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The Prize in Economic Sciences 2002

The Royal Swedish Academy of Sciences has decided that the Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel, 2002, will be shared between

DANIEL KAHNEMAN
Princeton University, USA

"for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty"

and

VERNON L. SMITH
George Mason University, USA

"for having established laboratory experiments as a tool in empirical economic analysis, especially in the study of alternative market mechanisms".

Psychological and experimental economics

Traditionally, much of economic research has relied on the assumption of a "homo œconomicus" motivated by self-interest and capable of rational decision-making. Economics has also been widely considered a non-experimental science, relying on observation of real-world economies rather than controlled laboratory experiments. Nowadays, however, a growing body of research is devoted to modifying and testing basic economic assumptions; moreover, economic research relies increasingly on data collected in the lab rather than in the field. This research has its roots in two distinct, but currently converging, areas: the analysis of human judgment and decision-making by cognitive psychologists, and the empirical testing of predictions from economic theory by experimental economists. This year's laureates are the pioneers in these two research areas.

Daniel Kahneman has integrated insights from psychology into economics, thereby laying the foundation for a new field of research. Kahneman's main findings concern decision-making under uncertainty, where he has demonstrated how human decisions may systematically depart from those predicted by standard economic theory. Together with Amos Tversky (deceased in 1996), he has formulated prospect theory as an alternative, that better accounts for observed behavior. Kahneman has also discovered how human judgment may take heuristic shortcuts that systematically depart from basic principles of probability. His work has inspired a new generation of researchers in economics and finance to enrich economic theory using insights from cognitive psychology into intrinsic human motivation.

Vernon Smith has laid the foundation for the field of experimental economics. He has developed an array of experimental methods, setting standards for what constitutes a reliable laboratory experiment in economics. In his own experimental work, he has demonstrated the importance of alternative market institutions, e.g., how the revenue expected by a seller depends on the choice of auction method. Smith has also spearheaded "wind-tunnel tests", where trials of new, alternative market designs – e.g., when deregulating electricity markets – are carried out in the lab before being implemented in practice. His work has been instrumental in establishing experiments as an essential tool in empirical economic analysis.

DANIEL KAHNEMAN, born 1934 (68 years) in Tel Aviv, Israel (US and Israeli citizen). PhD from University of California at Berkeley in 1961. Since 1993, Eugene Higgins Professor of Psychology and Professor of Public Affairs at Princeton University, NJ, USA. www.princeton.edu/~psych/PsychSite/fac_kahneman.html

VERNON L. SMITH, born 1927 (75 years) in Wichita, KS, USA (US citizen). PhD from Harvard University in 1955. Since 2001, Professor of Economics and Law at George Mason University, VA, USA. www.gmu.edu/departments/economics/facultybios/smith.html

The Prize amount: SEK 10 million, will be shared equally among the Laureates
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The Prize in Economic Sciences 2002

Traditionally, economic theory has relied on the assumption of a "homo œconomicus", whose behavior is governed by self-interest and who is capable of rational decision-making. Economics has also been regarded as a non-experimental science, where researchers – as in astronomy or meteorology – have had to rely exclusively on field data, that is, direct observations of the real world. During the last two decades, however, these views have undergone a transformation. Controlled laboratory experiments have emerged as a vital component of economic research and, in certain instances, experimental results have shown that basic postulates in economic theory should be modified. This process has been generated by researchers in two areas: cognitive psychologists who have studied human judgment and decision-making, and experimental economists who have tested economic models in the laboratory. This year's prize is awarded to the innovators in these two fields: **DANIEL KAHNEMAN** *and* **VERNON SMITH.**

Psychological and experimental economics

Experimental economics

The first experiments in economics were aimed at testing what is perhaps the most fundamental result in economic theory: under perfect competition, the market price establishes an equilibrium between supply and demand at the level, where the value assigned to a good by a marginal buyer is as high as that of a marginal seller. In Vernon Smith's early laboratory experiments, subjects were randomly designated roles as buyers and sellers with different valuations of a good, expressed as a lowest acceptable selling price and a highest acceptable buying price, respectively. Given the distribution of such "reservation prices", Smith was able to determine the theoretical equilibrium price – the price which is acceptable to equally many sellers as buyers. As early as 1962, when he published the results of his first experiments, Smith found, much to his surprise, that the prices obtained in the laboratory were very close to their theoretical values, even though subjects lacked the information necessary to calculate the equilibrium price. Smith and other researchers, among them Charles Plott, later carried out many similar experiments to test the agreement with theory, and have by and large confirmed the initial results. In addition, they found the outcome to be driven by the exact design of the market mechanism.

Many experiments have concerned the outcome of auctions, which are traditionally used to organize markets for raw materials and shares or other financial instruments. More recently, auctions have also been designed for deregulation and privatization of public monopolies, such as broadcasting rights. The theory of price formation distinguishes four basic auction forms used in the sale of a single object:

1. the English auction, where buyers announce their bids in an increasing order until no higher bid is submitted;
2. the Dutch auction, where a high initial bid is gradually lowered until a buyer melds his acceptance;
3. the first-price auction, with sealed bids, where the highest bidder pays his own bid to the seller; and
4. the sealed-bid second-price auction, where the highest bidder pays the second highest bid.

In controlled experiments, Smith and his colleagues were able to test several theoretical predictions. For example, they found – as foreseen by theory – that a seller can expect the same revenue in English and second-price auctions. Meanwhile, they were able to refute the theoretical prediction of equivalence between the Dutch and the first-price auction. Their experiments also demonstrated that the English and second-price auctions produced the highest average selling price, followed by the first-price auction and, lastly, the Dutch auction.

Smith also initiated the use of laboratory experiments as a "wind tunnel", where proposed auction mechanisms for privatization and public procurement can be tested in advance. Since these mechanisms are frequently complex and it is difficult to assess their performance solely on the basis of theoretical considerations, the experimental method becomes particularly useful. In similar experiments, Smith has evaluated different mechanisms for allocating airport time slots using computer-assisted markets. He has also evaluated various means of organizing energy markets in Australia and New Zealand, where the results have influenced actual market design.

The values at stake on real-world markets are often of a wholly different magnitude than the rewards which can be offered in an experimental setup. In particular, while emphasizing the importance of monetary incentives in experiments, Smith has developed methods where such incentives are not only sufficiently strong, but also designed to enhance the probability that the results would be applicable in real market situations. A major problem is that subjects' own (and unobserved) preferences can affect their behavior in an experiment. Consequently, a subject who is assigned the role of buyer, with a given demand function for a good, will not simply behave in accordance with this demand curve. Smith introduced a technique, known as the *induced-value method*, which solves this problem and provides the subject with incentives to behave as the experimenter intended. Through this and other contributions, as well as a series of practical recommendations for appropriate procedures in the laboratory, Smith has set methodological standards for what constitutes a good experiment in economic research.

Psychology and economics

Economic research often assumes that people are motivated primarily by material incentives and make decisions in a rational way. They are assumed to assess the state of the economy and the effects of their behavior by processing available information according to standard statistical principles. This approach has been formulated axiomatically in so-called expected-utility theory, which is the predominant economic theory for decisions under uncertainty.

The prevailing view in psychology in general, and cognitive psychology in particular, is to regard a human being as a system that codes and interprets available information in a conscious manner, but where other, less conscious factors also govern decisions in an interactive process. Such elements include perception, mental models for interpreting specific situations, emotions, attitudes and memories of earlier decisions and their consequences.

In extensive research on human behavior based on surveys and experiments, Daniel Kahneman and other psychologists have called into question the assumption of economic rationality in some decision situations. Real-world decision-makers frequently appear not to evaluate uncertain events according to the laws of probability; nor do they seem to make decisions according to the theory of expected-utility maximization.

In a series of studies, Kahneman – in collaboration with the late Amos Tversky – has shown that people are incapable of fully analyzing complex decision situations when the future consequences are uncertain. Under such circumstances, they rely instead on heuristic shortcuts or rules of thumb. A fundamental bias is nicely illustrated in Kahneman and Tversky's own

experimental data on the way individuals judge random events. Most experimental subjects assign the same probabilities in small and large samples, without taking into account that uncertainty about (the variance of) the mean declines drastically with sample size. People thus seem to adhere to a *law of small numbers*, without due consideration of the *law of large numbers* in probability theory. In a well-known experiment, subjects regarded it as equally likely that, on a given day, more than 60 percent of the births would be boys in a small hospital (with few births) as well as in a large hospital (where many children were born).

Similarly, an investor who recognizes that a fund manager beats the index two years in a row may conclude that the manager is systematically more competent than the average investor, whereas the true statistical implication is much weaker. Such shortsightedness in interpreting data might well help clarify various phenomena on financial markets that are difficult to explain with prevailing models – such as the ostensibly unmotivated large fluctuations to which stock markets are often exposed. In financial economics, a lively research area, *behavioral finance*, has evolved which applies insights from psychology in an attempt to understand the functioning of financial markets.

Another rule of thumb is *representativeness*. Kahneman and Tversky carried out an experiment in which subjects were asked to categorize individuals as a "salesman" or a "member of parliament" on the basis of given descriptions. When a randomly chosen individual was portrayed as interested in politics and participating in debates, most subjects thought he was a member of parliament, regardless of the fact that the relatively higher share of salespersons in the population increases the likelihood that he was a salesman. Even after subjects were informed that the proportions of members of parliament and salespersons in the population had been altered substantially, it did not seem to matter for the results.

Kahneman has thus demonstrated that in situations with uncertainty, human *judgment* often exploits rules of thumb which systematically contradict fundamental propositions in probability theory. His most influential contribution, however, concerns *decision-making* under uncertainty. A striking finding is that individuals are much more sensitive to the way an outcome deviates from a reference level (often the *status quo*) than to the absolute outcome. When faced with a sequence of decisions under risk, individuals thus appear to base each decision on its gains and losses in isolation rather than on the consequences of a decision for their wealth as a whole. Moreover, most individuals seem to be more averse to losses, relative to a reference level, than partial to gains of the same size. These and other results contradict predictions from the traditional theory of expected-utility maximization.

Not satisfied with having criticized standard theories of decision-making under uncertainty, Kahneman and Tversky also developed an alternative, known as *prospect theory*, intended to provide explanations for empirical observations. Prospect theory and its extensions can be used to better explain behavioral patterns which appear to be anomalies from the perspective of traditional theory: the propensity to sign up for costly small-scale insurance for appliances; willingness to drive many miles for a few dollars' discount on a minor purchase, but reluctance to do so in order to save the same amount on a more expensive good; or resistance to lowering consumption in response to bad news about lifetime income.

Two merging research areas

Modern research at the border line between economics and psychology has shown that concepts such as bounded rationality, restricted self-interest and limited self-control are important factors behind a range of economic phenomena. In particular, insights from psychology have had a strong impact on contemporary developments in financial economics. Why, then,

has it taken such a long time for these ideas to gain recognition in economic research? One explanation is that experimental methods have only recently permeated economics. As a result of experimental research on the relation between price formation and market institutions, a growing number of economists have begun to regard experimental methods as indispensable research tools. Today, a new generation of economists is the catalyst in a gradual amalgamation of two previously distinct research traditions in experimental economics and economic psychology. Daniel Kahneman and Vernon Smith, the key figures within these traditions, have contributed to an exciting renewal of economic research.

LINKS AND FURTHER READING

Advanced information on the Nobel Prize in Economics 2002, The Royal Swedish Academy of Sciences: www.nobel.se/economics/laureates/2002/ecoadv02.pdf

For collections of papers with contributions by the Laureates, see

Smith, V.L., *Bargaining and Market Behavior: Essays in Experimental Economics*, Cambridge University Press, 2000, and

Kahneman, D, and Tversky, A. (eds.), *Choices, Values and Frames*, Cambrige University Press, 2000.

The research fields are surveyed in

Kagel J. H. and A. E. Roth, (eds.), *Handbook of Experimental Economics*, Princeton University Press, 1995, and

Rabin M., "Psychology and Economics," *Journal of Economic Literature*, Vol. XXXVI, 11-46, March 1998.

THE LAUREATES

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