THE “RATIONALITY” CRITERIA IN DECISION MAKING THEORIES AND THE GAME THEORY

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Abstract

The decision-making process is a process explored by many different disciplines and handled in many different ways. This process, which is also the subject of economics, is discussed in terms of rationality criterion in economic literature. Some models considered that the decision-maker is rational, however some models rejected rationality. In this study, decision making theories are discussed in terms of rationality, and the Game Theory, which is a phenomenon, has been explained.

Keywords: Game theory, Decision making, Financial Decision.

1. Decision Making

Some of the theories of economics and finance describe human as "a rational being with full knowledge". But oppositely some of them describe as “irrational or limited rational” being. In particular, there are many different theories about decision making in conditions of under uncertainty. These theories are basically divided into two main headings. The first of these; traditional financial theories that emphasize investor rationality; Secondly; behavioral finance theories that advocate that decision makers remain under the influence of many prejudices (Sezer, 2013).

In traditional financial theories, the investor's behavior is generally rationality-based. The main objective of the investor is; to increase the wealth. When making financial decisions, he only takes into account the risk and return of alternative investment. Behavioral finance theories take into account that the investor is a human being. Therefore, the individual may be affected by rumors, emotions, behaviors of others and many other things in the market. Demirel and Günay

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(2011) stated that risk perception was affected by demographics such as gender and age in their study with university students. Therefore, the individual may not only be interested in risk and return.

Traditional and behavioral finance theories also differ in explaining investor behavior. Statman (2014) says, “Behavioral finance works on normal people like you or me. In standard finance, however, there are rational people. Normal human is not rational. In fact, we are mostly intelligent and sometimes have normal intelligence. But sometimes we become normal-stupid, managed by misleading emotions such as cognitive errors, exaggerated fears, unreal fantasies or overconfidence. In the same study, standard finance and behavioral finance are discussed in terms of some of their main characteristics as follows;

The four basic concepts of standard finance are: Human is rational, markets are efficient, people should organize their portfolios according to the rules of portfolio theory and the expected return on investment is characterized by the standard asset pricing theory. Also, the differences in expected returns are explained only by the differences in risk.

The four basic concepts of behavioral finance are: human is normal. Markets are not effective even if it is difficult to defeat them. People should organize their portfolios according to the rules of behavioral theories. The expected return on investment is characterized by behavioral asset pricing models. The differences in expected return are explained by more than just the differences in risk.

In traditional theories and behavioral theories, the subject matter is basically decision-making behavior under uncertainty. The theory of rational decision making under uncertainty was first formulated by Savage (1954) and required to determine the probabilities for possible outcomes and to rank the expected values of these results. The decision maker chooses the highest expected benefit from the alternatives (Samuelson and Zeckhauser, 1988).

1.1. **Rational Human-Based Models**

The theories of traditional finance are generally the theories that accept the individual as rational, in other words, the assumption is that “the individual will always act rationally”.
According to these theories, when an individual will make a financial decision, he will not be affected in any way by his feelings, his environment, his family, the media and makes his decision only by the financial calculations.

In traditional finance, the investor is also acting rational. According to Barberis and Thaler (2002), rationalism has two meanings. First, when new information is received, thoughts and expectations are updated as stated in Bayes Law; secondly, normative choices are made within these expectations consistent with Savage's Subjective Expected Benefit idea.

According to traditional financial theories, individual investors, who are free of their emotions and feelings, act in such a way that the prices of financial assets are equal to the present values of the cash flows expected from them in the future (Baker and Wurgler, 2007). Furthermore, according to the traditional theories, rational people creates more efficient markets. The issue of efficiency of markets shows itself as the Effective Markets Hypothesis in the financial literature (Fama, 1970).

The development of traditional finance has been began with the "Modern Portfolio Theory” developed by Hanry Markowitz in 1952. With his "Mean-Variance Model”, Markowitz presented the concept of risk mathematically (the standard deviation of an asset's return rate) and emphasized that the risk could be reduced at a certain level of return through diversification in the portfolio. The model, which is based on “Random Walk Theory”, states that the investors are rational, prefer low risk to high risk and high return to low return. After 1960, various asset pricing models began to develop. Sharpe (1964), Lintner (1965), Mossin (1966) Black, Treynor and many scientists have contributed to the development of Financial Asset Pricing Model. In the following years, the Arbitrage Pricing Model by Ross was introduced into the traditional financial literature in 1976 (Kıyılar, Akkaya, 2016).

1.2. **Investor Behaviour- Based Models**

Individuals sense the natural and social environment through which they live through the nervous system and transform the information they receive from this environment into a decision
or action (Abaan, 1998). Therefore, it is possible to talk about the effects of the natural and social environment that individuals experience in decision-making processes.

As Loizou mentions in his book which named as “Devil’s Deal; An Insider Tale of How Money Is Made” people may exhibit different investment behavior in different socio-cultural environments in different age groups. For example, if a stock investor is elderly, he will want to have a regular income and prefer to gain profit stock instead of capital gain. He won't take too much risk. Also, the environment in which an individual grows in can be decisive in this regard. For example, if a person have been raised by a gambler, his attitude towards risk will be different, but the attitude of another one whom has been raised by someone who worked in the same public office for forty years may be different (Loizou, 2012, Çeviren Şenerdi, 2015).

Most of the decision models based on investor behavior are related to psychology and sociology. Many psychologists have investigated how people behave in different situations and how they respond to different stimuli. Similarly, many sociologists have done similar research and have investigated the reactions of human, as the smallest unit of society, to social incidents. The effects of these reactions on financial behaviors of individuals are just beginning to be investigated in Finance. As it became clear that traditional finance was unable to answer some questions, “investor behavior” attracted the interest of investment gurus and academics and it has been a popular topic that has been frequently debated in recent days.

Among the models based on investor behavior, the most cited are the “Expectation Theory” and “Behavioral Portfolio Theory”. The Theory of Expectations is a theory that explains choice under uncertainty and is opposite to the Expected Utility Theory. Expected Utility Theory focuses on asset level, while Expectation Theory focuses on changes in asset (Ritter, 2003). Markowitz (1952) proposed the optimal portfolio theory with the assumption that investors avoided the risk to create an optimal portfolio that would maximize wealth and benefit, while Shefrin and Statman (2000) stated that investors' attitude towards risk was not as constant as Markowitz's assumption and proposed their theory “Behavioral Portfolio Theory” instead of it (Amirshahi and Siahtiri, 2010).
2. **Game theory**

Game Theory is a formal theory used in decision-making when a number of players have to make a choice that has the potential to impact other players (Turocy and Stengel, 2001). Game Theory is a discipline that examines the process of sharing the resources of many decision makers in an environment where resources are scarce (Uçan, Aytekin; 2013).

A study by Antoine Cournot in 1838 is one of the first known studies of game theory analysis. It was developed by Emile Borel in 1921 and by John von Neumann, a mathematician in 1928, as the 'Saloon Games Theory” in 1950, John Nash stated that finite games always have an equilibrium point and that they will act by observing the competitors options to gain the best results. The game theory was further developed between 1950 and 1960, and it began to become a theory used in war and politics and has been used in economic theories since the 1970s. It also found itself a place of use in sociology and psychology, linking these fields with evolution and biology (Turocy and Stengel, 2001). In 1994, John von Neumann and Oskar Margentern have introduced the game theory, which includes mathematical analysis of strategic decision making, into economics with their book named as “The Theory of Game and Economic Behavior”.

There are some assumptions of the theory that these hypotheses summarize why Game Theory is included in decision making models that accept individuals as rational. The basic assumption of the theory is that the individuals who participate in the game are rational and have all the information they have (Özel and Kılıç, 2008). Game theory is a theory that is used frequently in many areas, especially in economics. It is possible to mention three basic assumptions of the theory; individuality, rationality and interdependence. In the assumption of individuality, each individual will act only in his / her interests; the assumption of rationality shows that all individuals behave rationally; In the assumption of reciprocal dependence, it is stated that the welfare of individuals is partly determined by others. Particularly some of the assumptions of the theory are gaining importance as a technique used to identify the best strategies to deal with conflicting and competitive situations. In general, the following assumptions can be mentioned (Church and Ware, 2000):

- The number of players is finite and must be at least two players in the game.
• The players' interests conflict with each other, and each player chooses his own strategy for his own well-being. Alternative strategies are also finite.
• Each player is aware of all the strategies available to him and his opponent, but it is not known who will choose which strategy.
• All players also have simultaneous preferences, so they do not know what other players are choosing.
• The result of the game depends on the different moves of different players.
• After the game is over, each player receives a digital payment. This number may be negative when interpreted as a loss from the exact value of the number.

The most important example of game theory is prisoners' dilemma. According to the example developed by Albert W. Tucker (1983), two prisoners who are under arrest for the same crime and who does not know what each other is saying doesn’t know who confessed or who remains silent. At the same time, the prisoner who does not admit it is punished for ten years. When they both confess, they are both punished for five years. If both of them do not confess, they will each leave one year of imprisonment, just one year of punishment. It is possible to show this with a matrix as given below.

<table>
<thead>
<tr>
<th></th>
<th>Second Prisoner</th>
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<tbody>
<tr>
<td></td>
<td>Don’t confess</td>
</tr>
<tr>
<td>First Prisoner</td>
<td></td>
</tr>
<tr>
<td>Don’t confess</td>
<td>-1, -1</td>
</tr>
<tr>
<td>Confess</td>
<td>0, -10</td>
</tr>
</tbody>
</table>

*Table 1. Game Theory-Prisoners’ Dilemma*

Payments by the matrix are given by the pair (a, b) for each output; the payment of the first player and b; the second player's payment; -a and -b represent the years in prison. For a case where the first player uses the confession strategy, for example to determine a benefit function: u1 = (*, *). Utility function when the first player chooses confession and second player denial strategies will be stated as follows:
u1 (confession, denial) = 0 - 1 = u1 (denial, denial)

Benefit function when the second player chooses the confession strategy

u1 (confession, confession) = -5 - 10 = u1 (denial, confession)

In other words, which the second player chooses does not matter, the best strategy for the first player is confession. Confession strategy; for the first player is definitely a prisoner strategy. In the absence of any communication and coordination scheme, rational individuals are expected to play strictly dominant strategies because they certainly give a higher payout than a prisoner strategy. The solution to the prisoners' dilemma is therefore the pair (confession, confession) (Donduran, 2016).

**Results**

There are many studies in Finance literature on the investment behavior of individual investors, especially the conditions which they are at risk. The effect of uncertainty and risk on investment behavior was also searched by Kahneman and Tversky and they have proposed “expectation theory” to explain the notion. According to Kahneman and Tversky; deciding at risk can be seen as making a choice between expectations and gambling (Kahneman and Tversky; 1979). Although game theory is one of the most commonly used theories in the study of economic decision making in behavioral sciences, it actually supports the view that an individual dominantly seeks for his best interest which is coherent to the traditional doctrine established by Adam Smith. However, the provision of this benefit depends on the action plans of other players rather than the player's own strategy. In other words, the individual is as egoist as the classical economy predicts, but it will not be possible only with egoism to ensure its interests. That is, what strategy will be the best response to the strategy chosen by the competitor will determine the gain or loss of the individual.

According to decision models based on rational human being, the individual first wants to maximize his own interests and this is the factor that determines his next movement. According to these theories, the individual acting rationally is analyzed under certain assumptions. In game theory, the fact that the individual has to predict the behavior of other actors while creating his own behavioral strategy is based on the notion of behavior that rational
theories are not used to. In fact, this is the subject of the theory of rational theories in Economy literature. Thus, one of the basic assumptions of the theory is that all players are completely rational and have all the information that can be reached. This is also the basic assumption of classical economic theories. However, in a theory that the decision of the individual will depend on his behavior and also on the behavior of the other players, the assumption of rationality is still questionable.

The best decision can only be made by knowing the opponent's decision. However, in classical economic theories, full competition, perfect information, the desire to maximize individual interests, freedom of entry and exit to the market, decision-makers are considered to be rational individuals who make optimal decisions within the framework of data prices, without taking into account each other's behavior when making decisions (McCain, 2010: 1/13-20).

The criticism of the game theory is that the facts are simplified, and that human beings exist in real life, not in the laboratory environment when making a decision; another criticism of the theory is that the individual can usually choose two-choice strategies. However, individuals in real life have many opportunities for strategy. According to the assumption that the competing player may exhibit the most negative behavior, the game theory, which sees strategy monitoring as rational behavior, does not consider rational behavior as the options by which the players can win more together (Elibol, 2017).

While the questioning of the theories formed by rationality and the assumptions based on it, it is not unlikely that the game theory, which takes its place in many different subjects from individual relations to international relations, financial decisions to cold war, is considered to be one of the financial decision models based on behavioral approach and investor behavior.

References


