

The rationalist vs behavioral perspective

Michał Lewandowski

Theory of decision under objective uncertainty

A choice under conditions of uncertainty is a kind of individual choice, where choice consequences (also called payoffs) are not predetermined, but depend on the resolution of uncertainty, that takes place after the decision has been made. Such a choice is modelled by having consequences depend not only on the choice of an alternative but also on the occurrence of one out of several states of the world (also referred to as states of nature).

There are two types of uncertainty (Machina, Siniscalchi, 2014): subjective, in which the objective probabilities of individual states of nature are unknown or may not even exist, and objective, also known as risk (see Knight, 1921), in which these probabilities exist and are known to the decision maker. Uncertainty is represented by a random variable, called an act¹, which assigns elements from the set of consequences to elements from the set of states of the world. Objective uncertainty occurs when the measurable state space is a probabilistic space. Such uncertainty is represented by the probability distribution, of an act. Such probability distribution is called a lottery or a gamble. An act or a lottery are examples of elements of a choice set. The decision consists in choosing one element from a subset of the choice set. This subset represents the choices available in a given choice situation.

In order for the theory to be testable and falsifiable, it must be based on observable elements. Therefore, it is assumed in the classical decision theory that preferences are directly revealed via observed choices instead of being based on unobservable elements such as declarations or subjective feelings. The principle stating this is called the revealed preference principle. According to this principle, if the decision-maker chose element f from the subset F of the choice set, then, for each element f' from the set F , the element f is at least as good for him as f' .

The statement "at least as good as" is represented by means of a binary relation on the set of choices and denoted as \succeq . If the relation fulfills certain postulates/axioms, then it is called the preference relation. In the theory of decisions under the conditions of objective uncertainty (or risk, in short) it is assumed that decisions, and therefore also preferences, depend only on the probability distribution of payoffs and hence are independent of the states of the world in which payoffs occur. The preference relation is then a subset of the Cartesian product of the set of lotteries with itself.

Decisions under conditions of risk are thus formally modeled as a collection of lotteries and the preference relation defined on this set. Depending on the axioms, that reflect the rules that govern (the descriptive approach) or should govern (the normative approach) choices between lotteries, different theories/models of decision making are distinguished.

¹ Sometimes the term Savage act is used to distinguish it from the Anscombe-Aumann act, in which elements from the set of states are assigned probability distributions of a random variable. See Savage (1954) and Anscombe-Aumann (1963).

The Expected Utility Paradigm

The most widespread and best known is the theory of expected utility (EU theory). As a hypothesis, it was formulated by Bernoulli, D. (1738) as a way of resolving the St. Petersburg paradox posed by Bernoulli, N. (1713). The axiomatic representation of EU preferences was first proposed by von Neumann, Morgenstern (1944). The most compact formulation is that of Fishburn (1970). It is based on three axioms: weak order (the relation is full and transitive), continuity, and independence.

The EU theory was initially conceived as a cardinal way of measuring utility in the context of mixed strategies in zero-sum games, but quickly gained great popularity in economics – it has been adopted in the leading trends of economic modelling as the standard way to model decisions under conditions of risk. Many important hypotheses and models in economics are based on EU theory; examples are numerous across several disciplines of economics: hypotheses of permanent income (Friedmann, 1957) and rational expectations (Lucas, 1972) in macroeconomics; portfolio selection theory (Markowitz, 1952), Capital Asset Pricing Model (Sharpe, 1964) and the efficient market hypothesis (Fama, 1965) in finance; the theory of auctions (Vickrey, 1964) and models of asymmetric information (Akerlof, 1970) in microeconomics to name just a few most important examples.

The popularity of EU theory comes from the fact that it is a normative theory, i.e. one that describes how decisions should be made in a rational way. Axioms of this theory are treated as postulates of rationality in the context of decisions under conditions of risk. People whose behaviors are inconsistent with the axioms of this theory are susceptible to the acceptance of the so-called Dutch books (Yaari, 1985).²

The mathematical formalism of EU theory and its convenient properties, such as the linearity of the indifference curves, make the theory particularly easy to handle: the calculations are simple and it is possible to take into account various attitudes towards risk in a parsimonious way. A good illustration of this latter advantage is the fact that scientists almost unanimously accept the definition of risk aversion as one of the commonly occurring attitude towards risk and agree on the method of its measurement proposed by Arrow (1965) and Pratt (1964). At the same time, however, there is no consensus in the scientific community as to the definition and method of measuring risk itself (Aumman, Serrano, 2008).

Rationalists vs. behaviorists debate

The main weakness of the EU models stems from their normative nature and simplicity. Many decisions are not taken in a market-like environment, where consequences of any decision are easily verifiable, thus making it possible for the decision maker to realize his potential mistake and to correct it accordingly. It also turns out that there are factors beyond those included in the EU models that may have a significant impact on real decisions.

² A Dutch book is an equivalent of arbitration in decision theory. The Dutch book is a sequence of proposed exchanges that, if made, lead to a certain loss for the acceptor and a certain profit for the proposer, also known as the bookmaker. The decision maker is susceptible to Dutch books if you can construct a Dutch book that he accepts.

Starting from the classic Allais paradox (Allais, 1954) and ending with the Rabin's paradox (Rabin, 2000), over the years a great body of experimental data has accumulated that documents the alleged deviations of the observed behavior from that consistent with EU theory. If a given deviation of such kind is replicated repeatedly in various controlled experimental studies, in which the possible influence of third factors is limited, then such a result is commonly referred to as the EU paradox. It can be said that the behavioral trend in economics is largely based and motivated by the existence, discovery and explanation of the paradoxes of classical normative theory and in particular the EU paradoxes for decisions under risk.

The criticism of the standard approach in economics has triggered the reaction of scientists representing this approach. For simplicity, it can be assumed that nowadays there exist two views: the classical one, also known as normative or rational, and the behavioral one, also called descriptive or psychological. For the sake of simplification, from now on, we shall use the terms: rationalists and behaviorists.

A good illustration of the nature of the scientific debate between these two trends is the following. Based on the impressive amount of EU paradoxes, Rabin, Thaler (2001) declared that "expected utility is an Ex-hypothesis" and that they feel very much "like a customer in a pet shop beating away the dead parrot", alluding to the famous sketch from *Monty Python's Flying Circus*.³ While postulating the abandonment of EU theory, the authors call for the adoption of prospect theory (Kahnemann, Tversky, 1979, Tversky, Kahnemann, 1992, PT for short) as a theory that solves most of the problems of EU theory.

In one of the articles written in response to the aforementioned criticism of EU theory, Rubinstein (2006), using a fairy tale on the canvas of the biblical story of Adam and Eve in the Garden of Eden, tries to point out the flaws in the argumentation presented by behaviorists: he argues that the possibility of absurd conclusions drawn on the basis of reasonable assumptions (dilemma of absurd conclusions) is an inherent part of every economic model. According to Rubinstein, the model should be treated as a fairy tale rather than a detailed description of reality. And it is the moral that is the most important part of the fairy tale, not the fact that the story does not exactly match reality. Hence, the EU model giving absurd implication in some situations should not be the reason to abandon it. Otherwise, we would have to abandon all models.

The following question seems to lie at the heart of the dispute between behaviorists and rationalists: What qualities should a good model of decision-making have? Behaviorists believe that a good decision model is one that accurately reflects actual decisions, both in the sphere of assumptions, in the proposed mechanism for explaining the decisions as well as in the prediction of the decisions made. In the rationalist approach, the result rather than the assumptions and explanatory mechanism is the key. According to the classic "as if" principle, formulated by Friedman (1953) and later promoted among others by Aumann (1997), a good model should not be judged on the basis of its assumptions, but rather on the basis of the accuracy of its forecasts.

³ Rabin, Thaler (2001), p. 230. In this sketch, a customer who came with a complaint to a pet shop, tries to convince the seller that the parrot he bought in this store is dead.

Research agenda

In a behaviorist dispute with rationalists, I occupy an intermediate position. The arguments of each of the sides that I consider to be relevant are presented below.

Rationalist perspective

The basic argument for adopting a rationalist perspective is stability and coherence of behavior. The possibility of arbitrage makes irrational decisions unstable, i.e. they tend to disappear. This is because decision-makers either correct their decisions after finding out they have made a mistake that cost them their resources, or are unable to make further decisions, e.g. if the wrong decision has led them to bankruptcy.

The role of the normative decision theory is to determine, based on the chosen value system, which decisions are compatible with it and which are not. In particular, the decision-maker sets his/her goal (e.g. maximizing profit) and principles of behaving in certain simple situations in which decisions seem obvious (axioms). The task of the theory is to determine the logical implications of the axioms in the context of the chosen goal, so as to classify all possible decisions into ones that are or are not compatible with them. It is logical, therefore, that decisions belonging to the latter group should be considered a mistake by the decision maker. In order to formally demonstrate the aforementioned implications, decision theorists use what is called a preference representation theorem that shows the equivalence between a given representation (e.g. the EU representation) and the preference axioms (e.g. the EU axioms).

Secondly, a good model should be falsifiable according to the criteria of Popper (1934), i.e. it should clearly separate those choices that are compatible with the model from those that are not. Given an actual choice, it is determined whether the model is compatible with it, confirming its predictive ability, or not, thus falsifying the model. A good model shouldn't be too flexible so that it will explain any behavior. Such a model is worthless, because on its basis one could not predict what will happen in events and contexts other than those on the basis of which the model was built. The level of generality of the model is closely related to the above argument. A good model should apply in a wide spectrum of decision situations, in particular it should retain predictive power in contexts and decision-making problems beyond those on the basis of which it was build.

Behavioral perspective

The principle of revealed preferences and the resulting dependence of the theory on directly observable elements, is a very effective methodological assumption. This is a self-limitation, that made the level of testability in economics comparable to that of natural sciences. The "as if" principle, postulated by Friedman and Aumann, allows to ignore the simplification and lack of realism of the model if the model gives good predictions. However, there are often situations in which, apart from the prediction itself, we are interested in explaining and understanding behavior.

For example, many decision-making models explain the intersecting sets of possible choices. The Allais paradox can be explained both by PT and regret theory (Bell, 1982, Loomes, Sugden, 1982), and by dozens of other theories and models that have been proposed in the literature. If there are several ways to explain the same phenomenon, then the natural question arises which of these explanations is true.

Decisions are made by people. To understand them, one should not ignore what people are like. In this context, explanations that are consistent with common sense and psychological intuition are naturally preferred. For example, regret theory can explain why people buy lottery coupons (Gollier, C. 2016), but this explanation would ignore the fact that a person who did not buy a coupon cannot feel regret because he often does not know what number he would choose if she played and what number came out in this draw.

Complementarity of both perspectives

Both perspectives, i.e. the normative (as it should be) and the descriptive (as it is) ones, are important and may coexist as complementary approaches. On one hand, the normative aspects should have an impact on people's behavior. For example, if the decision maker may be convinced that his decision was wrong by demonstrating the logical flaw in a sequence of his choices, then the natural implication is that he will avoid making similar decisions in the future.

On the other hand, people's behavior can influence the normative assessment of a given behavior. For example, if in spite of persuasion you cannot convince a reasonable man that his decision was wrong, then maybe your arguments are too weak or the considered model that you have in mind, omits important aspects of the problem. It may happen that the model, and in particular the space of possible choices or states of the world⁴, is determined in a way that ignores important aspects of either the problem or its choice alternatives that may affect behavior. Then independence of decisions from these aspects becomes the implicit assumption of the model. Consequently, it may happen, that a given behavior is unreasonable in the original model but becomes rational in a richer model that takes these additional aspects into account.

For example, the silent assumption of many models is independence of decisions from the decision-making context, i.e. from the set of options that are available for choice at a given moment. However, there is a lot of experimental evidence that the decision context impacts many decisions significantly (eg Read D. et al., 1999, Wright, P. 1974). People choose differently under the pressure of time, environment, limited resources, etc. than without such pressure. In the analysis of a model, assumptions that are explicitly defined and those that are hidden in the structure of the problem are equally important (Bastiat, 1850).

A good model is a model that does not hide in its structure assumptions that are not consistent with reality and that may significantly affect the result. The simplifications adopted in the model must therefore be well-founded and in line with the cognitive objective.

Summary of the research agenda

Summing up the research program being carried out in the achievement presented for evaluation, for the observed EU paradoxes I am looking for explanations which, apart from psychological credibility, require the lowest possible departure from the postulates of rationality and thus retain their normative value, and therefore are both simple, general and give strong testable predictions.

Such an approach leads to a particular typology of observed choices according to the degree of their (ir-) rationality: the more one departs from rationality, the more (anomalous) behaviors

⁴ See e.g. Gilboa (2009), pp. 113-122.

can be explained. The cost is that in the process the model gradually loses its normative value and predictive power. Therefore, rather than explaining all possible behaviors, the point is to explain those that are robust and persistent.