

frontier research in economics

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Introduction

This essay deals with trends in economic theory over the past few decades. It is unabashedly subjective and partial. It does not attempt to provide an exhaustive panoramic view of current research in economics. Rather, I have chosen to focus on some of the recent developments that have tried to relax the highly restrictive assumptions under which General Equilibrium Theory (GE) had been built over the second half of the twentieth century. This enrichment in the description of the working of individuals, firms, government, and society at large, has also had the side effect of significantly increasing the inter-disciplinary nature of current research in economics. We are witnessing a remarkable overlap with political science and sociology, of course, but also with psychology, biology, and neuroscience.

Even with such a severe restriction in scope, I shall have to be more superficial than I would like. Also, my choice has the drawback of leaving completely uncovered important and dynamic areas of economics such as macroeconomics, finance, trade, and development, to mention a few.

The essay proceeds as follows. In the next section I start by giving a summary view of the GE model,

undoubtedly the core paradigm in economics. Section 3 describes the major departures from the standard GE model. Then I move into a more in depth analysis of the recent contribution of the *behavioral* approach to individual decision making. Inspired by research in psychology and largely based on controlled experiments, behavioral research tries to carefully document patterns of individual behavior that deviate from the choices predicted by the classical rational behavior model. Section 4 provides a description of all the ingredients involved in a decision so that we can give a more structured account of the different results and what are the precise ingredients that are questioned. Section 5 gives a synthetic account of the main contributions in *behavioral economics*. Finally, Section 6 takes stock of the research reported, makes an evaluation of the net contribution and derives implications for future research.

General Equilibrium and Welfare Economics

Modern GE theory started in the 1950s. The 1954 paper by the Nobel laureates K. Arrow and G. Debreu on the existence of a competitive equilibrium and the 1959 book by Debreu *Theory of Value* can be taken as the beginning of four decades of an extremely fruitful

effort to understand the working of competitive markets. The books by Arrow and Hahn (1971) *General Competitive Analysis*, W. Hildenbrand (1974) *Core and Equilibria of a Large Economy*, and A. Mas-Colell (1990) *The Theory of General Economic Equilibrium: A Differentiable Approach* can be considered the most significant landmarks of this endeavor.

GE consists of a very complex but schematic model that tries to capture the coordinating role played by markets in an otherwise atomistic and individualized society. It provides a rigorous proof of the Smithian claim that the invisible hand is sufficient to make mutually compatible the decisions taken by completely uncoordinated individuals and firms.¹ In this sense, the elimination of any reason for explicit or tacit coordination as well as of individual concern for others was crucial to the model. With all participants furthering their own interest (narrowly understood) and limiting their interaction just to supply and demand through the markets, the outcome would not turn out to be chaotic but orderly and efficient—in a sense to be made precise below.

Let us recall some of the assumptions needed to derive this mathematical result. The participating agents are an arbitrary number of individuals and firms. All participants can buy and sell commodities (labor, for instance) through the markets at the ruling prices. Most important, all participants are assumed to behave competitively, that is, to take prices as given.² In addition, individuals own all the shares over existing firms. The distribution of these shares across the population is arbitrary.

Initially, each individual owns a collection of commodities (which may well be only labor) and shares. By selling and buying they can obtain a new set of commodities (for instance, eight hours labor sold and bread and butter purchased). The amounts traded have to be within each individual's budget, where the monetary value of the budget is determined by the ruling prices. All individuals have preferences over the traded commodities, that is, they can rank any pair of bundles of commodities in terms of their desirability. Besides being complete, this ordering is assumed to be transitive, reflexive and satisfy a weak convexity condition.³ Most important, these preferences depend on personal consumption only, hence eliminating any form of altruism. Then, individuals are assumed to act rationally. That is, among the trades affordable to them (the value of purchases cannot exceed the value of sales) they choose the one they rank highest in terms of desirability. Thus, for any given vector of market prices each individual consumer thus has a

well-defined vector of demands and supplies of the traded commodities.

Firms purchase through the market commodities and labor supplied by other firms and by individual consumers (inputs) to turn them into a set of produced outputs to be sold in the market. How much output firms can produce from a given vector of inputs is conditioned by the production technology available to them. The set of feasible combinations of inputs and outputs is assumed to be convex.⁴ For every vector of prices, each firm chooses the vector of inputs (purchases) and the vector of feasible outputs (sales) with a view to maximizing their own profits.

An equilibrium is a vector of prices such that when all purchases and sales are aggregated for the entire economy, supply is equal to demand in each of the markets. A good part of the research in GE until the mid-nineties was devoted to demonstrating the existence of such an equilibrium vector of prices under the weakest assumptions possible on individual preferences and production technology. Indeed the collection of individual decisions taken by egoistic individuals and firms without any coordination can turn out to be feasible rather than generate disorder. Besides proving that the concept of equilibrium is not vacuous—there always exist such equilibrium situations—GE theorists also obtained conditions under which this concept was not too lax: equilibria are determinate, thus excluding continua of equilibria.

The most remarkable results of GE theory—the “Two Fundamental Theorems of Welfare Economics”—prove that these market equilibria have interesting efficiency properties. W. Pareto defined a basic efficiency requirement that has become fundamental in economics: a situation is (Pareto) efficient if by reallocating commodities in the economy it is not possible to improve the well-being of someone without harming somebody else. Notice that distributional justice is completely absent from this notion. An allocation in which one person owns everything while the rest are starving to death is efficient as long as individual preferences never reach satiation.

The First Fundamental Theorem establishes that all competitive equilibria are Pareto efficient. Therefore, market exchange among self-regarding participants also leads to an efficient use of the existing resources. The Second Fundamental Theorem says that every efficient allocation of commodities can be implemented as a competitive equilibrium, with an adequate redistribution of the initial resources. It follows that a socialist planned economy cannot do better than competitive markets—with an appropriate one-time redistribution of resources.

1 This issue—markets versus socialist planning—became salient in the Cold War political debate.

2 This assumption is more plausible when all participants are so small that they cannot influence prices by their action. It is obvious that this is not the case. Governments have had to set up competition agencies more or less effectively trying to guarantee that firms will not collude to manipulate prices. Workers too are to a large extent unionized in order to keep wages (and working conditions) up.

3 If bundle A is strictly preferred to B, then any convex linear combination $\lambda B + (1 - \lambda)A$, ($\lambda > 0$) is strictly preferred to B.

4 If the combinations A and B are feasible, so is $\lambda B + (1 - \lambda)A$, $0 \leq \lambda \leq 1$.

How much to redistribute and how to do it without distorting the working of the markets clearly is a question complementary to GE theory. These kind of questions pertain to *Welfare Economics*. If the government has to choose it has to be that there are some sort of "social preferences" ranking alternative policies by the social desirability of their outcomes. As early as 1951, K. Arrow (Nobel laureate, 1972) demonstrated that it was not possible to aggregate individual preferences into a social preference ranking, if this had to satisfy a set of reasonable properties. Welfare Economics—as well as Public Economics in general—ended up by assuming that somehow social priorities could be encapsulated into a *social welfare function*. The role of the government was then modeled in the same spirit as individual choice: to maximize social welfare under feasibility constraints. The contributions of P. Diamond and J. Mirrlees (Nobel laureate, 1996) in the mid-seventies set the basis of modern public economics by rigorously rooting the theory of government intervention on the foundations of GE theory.

This summary, of course, only records the most essential results of GE theory and the associated welfare economics.⁵ At the January 1994 meeting of the *Econometric Society* one of the most distinguished contributors to the development of GE theory, Andreu Mas-Colell, gave an invited lecture on "The Future of General Equilibrium."⁶ His presentation transpires the perception that GE theory had already reached its peak and that the attention of young researchers had already turned towards other issues that had been left aside by GE theory. We are going to review some of these new lines of research. But, before moving to the marrow of my essay it is imperative to stress one fundamental contribution of GE theory: mathematical rigor. This precisely is Mas-Colell's (1999) last line: "I would hope that the role of theorem proving is kept alive, perhaps not as strong as before, we may have overdone it, but with substantial presence" (p 214).

Major recent departures from the standard model

The extremely stringent assumptions of the GE model were obvious to all theorists, but were considered the price to pay to have a clean model of the working of the markets.

One obvious reservation is that in many markets there aren't sufficient enough firms so as to justify the assumption of competitive behavior. There are situations in which there exists a monopolist, and there are even situations in which a monopolist is considered to be "natural," as in the case of the supply of electricity, cable TV, and so forth. A monopolist is

not a "price taker," and it may take into account that the quantity it decides to produce will affect the price at which it is sold. In this case, the market equilibrium will typically not be Pareto efficient. The same result applies if there are several firms in the market, but their number is not large enough for each of them to act as if it had no effect on prices. This has given rise to the field of *industrial organization* mostly developed in the late eighties and nineties.⁷

A second major departure from the classical GE model has been the study of the role of information in the eighties and nineties. In the standard model, all participants are assumed to have the same information—which might mean the relevant probabilities in case of uncertainty. However, it is plain that this is not always the case. The classic example (Akerlof, Nobel laureate 2001) is the market for second hand cars: the seller, who has owned the car, has more information on its quality than does the buyer. In such a situation, one can show that equilibria are typically not Pareto efficient. Akerlof's used car example ("the market for lemons") is a parable that applies to a multitude of situations in which information about trade is not symmetric. Other examples include the insurance market (where the insured may know more about the risk than the insurer), employment contracts (where the employed "agent" may know more than the employing "principal"), and so on (Akerlof, Mirrlees, Stiglitz, Vickrey, all Nobel laureates).⁸

Yet another major deviation from the classical model has to do with externalities, namely, situations in which the consumption of one agent might directly affect the wellbeing of another. In particular, cases in which there is a public good—a good that can be used by many individuals simultaneously, such as hospitals, transportation, education, defense—fall in this category. Again, it was shown that competitive markets cannot be relied upon to result in a Pareto efficient allocation in these situations.

It so happened that all these deviations from the classical GE model were analyzed using game theory. Game theory started out as the analysis of parlor games at the beginning of the twentieth century. In the 1940, O. Morgenstern and J. von Neumann wrote the first book on the topic, which also suggested that the theory is the correct way to analyze all social and economic situations. The approach was soon refined by J. Nash, who held that all such situations should be analyzed from the level of the individual decision maker up. Nash suggested the notion of "equilibrium", currently named after him (Nash Equilibrium), which requires that each decision maker chooses his or her best course of action in accordance with what the others are doing.

⁵ See Mas-Colell et al. (1995) for a state-of-the-art presentation of the General Equilibrium model and microeconomic theory.

⁶ See Mas-Colell (1999).

⁷ The books by Tirole (1988) and Vives (2001) give a comprehensive overview of the topic.

⁸ See Stiglitz (2002) panoramic presentation in his Nobel lecture.

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Other major contributors to game theory include L. Shapley, J. Aumann, and R. Selten (the latter two are also Nobel Laureates, alongside J. Nash and J. Harsanyi).

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Note that I am skipping the new views on the behavior of firms beyond profit maximization. As an excuse, let me cite Mas-Colell (1999) who says "I am not sure that (...) we will end up seeing the theory of the firm at the heart of economics."

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The first classical model of a democracy is due to Downs (1957).

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Oemer (2001) is a rigorous and comprehensive book on political competition.

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See Persson and Tabellini (2000) for a very influential book in this area.

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See Grossman and Helpman (2001).

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See Esteban and Ray (1999) for a general model of conflict. Fearon (1996), Powell (1999) and Ray (2008b) have developed arguments to explain why society may fail in agreeing on a new social contract that Pareto dominates the costly outcome of civil conflict.

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As a consequence, the GE model is unable to analyze how the economy can reach the precise vector of prices that will clear all the markets.

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Ray (1998) is the basic advanced textbook in development economics. See also, Ray (2008a) for an overview of the recent developments in this area.

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See Jackson (2008b) for an survey of recent contributions and the books by Goyal (2007) and Jackson (2008a) for an extensive presentation.

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See Benabou (1993; 1996).

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See the survey by Calvo-Armengol and Yoannides (2008).

Game theory was perfectly suited to dealing with non-competitive markets, but only after the contributions of J. Harsanyi did it become apparent that situations of asymmetric information were also amenable to game theoretic analysis. This also made game theory the natural method to analyze problems of externalities and public goods. Hence game theory became the standard tool of analysis in microeconomic theory. Since the mid-seventies, economic theory has become dominated by game theory. Over recent decades, game theory has also proven a fundamental tool for macroeconomics and even political science. It seemed that any problem in the social sciences can be thought of as an application of game theory.⁹

Current research, however, is grappling with several fundamental problems, which suggest either that not all major problems can be relegated to game theoretic analysis, or that such analysis might not be complete. One can classify the different recent departures from the paradigm in three categories: (i) how individuals and firms decide; (ii) how governments decide; and (iii) how agents interact.

Even in such narrow an area of economics there are too many developments to permit a coherent and comprehensive presentation. I shall focus on the frontier research in individual rational choice only.¹⁰ However, before moving on, I shall give a sketchy picture of the main lines of progress on group decision and on the departure from the competitive assumption.

It is plain that government economic policies are not decided on the basis of maximizing a social welfare ordering. Rather, in democracies political parties propose policies and citizens vote over the proposed manifestos.¹¹ This is the orderly way that modern democracies are designed to resolve the opposing interests that characterize all societies. Therefore, if we want to understand the policies actually enacted we have to explain how political parties choose their political platforms and how they behave once in office.¹² This approach is what has become to be known as *positive political economy*.¹³ Of course, the literature has also explored the known fact that large firms and special interest groups are also effective in influencing the government in its decisions by lobbying through various channels.¹⁴

The political system is itself endogenous and responds to the nature of different, often opposing interests within the society. Acemoglu and Robinson (2006) have studied the role of social and economic change in forcing the political system to change. Specifically, they argue that democracies have

evolved as a commitment device: tension over the distribution of wealth and the threat of a revolution have historically forced monarchs to share their wealth. However, a promise to do so may not be credible. Democracy, according to this view, involving giving voting rights to larger fragments of society, allowed commitments to be credible and thus averted conflicts. But can the social contract always be modified in response to social changes? Clearly not. In the second half of the twentieth century there have been over 16 million civil deaths in civil wars. This exceeds by a factor of five the number of battle deaths in the same period. The threat of civil wars currently is so endemic that the World Bank considers political instability the most serious impediment for the effectiveness of foreign aid in promoting growth in developing countries. In economics, Hirshleifer (1991), Grossman (1991), and Skaperdas (1992) have pioneered the study of conflict, but we are still far from a satisfactory understanding of the causes of civil conflict.¹⁵ How economic agents interact is simply not modeled by GE theory. How the products produced by firms reach consumers or other firms is left out of the model.¹⁶ This lack of interest in the actual operation of economic transactions is partly due to the exclusive focus on competitive markets in equilibrium. Indeed, if markets are competitive and in equilibrium there is no point in looking for a better deal. All the requests get (magically?) satisfied and there is no chance of finding a seller offering a lower price. If, however, there are different prices for the same commodity or if certain requests (such as an individual's request to sell his or her labor) might not get satisfied, it certainly does matter how the transactions actually operate.

Most of the research on the actual working of economic interactions has been investigated by *development economics*. The most superficial observation of underdeveloped countries makes it plain that their economies cannot be conceived as a set of competitive markets in equilibrium. We owe to this branch of the literature most of the insights on the role of specific institutions, networks, and social rules in channeling economic interactions.¹⁷ At a more formal level, the existence of network connections and their impact on economic interactions has caught the attention of economic theorists. The essence of the model bears similarities with the local interaction models in physics with a crucial twist: the nodes are optimizing individuals or firms that can create or sever ties.¹⁸ This approach has given new insights in different areas of economics such as education¹⁹ and the labor market.²⁰

"Classical" rational choice

Many of the new directions of research in economics are driven by the need to relate theory to facts more strongly. This is especially true of modern "behavioral economics," as some colleagues term it. Since observed individual behavior is often at odds with the decisions that derive from the standard rational choice assumptions, economists have turned their attention towards the patterns of behavior that psychologists have been identifying by means of controlled laboratory experiments. The pioneering work of psychologists Kahneman (Nobel laureate in Economics, 2002) and Tversky²¹ has recently had a profound influence in economics. In addition to opening the minds of economists to the findings in psychology, it has also triggered a remarkable boom in experiments on individual and group behavior. C. Camerer, E. Fehr, D. Laibson, and M. Rabin, to mention a few, are among the economists that have worked more intensively in this field.²²

To proceed in an orderly fashion, I find it useful to separate the essential ingredients of the individual decision problem.

The first ingredient is an informational input. Individuals observe some information about the state of world. In standard consumer theory this information refers to prices and incomes and, in an uncertainty environment, to the probability of each of the possible realizations of the states of the world. This information typically constrains the set of actions available to each individual. The second ingredient is the computation of the consequences (deterministic or probabilistic) that derive from each possible action. For instance, we take the action of working for eight hours and purchase meat and fish. Or, we can give up on consumption by ten euros and spend them in buying lottery tickets with given probabilities on a set of prizes.

The third ingredient is individual preferences. These preferences are assumed to generate a ranking over all possible consequences (independently of the actions taken as such) according to their desirability, as explained before. When the consequences are probabilistic, individuals rank actions by their expected utility, that is, the weighted average of the utility of the various realizations, using probabilities as weights. The standard model assumes that these preferences are egotistic, independent of what others obtain.

The last ingredient is rational choice. By this we mean that each individual is able to solve the constrained maximization problem consisting of identifying the action in the feasible set that has the most desirable consequence.

Psychology and individual decisions

Experimental work on individual behavior consists of confronting a set of individuals with a situation (as controlled as possible) in which classical decision theory has an unequivocal prediction so that the researcher can contrast actual with predicted individual choices. There is a rich variety of such experiments exploring different types of violations of the predictions of the standard model.²³ For instance, a repeatedly studied experiment consists of subjecting a sample of individuals to the *ultimatum game*. Individuals are randomly matched in pairs and one is assigned the role of proposer and the other that of the receiver. The proposer announces a division of a given amount of money among the two players. Then the receiver either accepts—and the money is divided according to the proposed allocation—or refuses—and both players receive zero. If players care about their own material interest only, the second player should accept any strictly positive amount of money. Knowing this, a selfish proposer should give an arbitrarily small amount to the receiver and cash the rest. As it turns out, in all specifications of this experiment there is a substantial proportion of proposers that propose divisions that are quite close to the egalitarian one and of receivers that are ready to give up even a non-negligible positive prize in order to "punish" unfair proposals.

This experiment is but one example of the plethora of patterns of choice that are currently being tested by behavioral economists. Some of these experiments challenge certain specific ingredient of our previous description of the decision process. But some are less targeted and try to identify violations of the predictions of standard rational choice theory.

Let us go through some relevant complexities that standard rational choice theory dismisses by assumption at each of the ingredients of a decision. Some have been studied by behavioral economics, but many are still to be carefully explored. As it will become clear, my position is somewhat ambivalent. On the one hand, I think that economics has to enrich its basic model of rational choice. But, on the other hand, I am quite skeptical—if not critical—with many of the claims of behavioral economics. In this respect I feel more in line with the critical positions of Gul and Pesendorfer (2008) and Rubinstein (2006).

The first ingredient of choice is the processing of information. There are many channels through which the acquisition of information may affect decisions. In the first place, individuals categorize information. This has been an object of study by social psychologists for the past five decades, but only recently have economists started paying attention to

²¹ Tversky died in 1996. See the essay of Laibson and Zeckhauser (1998) on Tversky's contributions.

²² Camerer and Rabin invited lectures at the Ninth World Congress of the Econometric Society provide an overall view of the potentials of marrying psychology and economics [see also the discussion by Ariel Rubinstein]. They are all published in Blundell et al (2006).

²³ See Della Vigna (2008) for a comprehensive survey of the different types of experiments.

it. It is immediately clear that such a process can bias our decisions. Fryer and Jackson (2008) study how efficient processing of information leads to a coarser categorization of the types of experiences that are less frequently observed, lumping them together. As a result, decision makers make less accurate predictions when confronted with such objects and this can result in discrimination. Secondly, individuals have to have an idea of which information is relevant to the decision at hand and which not. In other words, they need to entertain a "model" linking the possible actions to their consequences, as we shall soon discuss. However, there is psychological evidence that individuals tend to censor evidence that refutes their view of the world.

Moreover, Benabou and Tirole (2006) argue that this censoring mechanism may serve a function by supporting a belief that the degree of social mobility is higher than it actually is, and thereby inducing individuals to make a higher effort than rational choice would warrant. Such unrealistic beliefs are especially necessary in countries with a limited social net, such as the US. Finally, the rational choice assumption that individuals will use information to perform Bayesian updatings of the relevant probabilities may be unwarranted. As argued by Gilboa et al. (2007) there are instances in which individuals cannot have prior beliefs that are represented by probabilities to start with because rational, justified beliefs fail to pin down a numerical probability.

The second ingredient consists of mapping actions onto consequences, either deterministically or probabilistically. This step presumes that in view of the evidence individuals can identify a model that fits the data and that this model is unique. It is plain that this is generally not the case. More formally, Aragonés et al. (2005) show that given a knowledge base, finding a small set of variables that obtain a certain value of R^2 is *computationally hard*, in the sense that this term is used in computer science. Because of this fact, rhetorical statements contributing no new evidence can induce a change of behavior, as they may make one aware of certain relationships among known variables, which are obvious post hoc, but have not been conceived of before. Multiple theories and as many decisions are compatible with a given stock of evidence. Picketty (1995) developed a model in which the belief in a particular theory induces decisions that generate evidence confirming this theory. Different individuals can sustain different theories and parents have an incentive to transmit their own theory to their children. Finally, another way of making decisions in the absence of a determinate interpretation of evidence is via social imitation. Banerjee (1992)

developed a model of herding in which individuals make inferences from the observation of the behavior of others regarding the information they might have had and this leads them to act in a similar fashion.²⁴ An alternative line is the effect of social identity in behavior. Akerlof and Kranton (2000) were the first to call the attention of economists to the role of individual identification with categories or prototypes. I think that this is an important line of research, unfortunately still largely unexplored.²⁵

The third ingredient is individual preferences. This possibly is the front where classical economic theory is more restrictive and unrealistic. In the first place, it assumes that preferences are defined over own consumption only. This excludes altruistic motivations of which we have ample evidence. There is a vast literature on altruism, especially reciprocity based. Rabin (1993), Levine (1998), Fehr and Schmidt (1999), Bolton and Ockenfels (2000), and Falk and Fischbacher (2006) have focused on the interaction between pairs of players where each player attempts to infer the motive of its partner and then modifies its social preferences accordingly, giving greater weight to partners who are believed to be benevolent and less weight to those who are selfish or malevolent. Additionally, individuals may value actions per se, independently of the valuation of their consequences. This refers to the self (self-esteem/pride) and to others (ethical judgments). See Lindbeck et al. (2006) for an economic analysis in which parents seek to instill work norms in their children which are sustained by guilt and Tabellini (2007) for the adoption and transmission of values of generalized morality.²⁶ Finally, individuals seem to face changes in their preferences both through time²⁷ and through restrictions in their choice set.²⁸

The fourth ingredient is decision making proper. That is the process of combining all the information available and turning it into the choice of a particular action. The assumption of rationality means that individuals are supposed to choose the action they value highest within the actions available to them. Therefore, one can say that individuals do not behave rationally only when the analyst can offer an alternative action different from the chosen one and that the individual accepts as preferable.

The joint consideration of the available information, the link between actions and consequences and the valuation of these consequences involves considerable reasoning and the reasoning capacity depends on education, training, and past experience. It follows that we can conclude that individuals behave non-rationally only if they insist on their choices after being shown by the analyst that better

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See the recent overview on herding by Rook (2006).

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Esteban and Ray (1994) launched the idea that social conflict is driven by the sense of identity with one's own group, combined with the complementary sense of alienation with respect to the others. However, they just axiomatize an index of polarization rather than go into developing a model of identity formation.

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For the particular case of norms pertaining to work, seminal contributions by Moffitt (1983) and Besley and Coate (1992) consider the case in which there is stigma associated with living on welfare. Lindbeck et al. (1999) have extended this analysis to include voting over welfare benefits. Cervellati et al. (2008) let moral judgments on effort determine self-esteem and esteem for the others.

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The psychological cost of a given time postponement of a prize is higher if this happens immediately than if it does later in the future. Laibson (1997) has termed these time preferences as displaying "hyperbolic discounting."

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Here is a prototypical example: I definitely prefer not to smoke. I also would like to have lunch with a friend who happens to be a smoker. I may commit not to smoke by not having lunch with my friend. I know that if I have lunch with her I may give in to the temptation of smoking. This idea has been thoroughly explored by Gul and Pesendorfer (2001).

choices existed for them. We shall come back to this notion of rationality based on Gilboa and Schmeidler (2001).²⁹ In the case of certainty, rational choice amounts to solving a maximization problem under feasibility constraints. However, already in the 1950s Simon (Nobel laureate, 1978) argued that individual rationality was “bounded” in the sense that human computing capacity is limited. But this line of enquiry has not had much following. Notice that “bounded rationality” does not imply non-rationality in the sense above. The reasoning required for a decision in the case of uncertainty is much more complex as it calls for the additional consideration of the probability of the occurrence of every consequence possible. Classical rational decision theory assumes that individuals value each action by the weighted sum of the valuation of the consequences, using the relevant probabilities as weights.³⁰ Experimental evidence seems to confirm regular violations of some of the axioms—the so-called Allais and Ellsberg paradoxes. In order to reconcile theory and behavior, Kahneman and Tversky (1979) proposed *prospect theory* for modeling decision under risk. Based on behavior—and not on axioms—they claim that probabilities do not enter linearly in the valuation of an action but through a weighing function that exaggerates low probabilities and moderates large probabilities. Also the valuation of each consequence is measured as a deviation from a reference outcome.³¹ Notice that this approach continues to assume that there exist well-defined probabilities for each of the possible consequences of an action. Yet this is rarely the case. Gilboa and Schmeidler (2001) postulate that decisions are based on the results observed in previous cases that are considered “similar” to the current problem. From a set of axioms they derive that the value of an action is the sum of the utility levels that resulted from using this action in past cases, each weighted by their similarity to the current problem.

As far as rational choice is concerned, we can conclude that, while there is little controversy on rational decision making in certainty, the case of uncertainty is still unsettled. Summing up, we have seen that actual behavior appears to display deviations in each of the ingredients of a decision problem. There certainly is room for enriching our modeling of how information is acquired and processed, of how individuals link consequences to actions, or even what are the different dimensions that agents value (in addition to the material tradable commodities). However, none of these changes appears to have much to do with the basic notion of making of an optimal decision under certain

constraints. In the next section we shall discuss what can we learn from the findings of behavioral economics and the extent to which they challenge the assumption of rational individual decision making.

Behavioral economics: taking stock

Where does the exploration of the links between psychology and economics lead us? The vast and solid empirical evidence that there is a number of psychological factors that matter when individuals make decisions has been seen by some behavioral economists as a challenge to the core paradigm of economics on rational choice.³²

I shall argue that it is unclear how experimental evidence can be extrapolated outside the laboratory—what can we learn from it?—and that the enrichment of the behavioral description of decision makers is likely to have more influence on models of applied economics than on the paradigm and core assumption that individuals act rationally (and essentially) out of self-interest.

What can we learn from experimental evidence?

In the first place, we obtain a controlled confirmation that individuals behave differently from what prescribes classical economic theory. Indeed, individuals care for things other than their own material consumption, such as the actions they may take per se, moral judgments of the self and of others, etc. Decision makers also do not perfectly process information and often violate some axioms of rational behavior. However, it is not always obvious how such evidence should be interpreted and, even if it were unequivocal, whether the violations found in experiments should form part of the standard modeling of individual behavior.

In a sense, the experiment by Kahneman and Tversky (1984) showing that framing does have an effect on individual behavior makes one skeptical about what we can learn from experiments. First, there is a suspicion that the observed behavior has been induced by the particular way the choice problem had been presented to the participants.³³ Should we then conclude that people generally violate the most basic assumptions of the theory, or should our conclusion be that *sometimes*, given certain very clever formulations, people may act in highly irrational ways?

Implicit in the work of experimental behavioral economists is the belief that there is a natural pattern of behavior that was not properly captured by classical decision theory and that can be identified by means of critical experiments. Camerer and Loewenstein (2003) tell us that “behavioral

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See a more detailed analysis in Gilboa et al (2008).

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Properly speaking the assumption is that individual choices respect the axioms proposed by von Neumann and Morgenstern (1944), which imply that the valuation of an action is its expected utility.

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The case of Ellsberg paradox is examined in C. R. Fox and A. Tversky (1995).

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Rabin and Thaler (2001) refer to classical expected utility theory as a “dead parrot,” from the comedy sketch by Monty Python.

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This and other arguments on the difficulty of extracting conclusions from behavioral experiments are carefully examined in Levitt and List (2007).

economics increases the explanatory power of economics by providing it with more realistic psychological foundations" and that "the conviction that increasing the realism of the psychological underpinnings of economic analysis will improve economics on its own terms." Also, Rabin (1998) asserts that "because psychology systematically explores human judgment, behavior, and wellbeing it can teach us important facts about how humans differ from the way traditionally described by economics." Therefore, the purpose is to capture the *true* nature of individual decision making from factual observations in experiments or by other means.³⁴

Can we capture this "nature" of decision-making by experiments? Further, does this "nature" exist in a meaningful sense?

Leaving apart the reservations on the effective ability to control experiments, it still remains unclear what is the exact "nature" we are measuring. In order to illustrate my point let me take the most popular experiment that we have described before: the ultimatum game. The costly refusal of "unfair" proposals is interpreted as showing that individuals also care about things other than their personal monetary payoff.³⁵ However, it can also be that this costly rejection of an unfair proposal is an emotional reaction that momentarily obscures what reason would have dictated. The extent to which reason overrides emotions varies across individuals—possibly depending on education and training—and, in any case, only the dictates of reason should be taken to conform to rational behavior. If we are interested in the choices that a specific group of individuals will make in a given circumstance, it might be critical to know whether they will react bluntly or whether they will make cold calculations.³⁶ However, it seems natural that a general theory of individual behavior should abstract from the fact that we may momentarily deviate from rationality.

This raises a fundamental question to which we shall return: whether rationality is something positive or normative. Should society train citizens to be rational?³⁷ In fact, we do through the compulsory educational system...

Even for a given degree of sophistication in reasoning specific experiences or training can have a profound effect on behavior. In trying to empirically identify the notions of equity actually used by individuals, the work of Amiel and Cowell (1992) is very pertinent to substantiating the point I am making. Students were shown a series of two lists of (ten) incomes and asked to rank them in terms of their relative inequality. The purpose was to test which of

the different criteria used in economics could find wide acceptance. Among these criteria they tested the *principle of progressive transfers* popularized by Atkinson (1970). This principle says that if we transfer one euro from any single person to someone poorer the resulting distribution is less unequal. The result of relevance here is that this principle found wide support among economics students—who were directly or indirectly familiar with the concept—and quite modest among the other students. Indeed, we can more easily interpret information when we have been told how to organize it.

The previous question of whether there is a "nature" of decision making that can be captured by experiments was somewhat rhetoric. The point is that with the present state of knowledge it is not possible for the experimentalist to conduct critical experiments. As discussed in detail by Levitt and List (2007), even the most carefully designed experiment cannot guarantee that all other influences have been effectively controlled by the analyst. Therefore, while experiments have an extremely useful role in highlighting deviations from prescribed behavior, they cannot in general unequivocally identify the causes of such deviant behavior. I find it very important that these experiments be continued, but I am persuaded that this will be a long term project that will require time, effort, and patience.

Behavioralism and rational choice

Behavioralism will have more influence in models of applied economics than in redefining the core paradigm of individual rational choice. Let me present two arguments in support of my point.

My *first argument* is that there are still too many aspects of behavior of which we have but a very imperfect understanding. We see that individuals may be motivated by altruistic feelings, for instance. However, we are still not able to understand the causes of the variation of these feelings across the population. Some researchers have seen altruism as driven by the search of the benefits of reciprocity. But even reciprocity can be in material benefits or it can be a reciprocity of attitudes. Other researchers see altruism as deriving from moral convictions. We also observe that the degree of altruism depends on the proportion of the group that behaves altruistically. We have only conjectures as to how all these aspects interact. So far we don't know whether moral values, response to observed behavior by others, tendency to reciprocate, and the like are exogenous parameters or at least partly result from the variables we are trying to analyze. It is obvious that without exactly knowing (or

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I shall not discuss the current attempts at exploring the link between decision making and brain activity. See Gul and Pesendorfer (2008) for a critical view.

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This interpretation is reinforced by the interesting result that when the proposer is replaced by a machine that it is known to select proposals randomly, then the second player accepts unfair proposals much more easily.

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Even if rejection truly were the result of moral disappointment, the experimenter should test whether leaving the decision of rejection for the next day would alter the results.

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"Human beings, Romans argued, consist of two elements: an intelligent, rational spirit, and a physical body. [...] In fully rational people—such as elite Romans, of course—the rational spirit controlled the physical body. But in lesser human beings—barbarians—body ruled mind. [...] Where Romans would calculate probabilities, formulate sensible plans and stick to them through thick and thin, hapless barbarians were always being blown all over the place by chance events." P. Heather, *The Fall of the Roman Empire*. Oxford University Press, 2005, 69.

hypothesizing) what determines what, these behavioral features cannot be incorporated into a general model.

My *second argument* is that, even if we knew much more about individual behavior, how many specificities do we want the paradigmatic model to take on board? When the objective is to predict the demand for a given product (a new car, for instance) textbook consumer theory is of modest help only. The sales department of large companies know all too well that there are many motivations other than price to buying a product, that a certain share of the market reacts to the pride of driving a new car, while another share carefully reads consumer reports, and so on. By correctly mimicking the reaction of each type of consumer they are able to estimate the potential demand with remarkable precision. However, most researchers would consider that this kind of exercise does not belong to economics as a science.

How has economics dealt with features that do not fit with the assumptions of the core model? For a long time, modern economics has identified “anomalies” such as public goods—the enjoyment of which does not reduce the supply available, such as public TV broadcasting or law-and-order (Samuelson 1954)—, Giffen goods—whose demand increases with its price (Marshall 1895)—, inconsistencies in inter-temporal choices (Strotz 1956), or the social status effects on consumption (Duessenberry 1953). However, the recording of such anomalies in actual behavior did not erode classical theory of rational choice. Rather, economics reacted by developing “auxiliary” models to examine how each such departure from the classical assumptions could modify the intuition derived from the GE equilibrium model.

Classical decision theory is not meant to be descriptive in the literal sense of the word. The contribution of the GE model has not been to produce theories that actually predict anything with any precision, but a new way to think about the world that is truly illuminating. Giving up accuracy for insight is a familiar trade-off in economics, and perhaps the social sciences at large. How far one should go in skipping specificities in behavior is debatable. Should research in economics proceed as in the aforementioned cases and also develop “auxiliary” models while preserving the essence of the GE model as the core paradigm? My position as of today is in the affirmative, at least as long as we cannot neatly identify the exogenous determinants of the observed behavioral patterns.³⁸

How realistic a theory has to be?

There is little doubt that, for specific applications, one would like to have as accurate a theory as

possible. However, for theoretical applications, such as the derivation of the welfare theorems, it is not obvious that more accurate assumptions result in more accurate, let alone more useful, conclusions. The reason is that theoretical applications use models that are known to be false as a way to sort out and test arguments. Certain assumptions, which are certainly incorrect when tested in a laboratory, can be more useful for certain purposes and less for others. There is a danger that an experimental finding such as framing effect might, when put together with other theoretical assumptions, lead to a result that is less realistic than the assumption that framing does not matter.

Thus, the question we should ask ourselves when we deal with general economic thought is not whether a particular assumption is accurate. Rather, as pointed out by Milton Friedman (Nobel laureate, 1976) long ago, we should ask whether it leads to more accurate conclusions when coupled with other assumptions and, importantly, whether it suggests a reasonable trade-off between accuracy and strength. If we end up rejecting all assumptions, and therefore saying nothing, the accuracy of our models will be of little consolation.

Closing comments

Some researchers have been tempted to interpret the observed deviations in behavior as a challenge to the assumption of rationality. As we have seen, many deviations in behavior are due either to mistakes in processing the information, to framing or to a misunderstanding of the relationship between actions and consequences, or due to temporary perturbations in preferences or in time discounting (provoked by emotions and the like). As pointed out by Gilboa and Schmeidler (2001) and Gilboa et al. (2008), all these deviations have the following in common: if exposed to the analysis of their behavior, decision makers would wish to change their choices. For instance, they would want to eliminate identifiable errors in reasoning or blunt reactions. Thus, what is irrational for a decision maker are those types of behavior that will not be robust to analysis; they are likely to change when talking to an expert or brainstorming the decision with other decision makers. It appears more useful to focus on those deviations from classical theory that pass this test of robustness, that are “rational” in this sense. Other violations are sometimes thought provoking and often amusing, but they need not qualify as a basis for responsible economic analysis.

I wish to conclude this essay with a few words for the immediate future of research in behavioral economics. There is nowadays a burst of departures

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I personally find more embarrassing the assumption of competitive behavior when, for instance, the critical oil market is controlled by the OPEC countries.

from the standard rational choice model, all motivated on the grounds of psychological evidence. In Rubinstein's (2008) words, a model "that has at its core fairness, envy, present-bias and the like is by now not only permitted but even preferred." All this variety of departures certainly produce intellectual excitement, but it also produce perplexity and a sense of lack of direction. Every newly identified pathology is cheerfully welcome. In my view, an effort should be made to introduce some order in this chaotic landscape. Research should concentrate on a few types of deviations only. The ones that may be more critical from the perspective of economics –as Gul and Pensendorfer (2008) recommend. Once the implications have been well understood we may move to a further enrichment of our modeling of individual decisions.

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