paxson and economist Jonathan Cohen constitutes the beginning of today's "Society for Neuroeconomics" and this meeting focused on the question of how neuroeconomics should follow from now on. According to Paul Zak, the first meeting that can serve as a basis in neuroeconomics was held by Greg Berns of Emory University in the fall of 2003. This meeting stands out with the fact that approximately one-third of the 30 researchers attending the meeting have a doctorate in economics, one third have a doctorate in neuroscience, and the rest are medical doctors (Demirel, Selim K. & Artan, Seyfettin, 2016).

6.CONCLUSION

The assumption of rational individual behavior is the basis for almost all of the theories of behavioral economics. However, it can be possible to relax this assumption and search for individual personalized reactions while building the theories. This can be done by using the methods of neuroeconomics.

In this context, in this paper, an investigation had been done to see what exists in the literature in the fields of behavioral economics and neuroeconomics. The purpose of this investigation was to see whether there exists an experimental design which provides individual reaction data. The search showed that there exists no such study. This is an important gap for the fields which should be filled.

The preliminary investigation for the possibility of designing an experiment gave encouraging and exiting outcomes. The necessary equipment for measurements of brain activities were valid in Şehir Hospital which is the application hospital of the Ankara Yıldırım

Beyazıt University. The contact with the personnel showed that it could be possible to use the equipment.

Therefore, the results of the investigations presented in this paper opened the platform for a further study which is an experiment. Some behavioural economics subject will be chosen. For that subject, a careful experiment design will be build. Using the outcomes of the experiment a data will be formed. This data will be used in the application instead of rational expectations assumption. The answer to the question of “Can Neuroeconomics Change the Traditional Assumptions of Rationality?” might be “yes”.

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