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Kenneth J. Arrow

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RICHARD T. ELY LECTURE

Methodological Individualism and Social Knowledge

By KENNETH J. ARROW*

It is a touchstone of accepted economics that all explanations must run in terms of the actions and reactions of individuals. Our behavior in judging economic research, in peer review of papers and research, and in promotions, includes the criterion that in principle the behavior we explain and the policies we propose are explicable in terms of individuals, not of other social categories. I want to argue today that a close examination of even the most standard economic analysis shows that social categories are in fact used in economic analysis all the time and that they appear to be absolute necessities of the analysis, not just figures of speech that can be eliminated if need be. I further argue that the importance of technical information in the economy is an especially significant case of an irreducibly social category in the explanatory apparatus of economics.

In the usual versions of economic theory, each individual makes decisions to consume different commodities, to work at one job or another, to choose production methods, to save, and to invest. In one way or another, these decisions interact to produce an outcome which determines the workings of the economy, the allocation of resources in short. It seems commonly to be assumed that the individual decisions then form a complete set of explanatory variables. A name is even given to this point of view, that of *methodological individualism*, that it is necessary to base all accounts of economic interaction on individual behavior. In recent periods, a specific version of this

methodology has invaded other social sciences, under the name of *rational-actor* models. But today I will confine myself to the extent possible to the role of methodological individualism in economics.

The unwieldy adjective, "methodological," is needed to distinguish the concerns of constructing positive theory from the normative and policy implications wrapped up in the term, "individualism." This distinction is not easy to keep clear, and the temptation to join methodology and ideology is strong. Thus Paul Samuelson (1963) starts a speech on the policy limitations of individualism by comparing the competitive model of the economy to the physicists' theory of dilute gases, and comparing the need for state intervention to increasing density and consequently increased interaction of atoms. He appears to suggest that a failure of methodological individualism leads to a failure of individualism as a normative guide. Friedrich von Hayek, with totally opposed values, is even more explicit in identifying explanation and values. To quote, "true individualism... is primarily a *theory* of society, an attempt to understand the forces which determine the social life of man, and only in the second instance a set of political maxims derived from this view of society" (Hayek, 1948 p. 6; emphasis in the original).

I am old-fashioned enough to retain David Hume's view that one can never derive "ought" propositions from "is" propositions. The two issues, method and value, are distinct. In fact, the typical economist's argument today for government intervention to protect the environment rests on individualistic valuation, and the implementation of policies assumes individualist behavior in responding to regulation or taxes or some version of prices. On the other hand, it is certainly possible to model economic behavior in terms of socially defined variables,

*Department of Economics, Stanford University, Stanford, CA 94305. This work has been supported by NSF Grant SES-9209892. Another version of this lecture was delivered as the Lazarsfeld Lecture, 11 November 1993, at Columbia University.

such as conformity, common pools of knowledge, and governmental behavior, and still argue that individual choice is apt to dominate intervention by social entities because the latter are inefficient.

I first want to sketch very incompletely the explicit advocacy of methodological individualism particularly among the Austrian school and those influenced by them. I then want to indicate the useful implications of methodological individualism for positive economics. It is usually thought that mainstream economics is the purest exemplar of methodological individualism, so I will then examine some standard economic models to see if in fact they do conform to its requirements. As we will see, they do not. In fact, every economic model one can think of includes irreducibly social principles and concepts.

Particular stress will be placed on the role of information in the economic system. Limitations on individualistic methodology appear very strongly when considering the role of information, though again the individualistic viewpoint is not to be completely neglected.

I. Some Historical Remarks

Though economic thinking since at least the time of Adam Smith has the individual decision-maker at the core, the self-conscious formulation of the individualistic perspective is usually associated with the Austrian school. Its founder, Carl Menger, was led to methodological controversy by his sharp disagreement with the historical school of economists. His 1883 book covers a wide range of topics, including what seems to me to be an unacceptable dichotomy between theoretical and empirical research. A major strand is certainly an attack on the notion of a "national economy," which is rather the outcome of many "individual economic efforts." To understand a "national economy" requires understanding of the "singular economies in the nation," to use Menger's words as translated (Menger, 1985 pp. 93-94). Yet Menger does not supply a fuller definition of methodological in-

dividualism. Presumably his earlier (Menger, 1871) treatise exemplified its use, and indeed even the social concept of a market does not appear there.

Menger certainly does not elaborate the concept very fully. He recognizes that the "singular" economies engage in trade with each other, but the needs served, he emphasizes, are those of individuals, not of "the nation as a unit." The so-called, "national economy" is a complex of economies, not an economy, in Menger's view (Menger, 1985 appendix I). The meaning of individualism was taken up again by a later, though atypical, Austrian, Joseph Schumpeter (1909), in a paper on the concept of social value. Among other points not relevant here, he emphasizes that, while there are no social values, properly speaking, in a private-property economy, nevertheless under perfect competition the interaction of the individuals produces something which we may usefully call a social value. In Shakespeare's *Troilus and Cressida*, the Trojans debate the value of Helen of Troy:

Hector: *She is not worth what she doth cost the keeping.*

The hothead, Troilus: *What's aught save as 'tis valued?*

Hector: *But value resides not in particular will.*

[Act II, Scene II, lines 52-54]

Hector's answer, like Schumpeter's, suggests the ineradicable social element in the economy.

More currently, James Buchanan has identified himself with typical vigor as a methodological individualist and indicts macroeconomics and, with more qualification, general equilibrium theory and neo-classical theory in general as departures from the correct understanding of an economy as an order, rather than as a resource-allocation mechanism (see e.g., Buchanan, 1989). Like Hayek, he does see a link between methodological and normative individualism: "I suggest that an accepted understanding of the economy as an order of interaction constrained within a set of rules or constraints, leads more or less directly to

a normatively preferred minimal intervention with the results of such interaction" (p. 88). He explicitly rejects Hume's dichotomy between "is" and "ought."¹

II. The Case for Methodological Individualism

The starting point for the individualist paradigm is the simple fact that all social interactions are after all interactions among individuals. The individual in the economy or in the society is like the atom in chemistry; whatever happens can ultimately be described exhaustively in terms of the individuals involved. Of course, the individuals do not act separately. They respond to each other, but each acts within a range limited by the behavior of others as well as by constraints personal to the individual, such as his or her ability or wealth.

A market would appear to an economist to be an obvious illustration of a social situation as an interaction among individuals, and individuals are certainly an indispensable part of both its description and its analysis. But an army is equally composed of individuals, and no analysis of its workings can ignore how individuals give orders or react to them. Similarly, if we want to study congestion on roads or bridges, the role of the many individuals who can choose one route or another or drive slowly or rapidly is essential to the study of the existence and dynamics of congestion.

Thomas Schelling (1978) has given a wide variety of social interaction situations where the social outcome was surprisingly different from the individual motivations. To be sure, Adam Smith already taught us that the efforts of entrepreneurs for maximum profit lead to minimization of profit for all. Generalizing from the "invisible hand" argument, Menger, Hayek, and other Austrians have associated the notion of "spontaneous order" to the individualist theme.

Whereas Smith went from individual interactions within a given social framework to resource allocation, Menger and others hold that the institutional rules themselves change as a result of a myriad of individual actions. Menger exemplifies this theory with an ingenious hypothetical account of the origins of money (Menger, 1883 pp. 152-55). Some individuals, perceiving that barter with goods having an irregular demand is difficult, have the idea of acquiring a good in steady demand when they can, even though they do not want that particular good. Once this happens, the advantage to others to do the same increases, and some goods become recognized as being readily accepted. In the political sphere, Edmund Burke had argued this point much earlier, in his attacks on the French Revolution, as had legal scholars and philologists in the early 19th century. In Burke and Hayek, this leads to a principled rejection of deliberate changes in society, for the existing institutions, having arisen by so many individual choices, embody the wisdom of the ages. Menger (1883 pp. 145-46) is more reserved; he considers that some social changes occur consciously and for pragmatic reasons, while others are indeed the unintended outcomes of individual actions. Buchanan (1989 p. 92 and footnote 5) is even more emphatic in rejecting the universality of unconscious institutional design.

It strikes me, by the way, that the current focus of evolutionary analysis on strategy choice in games might be better directed toward changes in the rules of the game. This would be a formalization of the notion of spontaneous order.

It is clear that the individualist perspective does play an essential role in understanding social phenomena. Particularly striking is the *emergent* nature of social phenomena, which may be very far from the motives of the individual interactions. It is a salutary check on any theory of the economy or any other part of society that the explanations make sense on the basis of the individuals involved. Any attempt to understand disequilibrium dynamics must require the understanding of the information and

¹For an illuminating discussion of individualism with special regard to the implicit problems of knowledge, see Lawrence A. Boland (1982 Ch. 2).

strategy choices available to individual actors.

Social and historical determinism is not as popular a viewpoint as it used to be, and an individualistic perspective is a guard against such theories. Whether in Marxist or other forms, such theories relied heavily on disembodied actors such as classes or national spirits, rather than on the actual persons. The newer trends in historical analysis are more concerned with contingency than with determinism, contingencies arising from the flexibility and freedom of individual human decision-making.

In this quick presentation of individualism, I have avoided the term, "rational choice." The individualist viewpoint is in principle compatible with bounded rationality, with violations of the rationality axioms, and with the biases in judgment characteristic of human beings. The additional step to rational choice is, of course, of the greatest practical importance to theory formation, but it is not in principle necessary for the individualist viewpoint.

III. Competitive Equilibrium and Methodological Individualism

I have emphasized the desirability of an individualist perspective. I now want to argue that economic theories require social elements as well even under the strictest acceptance of standard economic assumptions.

The prototypical economic model, despite battering, is general competitive equilibrium. Individuals and firms take prices as given. Individuals choose consumption demands and offers of labor and other assets, subject to a condition that receipts cover expenditures. Firms choose inputs and outputs subject to the condition that the outputs be producible given the inputs. How they make these choices depends on many factors: tastes, attitudes toward risk, expectations of the future. But, it is held, these factors are *individual*.

Even if we accept this entire story, there is still one element not individual: namely, the prices faced by the firms and individuals. What individual has chosen prices? In

the formal theory, at least, no one. They are determined on (not by) social institutions known as markets, which equate supply and demand.

I pass over many other questions of social roles in this description. Tastes may be socially caused; expectations are influenced by others; firms are organizations, not individuals. But I want to argue the case most favorable to individualism.

The failure to give an individualistic explanation of price formation has proved to be surprisingly hard to cure, though there are some ingenious stories. They all depend on the closest realization of individualism in economic theory, which is to be found in game theory, and indeed Buchanan (1989 p. 82) asserts that, "game theory offers the appropriate mathematical framework that facilitates an abstract understanding of economics."

IV. Game Theory

The current formulation of methodological individualism is game theory. This is not a particular theory of social interaction, but rather a language for such a theory. It may not be surprising that its authors are an Austrian economist and a Hungarian mathematician-economist at least closely connected culturally to Austria.

In a game, each agent chooses one among a set of strategies available to him or her. In the usual formulations, the set of available strategies is fixed, independent of the choices of others. The outcome or payoff of the game for each player is a function of the strategies of all the players. Hence, all the interactions among players are embodied in the payoff functions. The choice of actions is totally individualistic. For the game formulation to be meaningful, the outcomes defined by the payoff functions must be possible; for example, demand should never exceed supply for any commodity.

It has proved difficult to define competitive equilibrium as the outcome of a non-cooperative game. It is not difficult to construct a game whose equilibrium point is a competitive equilibrium; indeed, Gerard Debreu and I did something close to that in

our proof of existence of competitive equilibrium (Arrow and Debreu, 1954), and an unpublished version uses a game strictu sensu. But the game was purely a mathematical construct; when nonequilibrium strategies were played, the outcomes were not feasible. Games whose outcomes are always feasible and whose equilibria are Walrasian have been constructed, but their relation to real-life phenomena has varying degrees of weakness (see e.g., David Schmeidler, 1980).

The most realistic-sounding noncooperative-game-theory model of competitive equilibrium I know of is due to Douglas Gale (1986a, b), though in its present form it applies only to a pure exchange economy. Pairs of individuals meet at random and bargain (bargaining is itself formulated as a subgame). With the endowments obtained as a result of the bargaining, they again meet in pairs chosen at random, and so forth. The bargaining at any time is, of course, affected by the (rational) expectations of the results of future bargains. These expectations are, in effect, prices. Gale's model is a possible formalization of the Austrian viewpoint. However, prices never appear as objective phenomena; they are only subjective, that is, expectations held in the agents' minds.

For a different perspective on the individualist nature of game theory, consider another economic model, oligopoly. This problem could be considered the very origin of noncooperative game-theoretic analysis in economics (there are, I believe, even earlier examples of noncooperative game theory in the analysis of social games); the analysis, in completely modern form, goes back to Augustin Cournot (1838). We recall the formulation. A set of firms are producing the same good. Each chooses a quantity; the price is that which clears the market for the total quantity supplied by all firms. Any one firm then has a profit equal to the revenue from its chosen output less the cost of producing that output. Each firm maximizes its profit given the outputs of the other firms.

This seems straightforward enough, and yet there are some difficulties. One is a recurrent question ever since game theory was formalized and even earlier in discus-

sions of oligopoly theory. The optimizing strategy for each firm depends on the strategies chosen by the other firms. But how does a firm know what the other firms are doing? Indeed, it is of the essence that they are chosen simultaneously. Each firm has an expectation or conjecture (to use Ragnar Frisch's term) about the others' actions. Why should they be consistent? This problem is again actively on the agenda of game theorists. It is a problem of knowledge.

Even if we do not question the concept of an equilibrium point, there is another difficulty, first raised by Joseph Bertrand (1883) in his very belated review of Cournot's book. What after all are the strategies of the two players? Cournot assumed that firms choose quantities. Is it not equally reasonable that firms choose prices? If we assume rational consumers, they will all buy from the sellers with the lowest price. The outcome of this game is entirely different from Cournot's; under simple assumptions it is in fact the competitive equilibrium even if there are only two firms.

What this example shows is that the *rules of the game* are *social*. The theory of games gets its name and much of its force from an analogy with social games. But these have definite rules which are constructed, indeed, by a partly social process. Who sets rules for real-life games?

More generally, individual behavior is always mediated by social relations. These are as much a part of the description of reality as is individual behavior.

V. Externalities

Even within standard economic theory, I have taken the case most favorable to individualistic analysis. Economics has for about a century (since Alfred Marshall [1920; first edition, 1890]) recognized the importance of what we have come to call externalities. Roughly speaking, these are social interactions not mediated through the market. The analysis is currently applied especially to environmental issues; air and water pollution, global warming, toxic wastes, but also congestion.

This ground is too familiar for discussion, and much study proceeds along individualistic values, though calling for some kind of collective action. One technical remark is useful as a preliminary to the following discussion of knowledge and information as social as well as individual characteristics. For many, though by no means all, externalities, the effect depends on the total of many individual contributions. For example, individual combustion activities contribute to a stock of sulfur dioxide in the atmosphere, the effect of which on individuals depends only on the total, not on the individual contributions. Let us call such externalities *funded*. This does not change the underlying logic of externalities but does simplify the analysis.

VI. Social Knowledge

Among the externalities that Marshall was concerned with, a prime example was information, especially technical knowledge. The caustic dissenter, Thorstein Veblen (1919 pp. 180–230; originally appearing in 1908), in reviewing John Bates Clark's textbook, identified socially held technical knowledge as a main determinant of economic activity in every economy. In primitive societies, to quote, "[t]he 'capital' possessed by such a community—as, e.g., a band of California 'Digger' Indians—was a negligible quantity, more valuable to a collector of curios than to any one else, and the loss of which to the 'Digger' squaws would mean very little. What was of 'vital concern' to them, indeed, what the life of the group depended on absolutely, was the accumulated wisdom of the squaws, the technology of their economic situation." (Earlier, he had said, "women seem in the early stages to have been the most consequential factor instead of the man who works by himself.") Veblen did not deny that the capital goods are more significant in modern economies, but, "[t]he commonplace knowledge of ways and means, the accumulated experience of mankind, is still transmitted in and by the body of the community at large; but, for practical purposes, the advanced 'state of the industrial arts' has enabled the owners

of the goods to corner the wisdom of the ancients and the accumulated experience of the race" (p. 185).

Of course, other forms of knowledge than purely technological are essential to the social system in general and the economy in particular. In many ways, these forms are stressed by Hayek. In his famous 1945 paper on knowledge in society (Hayek, 1948 Ch. 4), he emphasizes the dispersed and tacit nature of knowledge and argues that the economy solves the problem of allocating resources under these conditions. His motive was to rebut the possibility of a centrally planned society, one in which the relevant knowledge is concentrated in one place. But in the course of his argument, he has put obstacles in the way of a better understanding of the generation of knowledge.

He does acknowledge (pp. 79–80) that scientific knowledge differs from the tacit knowledge held by individuals and not easily transmitted to others. In scientific knowledge, expert opinion may indeed count for more than the knowledge dispersed throughout the economy. However, Hayek tends to minimize the role of scientific knowledge and does not really discuss technological knowledge at all, a good deal of which is transmittable to others. Let me call scientific knowledge and the more transmittable parts of technological knowledge together "reproducible knowledge." (Of course, a fuller account would have to recognize varying degrees of reproducibility.) In many ways, the distinction between reproducible and tacit knowledge is parallel to that between evolutionary and conscious changes in social organization that I referred to earlier.

Suppose we try to pursue the individualist viewpoint about knowledge, that knowledge is held by individuals. What is striking is that neither Hayek nor his socialist opponents were concerned with changes in knowledge. The stock of knowledge is given. Hayek takes this knowledge to be distributed among economic agents and attributes to the socialists the view that it is or can be held centrally. (This is in fact a caricature of the position of the market socialists, from Enrico Barone through

Oskar Lange and Abba Lerner.) More modern economics is concerned with the acquisition of new knowledge, and the test of the individualist viewpoint has to be an attempt to understand how and why new knowledge is held by individuals to see if the account is adequate.

New knowledge is acquired in two different ways: (1) acquisition from observing nature (whether by research or by less formal procedures); and (2) learning from other individuals, which in turn can be subdivided into (a) intended learning (communication, education), and (b) inferring the knowledge of others by observing their behavior.

Let us consider the second mode, learning from others, first. There are clear empirical problems with maintaining the individualist orientation. Technical and other knowledge exists in social form: books or universities (professors in many courses are largely interchangeable). These are examples of *intended* communication, though not precisely individualistic as to recipients. Inference from the behavior of others is even less individualistic. The existence of new products is itself a transmission of information, an externality; it shows that certain ways of progress are possible, even if the principles are not made public. When the atomic bomb was new, there was great concern about secrecy; but wise physicists observed that the most important information was that the achievement of nuclear fission was possible, and that could hardly be held secret. In practice, reverse engineering and the diffusion of basic unpatentable knowledge imply a much more rapid transmission of technical information than merely the existence of new products (see Edwin Mansfield [1985] who estimates that new technology becomes available to other firms within one or two years).

It is curious, by the way, that so much of the literature of the last 20 years has concentrated on using prices as a source of information (e.g., Sanford Grossman, 1976; Roy Radner, 1979; Grossman and Joseph E. Stiglitz, 1980). Interesting as this work is, the assumptions needed to imply that prices reveal much of the private information of others are unrealistically strong, while the

revelation of quality information is much more transparent.

With this perspective, it may be easier to think of information breeding information and to suppress the role of individuals. This is very much like the role of genetic information. As the late 19th century writer, Samuel Butler, said: "A chicken is an egg's way of making an egg."

Indeed, models in which socially available information is a variable are not uncommon, especially in the literature on technological innovation and economic growth. One class includes those models which emphasize the diffusion of technology (for well-known examples, see Zvi Griliches [1957], Everett Rogers [1962], and Mansfield [1968 Part IV]). The tradition in turn derives from earlier work in anthropology and sociology, in which traits (in particular, technologies) in possession of one group spread to another at rates proportional to the contact between the groups. These in turn are related to theories of the spread of epidemics.

Modern theories of economic growth incorporate many of the same elements. Subtle observation is not needed to see that we have had great changes in our technological knowledge. The need for economic analysis is to explain steady or even accelerating rates of growth in advanced economies. Neoclassical economics without increased knowledge should lead to diminishing rates of growth, even apart from Malthusian considerations and exhaustible resources.

While dissemination of existing information can certainly account for some gains in productivity, it is clearly necessary for sustained growth to have information new to the entire system, not merely learned from others. Where does this new knowledge come from? The literature has two viewpoints, although they are not really exclusive. One is that the growth in knowledge is exogenous to the economy (Robert Solow, 1956), the other that it is endogenous, a result of economic processes (the "new growth economics").

The first is equivalent to saying that knowledge produces knowledge. The second emphasizes that knowledge is pro-

duced by individual decisions to invest resources to produce new knowledge; doubtless, this is a phenomenon of increasing importance in the economy. It is indeed the first of our two modes of information acquisition sketched above and seems to fit well into the individualistic paradigm. But, because learning from others is so prevalent and so unavoidable, information is, for the most part, kept private only temporarily if at all. For this reason, the current theories of economic growth emphasize the role of informational externalities (see Robert E. Lucas, Jr. [1988] for a typical presentation). Information privately produced for private gain contributes as an unintended by-product to the social pool of information. This in turn is an input into both production of goods and creation of new knowledge.

Information has thus both public and private aspects. There are more and more examples of firms whose primary value is the possession of an informational advantage. This points to what I think will be an increasing issue in the analysis of industrial organization. The private property essential to the firm is eroded by the public access to the information which is part of that property. I do not know what can be predicted about the future development of firms, but I think that we are going to see new forms of property with aspects of both private and public goods.

Methodological individualism has indeed one major implication for information acquisition, ironically one not very compatible with neoclassical paradigms, particularly not with rational choice. Information may be supplied socially, but to be used, it has to be absorbed individually. The limits on the ability to acquire information are a major barrier to its diffusion. This line of argument leads to Herbert Simon's concept of bounded rationality and to the emphasis on learning as a process in time.

I have no easy summary. But I do conclude that social variables, not attached to particular individuals, are essential in studying the economy or any other social system and that, in particular, knowledge and technical information have an irremovably social component, of increasing importance over time.

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