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The science of experimental economics☆

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ABSTRACT

In this paper we present the views of two practicing experimental economists on the role of economic experiments in the science of economics, and in particular on the interaction between economic theory and experimental design and data.

Games people play, you take it or you leave it
Things that they say, just don't make it right
If I'm telling you the truth right now, do you believe it
Games people play in the middle of the night

Where do we go from here?...
Alan Parson's Project: Games People Play

1. Introduction

Some years ago, it was still common to argue that economics could never be an experimental science but was confined to be purely observational or theoretical. Today the integration of experimental economics into mainstream economics is an established fact. Economics *is* an experimental science, as well as a theoretical and observational one.

In this essay we discuss our views on what experiments can contribute to economics. Our focus is mainly on the relationship between theory and experiments. Experiments are historically closely linked to economic theory and recently empirical economists who typically use non-experimental observational data have begun to use experimental methods. Our eclectic views in this essay are those of "practitioners" of experimental economics, not those of professional methodologists. Like most economists we are normally busy doing research, not philosophy of science.

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A large body of experiments has established "anomalies" in individual decision-making (summarized in a wonderful popular book by Thaler, 1991) and the body of evidence from experiments on bargaining, public goods, coordination, markets, auctions and individual decision-making has grown (Kagel and Roth, 1995, 2009; Plott and Smith, 2008). Standards of how to conduct economic experiments have emerged, textbooks teach methods of experimental economics (Davis and Holt, 1993; Friedman and Sunder, 1994; Friedman and Cassar, 2004), and a dedicated field journal, *Experimental Economics*, has an increasing impact in economics. Experimental economics has come of age.

This essay reflects our views on how we see experimental economics now. We want to acknowledge the pioneers who have shaped much of the methodological convictions of most experimental economists (e.g., Smith, 1982; Plott, 1982; Roth, 1995). A second wave of methodological thinking is taking shape in the form of specialized books tackling methodological issues (Guala, 2005; Caplin and Schotter, 2008; Bardsley et al., 2009), special issues (Methodology, e.g., Sugden, 2005a), and methodological articles in major journals (e.g., Samuelson, 2005; Levitt and List, 2007; Schmidt, 2008). Our goal is to contribute to this thinking about the field.

We begin with our perspectives on economic theory and experiments (Sections 2 and 3). We then move to a discussion of what theories can do for experiments, and what experiments can do for theories (Sections 4 and 5). Section 6 discusses how we should evaluate theories in light of experimental data. We summarize with our "Top Ten" list of things to do (and avoid) for experimentalists and theorists alike in Section 7. Section 8 concludes.

2. What is (economic) theory?

Economic theory provides a framework and tools for describing and analyzing economic situations. It makes behavioral assumptions to derive predictions and to provide explanations of economic and social phenomena. More specifically, an economic theory (model) is a description of a social situation, which involves specifying the actors, the choices they face, their information, and how they evaluate each possible outcome.

Behavioral assumptions enter in three ways: a first set of assumptions specifies how the individuals evaluate each possible outcome. The evaluations of outcomes are described by the preferences of the individual, including attitudes towards risk and uncertainty ("risk preferences"), the future ("time preferences"), and the extent to which outcomes and the behavior of others are relevant ("social preferences"). A second set of assumptions explicates the individuals' cognitive abilities (their degree of logical sophistication) and how they form beliefs about uncertain states of the world. A third set of assumptions specifies how the individuals will behave. These behavioral predictions are derived by applying "solution concepts", which describe how assumptions on preferences and beliefs translate into outcomes.

This description of economic theory is a very abstract framework, which is instantiated with more specific assumptions to derive predictions. We describe "standard economic theory" as theory which assumes:

(i) Economic decision makers are cognitively sophisticated—they are assumed to be rational; their preferences are complete, transitive and obey the other axioms of expected utility theory. Individuals also have rational expectations about relevant states of the world and the behavior of others. In strategic situations rationality is common knowledge, that is, everybody is rational, knows that everybody is rational, knows that others know that everybody is rational and so on.
(ii) Risk preferences obey the expected utility principle. Time preferences exhibit exponential discounting. Social preferences are assumed to be zero (or already captured in the utility function). In applications, functional forms for the utility function are specified, e.g., it is assumed that people have Cobb-Douglas utility functions or that they have constant relative or absolute risk aversion.
(iii) Solution concepts are typically equilibrium concepts, like competitive equilibrium, Nash equilibrium, or subgame perfect Nash equilibrium.

It is important to note that these assumptions are psychological (behavioral) because they specify how individuals evaluate outcomes, reason, and reach decisions. This standard model is an extremely powerful framework which provides intellectual clarity and tractable formalizations. This framework has generated considerable theoretical advances in all areas of economics (see, e.g., the textbooks by Mas-Colell et al., 1995 and Romer, 2005, and the essays by Becker, 1993 and Lazear, 2000). This framework has made economics the most influential of the social sciences.

More generally, a theory (model) is an abstraction from the world. Models are, by definition, wrong (descriptively inaccurate). However, this does not mean they are useless. In particular, theories make the logical implications of behavioral assumptions explicit and concrete. The standard model can be seen as a boundary case, but understanding boundary cases is critical for scientific development. This does not relieve theorists from developing models based on more descriptively accurate assumptions, but it provides an important benchmark against which these theorists can compare the implications of their new models.

In summary, economic theory provides a framework for analysis. The conceptual distinction between preferences, beliefs, and constraints is an extremely useful framework that has served economics well. The behavioral assumptions of the standard model are boundary cases, but the standard model has been invaluable in providing testable predictions and developing theoretical alternatives.