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Economics has a number of contemporary images: the theory of supply-and-demand, Keynesian macroeconomics and national aggregate demand management, the science of self-interested behavior, rational choice theory, *laissez faire* and the idea that markets should be free and unregulated, mathematical formalism, and even the Washington consensus on globalization.

In addition, there are many unhappy things people perceive to be true about the economy that they believe fairly or unfairly economics have brought about: increasing competition throughout life, threats to the viability of families and communities, job losses due to rising imports, uncertain careers, financial market instability, declining personal security, discrimination, and so on. There fewer things people perceive about the economy in a positive way that they attribute to the influence of economics, but sometimes they credit economics with ensuring near full employment, maintaining economic growth, and making globalization possible.

Economists themselves share some of these opinions, but as insiders to economics, they are far more cautious about the link between economics and the economy. While a part of economics is indeed about designing policies based on economic theory, economists are rather skeptical from a professional perspec-

tive about policy effectiveness. That is, they recognize that policies can be changed in the process of implementation, that they can have unexpected consequences, and that they are based on limited knowledge about the economy. Where hesitation seems to have been lacking on the part of economists is in regard to the confidence they have about the accuracy and reliability of economic theory. Yet this now seems to be changing. This represents a fairly new development in postwar economics, and some reasons why this change seems to have come about will follow.

To begin, it helps to have some sense of the development of economics as a professional field. As a separate academic domain of investigation, economics was first established at Cambridge University in the last decades of the 19th century under the influence of Alfred Marshall, with parallel developments occurring around the same time or shortly thereafter in other industrializing countries. Of course the investigation of economic life long preceded Marshall's efforts, but the academic professionalization of economics served to re-characterize economics as a science and exclude many who lacked the requisite standardized training from effective participation in the discussion of economic issues.

A next important development for economics was the Great Depression, which led to a

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change in the public view of the prerogatives and responsibilities of economics and economists vis-à-vis the economy. The aggregate demand management economics of John Maynard Keynes—later called Keynesian economics—was generally accepted by economists and the public by mid-century as being successful in maintaining high levels of employment and production, and economists were thus expected to act on the policy front when economies suffered, and seen as legitimately qualified to do so.

A third important development was World War II and the postwar mathematization of economics. The war created massive materiel and personnel management problems that required new quantitative tools. Economists borrowed liberally from physics, engineering, and operations research to develop these tools, and then carried them forward in the postwar to the analysis of markets and economic systems. The postwar period also saw tremendous resources devoted to the development of university research faculties across the sciences—partly driven by the Cold War. This had the effect of multiplying the number of professional economists with mathematical training many times over, thus creating a large identifiable academic-governmental constituency with generally high public approval associated with the perceived performance of economics in the Depression and the War.

Moving toward the present, our current understanding of the world pivots on the fall of the Berlin Wall in 1989. A change in the status of economics seems to share this same date. One thing the Cold War did to economics (with the exception of the Vietnam period) was drive out difference of opinion about its subject matter. The technical assistance of economists in the war effort promoted mathematical modeling in economics after the war, which drove out more qualitative approaches, plus diversity in general. Economics standardized itself around neoclassical theory and sys-

tematically cleaned house by denying paths to professionalization to individuals interested in non-standard and heterodox approaches to the field. Minus the Wall, however, the standardization of economics seemed less compelling. At the same time, dramatic change in the world's economy associated with its increasing integration or globalization raised the question of economics' flexibility and comprehensiveness. What then has happened, then, to economics in the last quarter century?

Recent economics can be described as a traditional neoclassical core surrounded by two sets of approaches that challenge it: (a) heterodox research programs (many of them long-standing, others more recent) that have survived the standardization process, and (b) a collection of new research programs which largely derive from the influence of other sciences on economics. The former include institutional economics, Marxist economics, radical political economy, social economics, feminist economics, Post-Keynesian economics, and neo-Austrian economics. The latter include behavioral economics, game theory (in various forms), experimental economics, evolutionary economics, and complexity economics.

Neoclassical economists generally ignore both sets of approaches but are increasingly aware that the standard view of economics is under challenge from many directions. There is also criticism of economics by those who consider themselves neoclassical, led by a number of leading economists who are either dispositionally open to change in economics or who have their own complaints against neoclassicism. Thus the old confidence economists exhibited in the first two or three decades after the war about the state of economic theory now seems to be somewhat weakened. This is not to say that economists who follow standard theory anticipate its demise. Rather it is more a matter of an increasing concern that the challenges to the

standard approach in many instances go directly to its heart ... and may be right. Let me identify some of these challenges, as well as those who are responsible for them.

Most important of all is the critique of rationality and rational choice. Neoclassical economics has come to be seen by many as the theory of rational choice, whereby individuals make optimal choices for themselves based on the prices they face and their personal preferences. Other people's desires and the different circumstances in which choices are made are said to not influence the individual's decision. Prices create clear incentives for self-regarding individuals, and individual behavior maximizes individual utility, or makes the individual as well off as possible. That individuals choose rationally is also the foundation of the claim that markets work efficiently, that is, that left to operate freely they make everyone better off (putting aside a small number of cases generally agreed to represent exceptions).

But there is now considerable empirical evidence from psychology that individuals do not choose rationally. Economists have historically assumed that individuals choose rationally and marshal a variety of thought experiments to motivate this assumption. But psychologists since the 1970s, in an empirical subfield called behavioral decision research, have run actual experiments that consistently demonstrate that individuals do not behave rationally. In particular they show that individual decision-making is reference-dependent, meaning that the circumstances in which people make choices have anchoring effects on those choices. Thus how a question is posed influences the choice a person makes. Moreover, people seem to be rather poor at making certain kinds of choices in which considerable information processing is required, especially with respect to estimating probabilities as are associated with choices concerning future events. What psychologists have conse-

quently argued is that people use a variety of cognitive devices to help them frame their decisions. This has been articulated as the heuristics and biases program, associated with the influential research of Daniel Kahneman and Amos Tversky, and now an active field in economics called behavioral economics. Economists have not been able to avoid becoming acquainted with this research, since Kahneman received the Nobel Prize in Economics in 2002, despite not being an economist. (Tversky would likely have shared the Prize but was deceased.)

Thus a key foundation of neoclassical economics, rational choice, has been strongly challenged. Further, it has been challenged not simply as a scientific tenet, but also at the level of its methodological foundations. John Stuart Mill, a half century before Alfred Marshall, argued that economics is primarily a deductive science or a special kind of logic. Until the rise of econometrics after World War II, economics' credentials as an empirical science have been thin at best, while econometrics—the statistical analysis of equations representing economic relationships—has never really tested the economic behavior underlying those relationships. Thus it was something of a shock to the economics profession when Kahneman and Tversky and their colleagues not only demonstrated that one empirically could test individual choice behavior, but that the experiments in which this was done could be extensively replicated. Economists had always argued that experiments could not be done in economics on the grounds that one could not isolate and scientifically control a piece of the economy and run experiments on it. But the psychologists had a long tradition of isolating individuals in laboratories and testing their behavior. For them it was a minor development of their science; for economics it was a significant development, and, moreover, one disruptive of long-established thinking.

A second key challenge to neoclassical economics was to the concept of equilibrium. The idea of an equilibrium state is the idea of the economy, or a part of it, settling into a condition in which there are no forces acting to produce change. It is also the idea that the economy tends to settle to natural resting places in which the different plans and behavior of countless different individuals is harmonized. The classic example is the balance of supply and demand. As a price rises, supply rises and demand falls; as a price falls, demand rises and supply falls. Economists argue that prices will fluctuate until the amount demanders want is exactly equal to the amount suppliers offer, and the market clears. The doctrine underlies the *laissez faire* prescription economists see as their default policy position and is the basis for the idea that economists generally favor free trade in markets.

The situation with the equilibrium concept in economics is a little more complicated than the situation with the rationality concept. A set of very technical results in the 1970s in the theory of the economy as a general equilibrium of markets—known as the Sonnenschein-Mantel-Debreu results—demonstrated that two of the main properties universally agreed to be part of the concept of an equilibrium, namely, that it is unique and stable, were impossible on the standard foundations. By most accounts, this led to economics' general abandonment of the notion that the economy could be represented as one large general equilibrium of markets, and the substitution of an entirely new approach developed in mathematics called game theory.

Game theory was created explicitly for economics in the 1940s by John von Neumann and Oskar Morgenstern. So in trouble on a foundational concept, economics turned to mathematicians. Indeed they soon substituted a new concept of equilibrium for use in game theory that came from another mathematician, John Nash (also later a Nobel Prize winner in

economics). Unfortunately, it was soon determined that equilibrium in this new game theory framework suffered one of the same failures as general equilibrium theory: it could not be shown to be unique. Thus economics found itself with the idea of the economy settling to some equilibrium state of affairs but could not determine which state of affairs it was!

In the economics of the last quarter century, then, two new initiatives have come forward as proposals regarding how this situation might be sorted out. Again, both come from outside of economics, one from evolutionary biology and the other from physics. Evolutionary biology came into economics when a small group of economists remodeled games as contests between different types of players in evolutionary settings. The population frequencies of these different types of players were considered equilibrium outcomes, and these outcomes could be shown to have a number of desirable, expected properties associated with equilibria. However, since the players in these evolutionary games were now types of individuals—or species in effect—the price at which this re-elaboration of the equilibrium concept was achieved was the removal of particular individuals from economic analysis. In evolution, individuals do not survive; species do. It may well be of course that economics in the long run is about the survival of kinds of economic agents rather than about individuals as economic agents. But this means it has little to tell us about ordinary day-to-day decision-making in economies in the short run. Presumably most people expect economics to have something to say about this too.

Physics (or rather physics, a number of other physical sciences, some of the computational sciences, and a number of other fields) has also had an impact on thinking about equilibrium in recent economics in influencing economists to think about the economy as a

complex adaptive system. In general, the emergence of complexity theory in recent years is due to advances in computing power that have made it possible to simulate large complex systems of different relationships with multiple confounding feedback patterns that cannot be solved with traditional analytical methods. Simulations run over many periods and may exhibit phase transitions and emergence in which formerly undetectable aggregate phenomena suddenly become manifest.

In economics, complexity thinking begins with the idea of collections of heterogeneous individuals or agents who directly interact with one another. An important subject of investigation is network effects, or how concentrations of interrelated individuals display shared characteristics that have varying impacts on their individual behavior. Many of these new models are quite interesting, but they often have some very untraditional results for standard economics. One is that equilibria may either not exist or be transitory. An economy may move through a number of only temporary resting points that are unstable. Thus economics' long attachment to the equilibrium concept may ultimately go by the wayside.

This also has implications for that standard concept of the individual. If the economy never really settles into one state or another, it may not make sense to say that individuals ever maximize anything. They might rather be seen as continually sorting through a variety of different strategies as appropriate to the changing circumstances they encounter, never achieving anything that might be termed a best state of affairs.

Thus both rationality and equilibrium, mainstays of postwar standard neoclassical economics, have an uncertain future in economics. This is not to predict that economics will undergo significant change in the future or that these concepts will disappear. But they

no longer have the same unchallenged position in the field they had in the three decades after the War. We might say, then, that economics is becoming more pluralistic, and per-

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haps more decentralized with a larger number of research strategies being pursued, not all neatly covered by one large umbrella view of economics. In addition to the developments discussed above, five more deserve mention, three of which were also associated with individuals awarded Nobel Prizes in Economics.

First, there is now an entire field of investigation in economics called experimental economics. Having long denied experiments could be carried out in economics, now a significant number of researchers in the field are carrying them out. Many deny that individuals must always be seen as rational. For example, Vernon Smith (also an Economics Nobelist in 2002) allows that individuals may act for a variety of reasons, but sees the market process as ultimately driving individuals to efficient market behavior. He thus decouples the standard neoclassical view that rationality and efficient markets in equilibrium go hand in hand, in order to preserve the idea that markets tend to produce efficient equilibrium outcomes. Further, his conclusions are the result of numerous market experiments run by him and his colleagues. Whereas economists previously argued in deductive fashion that markets settle to equilibrium, Smith succeeded in showing this to be an empirical result.

Second, as the 2007 Nobel Prize shows, there is an active new field in economics called market design. Market design economics investigates the institutional structure and pricing mechanisms of efficient markets and then develops strategies for reforming exist-

ing markets that are inefficient and creating markets that would be efficient where they do not exist. An example of reforming an inefficient market is the design of applicant-vacancy matching algorithms or procedures for medical residents. An example of a created market was the design of auctions for the U.S. Federal Communications Commission granting of access rights to the electromagnetic wave length spectrum.

One remarkable thing about market design economics is that it abandons the traditional assumption in economics that markets are naturally competitive and should be left free and unregulated. In market design economics, in contrast, the idea is that markets often need to be constructed in order to work freely. Another thing that is interesting about market design economics is its recourse to experimental research in the laboratory. Possible institutional arrangements for markets are first tested in the lab before being tried in the real world, so again deductive investigation is not enough.

A third new area of investigation in economics is neuroeconomics. Neuroeconomists use brain-scanning techniques from neuroscience to investigate how the mind functions when individuals engage in economic behavior in laboratory situations. For example, in some experiments, individuals play a game involving bargaining, and researchers then examine their brain activity to determine which centers of the brain are active. The standard view is that decision making involves the prefrontal cortex or the “thinking” part of the brain. But there is considerable evidence showing that areas of the brain associated with emotional response, or affect, play important roles when individuals find themselves in bargaining situations. This raises general questions about human ability in decision making. If people do not always make decisions rationally, they may not always make decisions that are in their best

interest, as for example when they decide how much to contribute to voluntary pension savings plans. There may then be an argument for public policy initiatives that set default options for such programs that would be in individuals’ best interests.

A fourth new development in economics is capabilities research, inspired by the work of Amartya Sen, also a Nobel Prize winner in economics. Capabilities are freedoms to exercise various capacities or functionings we have. Thinking of individuals in these terms is a departure from the standard view that individuals are utility maximizers, where this is usually understood in terms of preference fulfillment. Preferences are always given on the standard view, but the exercise of capabilities involves the development of individual capacities or functionings. This leads to an entirely different view of individual well-being and has resulted in the construction of a number of new types of indices to measure progress in developing individual capabilities. For example, the United Nations Human Development Programme uses the Human Development Index to determine different countries’ progress in promoting the achievement of higher levels of basic human capabilities. This has important implications for public policy in developing countries and indeed for policy in developed countries as well. The capabilities concept’s adoption by economists was largely inspired by philosophical influences on economics.

Fifth, a new view of the concept of individual preference is called the social preferences approach. Much experimental work in economics investigates individual behavior in game theory settings. The standard neoclassical prediction is that people would generally act in a self-regarding way in these experiments. But one result of game theory experiments is that people are also motivated by social preferences—altruism, fairness, and reciprocity—and that these motives may

dominate self-interest. The most famous experiment is the ultimatum game in which one player is given a sum of money and may decide to give some of it to a second player. If the second player accepts, the distribution is made, but if the second rejects the offer, neither get anything. Self-interest predicts that the first player offers the smallest possible amount, and the second player accepts this. But the evidence consistently shows that larger amounts are offered, and very small amounts are rejected. Thus people have social preferences, or preferences concerning their relations to others, and the traditional *Homo economicus* view of the individual seems limited in what it can explain.

Thus, despite the fact that economics is still largely identified with standard neoclassical economics, there is considerable change in the field, particularly on the research frontier. Much of this change, moreover, is inspired by influences of other sciences on economics. Sciences, of course, are distinguished by their subject matters, but they also typically have different practices of investigation and methodologies of explanation. Thus as new concepts and ideas come into economics from other fields, they often import along with them new ways of conceptualizing investigation in economics. Game theory and experimentalism are two prime examples of this. Neither methodology existed in economics until the postwar period, and together they have created a range of new strategies for explaining markets and economic behavior. From the point of view of non-economists, no doubt many of these kinds of changes appear esoteric and unrelated to everyday concerns regarding the functioning of markets and entire economies. Moreover, societies seem most concerned with economics as regards economists' policy recommendations. Policy targets changes in the ways economies work, but it need not be accompanied by theoretical explanation. Debates over economic policy

concern impact, and rarely do non-economists debate impact in terms of theoretical distinctions. That they leave to the economists, so that change in the foundations of economic policy generally occurs, as it were, behind the scenes.

In addition, economics as a science is in an unusual position with respect to the nature of its policy prescriptions as compared to many other sciences. A science's policies can be looked at in two ways: how great their impact is, and how precisely they are able to target their object. For economics, impact is often high since many people's lives can be affected by economic policies in significant degree. But, as noted at the outset here, economists are aware that economic policy may not achieve its objectives, because policies can be changed in the process of implementation, they can have unexpected consequences, and they are based on limited knowledge about the economy. Thus the general situation for economics is that things can go wrong, and sometimes in a serious way. This by itself is enough to make economists cautious about the claims of economics in explaining the economy. But the change in recent economics has added another reason for caution. No longer does it seem that economics as a science is complete and mature, as many believed in the first three decades after World War II. Now it is increasingly recognized that there is on-going change, debate, and key theoretical challenges afoot, reducing confidence regarding how secure economic theory should be thought to be. Perhaps the response to this will be to keep debates in-house. Then, should a new consensus emerge in the future about the nature of economic science, economics may re-appear as a unified science. ♦