Rivista Internazionale di Scienze Sociali, 2012, n. 3, 289-293

RATIONALITY AND UNCERTAINTY

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The situation seems here to be that, before
we can explain why people commit mistakes,
we must first explain why they should ever be right.
Hayek (1937, p. 2)

ABSTRACT

Experimental psychologists and economists construct an individual or interactive decision situation in the laboratory. They find non-negligible differences between the observed behavior of participants and the theoretically implied behavior. We refer here to the expected utility theory and to strategic equilibrium in non-cooperative game theory. We comment on the question whether rationality*, implies these theoretical behaviors and whether the non-negligible differences as above imply that participants in experiments are irrational. We also comment on the relation between rationality and consistency, in particular in situations of uncertainty.*

Keywords: Biases, Decision making, Bayesian, Behavioral Economics, Uncertainty.
JEL Classification: B4, D8.

1. RATIONALITY AND UNCERTAINTY

When a person must choose an action out of several available, she picks one that best suits her goals. The usual caveats apply: the person's choice is constrained by the information she has about the relation between the available actions and their consequences and, moreover, by her information about availability of actions and about her goals. But the revealed preference approach, embraced by economic theory, implies that ''picking a best'' is a tautology. The chosen action, by definition, is one that fits best the person's goals given the constraints. Thus to have a non-vacuous concept of rationality of choice additional data is required. One must have access to the person's information and to his intellectual capabilities.

The authors are thankful for partial .nancial support to the National Science Foundation and to the Israel Science Foundation, respectively.

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Since this information is, for the most part, difficult or impossible to obtain, it is not practical to verify that economic actors perform optimally in their choices. The term economic actors is used here to denote real people making real economic choices, such as consumption and saving decisions. We distinguish these actors from economic agents, who populate economic models[1]. There is however one additional role for economic actors, or at least for some of them, which is discussed here: participants in economic experiments.

In this last role the actors fail. Not all and not always, but often enough to create a divide between agents and actors. Agents follow the theory, by definition, whereas actors do not. As an example consider the paper by Goeree and Holt (2001). In this experimental work, in ten games, the results are in agreement with game theory. However a change in payoffs leads, in each game, to behavior quite different than what the theory prescribes. Winner's curse is another example where experimental results consistently defy theory, (Kagel and Levin (2002)). But even in tasks of individual decision making they do not behave as if they maximized (subjective or given) expected utility. (See the *biases literature* in Wikipedia.)

There are several ways to deal with this divide. One is to do nothing. This path can be, and has been, justified in different and sometimes conflicting ways. The first is a denial. The actors behave differently than the agents because the actual task they face is not what the experimenter claims it to be, their goals are not those assigned by the experimenter, external validity does not hold, etc...

Another justification of *doing nothing* argues that the model has been constructed to make a point and/or to give an insight to the economist when considering a problem in the economy or in economics. It was not claimed that the model is descriptive. See Clarke and Primo (2007), and Gilboa, Postlewaite, Samuelson, and Schmeidler (2011). According to this approach, some models belong to the theoretical discourse, help one researcher to convince others that certain models or assumptions in them make sense, or don't make sense, as the case may be etc.

An alternative way to deal with the divide is to adjust the economic models. See the *behavioral economic* literature and the *extended Bayesian* or *non-Bayesian decisions under uncertainty* literature for work in this vein. The latter literature still claims that the models are mostly normative or also belong to the theoretical discourse as above. A third alternative is to radically improve the experimental setting and try to switch to, or concentrate upon, natural experiments. This should disarm the criticism of experiments mentioned above.

What is a role of rationality in all this? Rationality in economics, starting with Hume (1739), uses reason only as a tool to reach goals, not to determine which goals to choose. Thus preferences between final consequences reflect agents' or actors' tastes, and are constrained by transitivity[2]. The latter is the main contribution of rationality. Some assumptions on tastes, like monotonicity, are based on the defi-

[1] For the sake of simplicity we disregard here other economic activities of economic actors as managers, regulators, judges etc..., and the same applies to economic agents.

[2] Final consequences are considered as deterministic within the model.

nition of commodity (and on the concept of scarcity), while others, like continuity, are empirically neutral. Other assumptions on tastes are tentative, awaiting better analytical tools.

The situation changes when agents and actors alike must choose between alternatives whose matching to consequences is not deterministic or even not fully known or understood. This raises a challenging modeling question: how to represent an agent's partial information and how to model his use of this information. In the prevalent theoretical models the agents are Bayesians who maximize expected utility. Recall that when a Bayesian agent does not know a value of a parameter or a variable, he knows its probability distribution or at least behaves as if he new it. Consider the example below.

19	0	In the matrix to the left the entries are in cardinal **utiles**
0	19	where the left column corresponds to an event E, whereas
9	9	the right column corresponds to the complementary event.

Note that when choosing among T (top), M (middle), and B (bottom), B is not an option for Bayesians. There is no prior justifying it. When $p(E) < 1/2$, then the expected utility of M is the highest. When $p(E) > 1/2$ then the expected utility of T is the highest. Finally, when $p(E) = 1/2$ then the expected utility of B, 9, is smaller than 9.5, the expected utility of T and B . However when there is meager information about the events E and its complement E^c, choosing B can make sense. Examples of such events E are easy to think of: three years from today the rate of exchange between the GBP and USD will be higher than today; the rate of unemployment (or inflation) in 2016 will be above α (β respectively). If E is not easily seen as more likely than E^c and vice versa, and 9 utiles represent a non negligible share of savings toward pension, choosing T or M may appear too hazardous.

Hume requires the use of judgment in attaining one's goals. Gilboa, Maccheroni, Marinacci and Schmeidler (2010) call an action objectively rational if the decision maker can convince others that the chosen actions best for attaining his goals. They call it subjectively rational if others can not convince the decision maker of the opposite. The latter concept is essentially what Gilboa and Schmeidler (2001) termed rationality: ''when the decision maker is confronted with an analysis of the decisions involved, but with no additional information, she does not regret her choices''.

In other words, consistency is not a sufficient condition for rationality. In a framework where decisions are based on tastes and beliefs, the latter require justification. (See the self explanatory title: Rationality of Belief or: Why Bayesianism is Neither Necessary Nor Sufficient for Rationality, by Gilboa, Postlewaite and Schmeidler, 2009.) Justification of beliefs means relying on data and their statistical analyses. If the latter is based on an economic model, there are data that verify the model in addition to the data that justify the beliefs. Statisticians, econometricians, computer scientists, and other applied scientists and engineers use Bayesian procedures only when they can justify the priors they use. Of course, action must be ta-

ken also in cases of meager information. The chosen action may be consistent with some beliefs (implicit or explicit) that are not justified by data. We conjecture that the majority of the decision makers will regret their choice if confronted with analysis showing the data they had access to contradicts these beliefs.

A main topic in the article of Mullet (2012) is the divide between the performance of actors in experiments and what is expected of them by the experimenters, maximizing expected value. The latter Mullet considers as rational, and such is in his view the Bayesian update. However people who fall prey to biases are just reasonable, and rationality is not required for economics. The present authors are sympathetic with Mullet (2012) that restricting rationality to Bayesian expected value, or even expected utility, is neither necessary nor sufficient for rationality. He does not define *reasonable*, but any reasonable definition of the term should not label all biases as reasonable. Quoting again from Gilboa and Schmeidler, (2001): ''Casual observation shows that most people feel embarrassed when it is shown to them that they have fallen prey to framing effects (Tversky and Kahneman (1981)). Hence we would say that, for most people rationality dictates that they be immune to framing effects.'' Extending this idea to other biases, our suggestion is that the reasoners themselves will decide what is reasonable.

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