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## Introduction

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# 1. Introduction

**Richard Arena and Agnès Festré**

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The role played by the notion of belief in modern economics is somewhat paradoxical. On the one hand, it is clearly and increasingly gaining prominence in most fields of contemporary analysis, such as decision theory, price theory, finance, game theory, information theory, sunspot theory, economics of the mind and organization theory. On the other hand, this popularity stands in stark contrast to the lack of precision that characterizes the concept of belief within economics. The paradox could be easily dismissed by arguing that belief shares the fate of many other concepts encountered in modern economic analysis: the more they are used, the less they are precise. The reasons for this tendency are certainly complex and we shall not attempt to tackle them here. Suffice it to say that a more general and systematic reflection on the role of beliefs in economics still needs to be carried out, especially given that by doing so our knowledge of many economic phenomena and their interactive mechanisms would certainly increase.

It is by no mere accident that beliefs have come to occupy an increasingly prominent place in modern economics. This is the result of the influence of three current strains of modern economic thought, all affecting our representation of economic agents and of economic forms of rationality.

The progressive decline of the General Equilibrium research programme substantially changed the idea of economic equilibrium that prevailed among economists during the first two decades following the second world war. Until the 1970s, economists assimilated the micro-coordination issue into the problem of the co-ordination of individual agents in interacting markets through a unique central co-ordination mechanism (the well-known ‘tâtonnement’ process – see, for instance, Arrow and Hahn, Chap. 11, esp. pp. 264–70). As the General Equilibrium agenda came to be replaced by a research programme based on the theories of games and information the landscape changed. Strategies came into the picture and these had to be based on mutual and rational knowledge and beliefs. Briefly speaking, a new view of micro-coordination emerged, which was no longer forced to rely on the analytical assumption of centralized markets. However, the

introduction of this new view was confronted with a difficulty, which both Morgenstern (1935) and Hayek (1937) had already emphasized in the interwar years. Given that agents interact in all economic systems their decisions are at least partially based on the forecasts they are able to make in relation to the expected behaviour of other agents. Now, if we accept the assumption that these decisions and forecasts must be rational, a logical problem arises. In order to display rational micro-behaviours, agents must acquire some knowledge of the beliefs and information of other economic agents. However, it is clear that part of this information and beliefs also depend on their own knowledge and beliefs. A problem of logical circularity thus arises, which game theory tried to solve.

While all these developments were taking place, substantial work was also being carried out in an attempt to better understand the processes leading to equilibrium. This work gave rise to the competing ideas of 'eductive' and 'evolutionary' processes (see the contributions of Guesnerie and Walliser in this volume). Eductive processes are processes in which an equilibrium state stems solely from the reasoning of hyper-intelligent players who share a common knowledge of the game structure and of their rationality (see the introductory part of Walliser's contribution to this volume). By contrast, evolutionary processes are those in which an equilibrium state results from the convergence of a learning or an evolutionary process followed by players with bounded rationality but mindful of previous play (*ibid*). Evolutionary mechanisms have many variations. Despite this diversity, they all share a form of rationality which is radically different from the one featured in eductive models. Evolutionary models exclude a 'strong' form of rationality, which allows agents to have direct access – i.e. through purely mental means and independently of any form of social interaction – to the common knowledge of the structure of the economic system and of the rationality of other agents. In fact, 'evolutionary' decisions take into account beliefs founded only on the knowledge of past individual actions and observed forms of social interaction. This means that agents contribute to the generation of inter-individual evolutionary mechanisms which they ignored *ex ante*. However, this type of individual learning does not imply a strong knowledge of the strategic neighbourhood of agents and most importantly it does not require knowledge of the overall consequences such mechanisms have on the whole economic system.

The increasing attention paid to the notion of agent heterogeneity also substantially contributed to the emergence of the notion of belief in economic theory. We are all very well aware of the theoretical limits imposed by the treatment of agents and individual rationality in General Equilibrium theory with complete markets or by the use of the idea of a representative agent. These limits clearly derive from the assumption of agent homogeneity.

Various attempts have been made to relax it, putting various forms of heterogeneity in its place. For instance, the pioneering works of Radner and Hahn, mentioned by Guesnerie in this volume, used information to characterize the heterogeneity of individual agents in different situations. They showed how different individual information sets and different micro forecast structures allowed for the characterization of agent ‘specificities’ in relation to, but quite independently of, their particular preferences and initial endowments. Agent heterogeneity based on information specificities is commonplace within game theory: agents differ depending on the nature of their knowledge and the structure of their beliefs.

The assumption of agent heterogeneity is not, however, the result of modern analytical developments. General Equilibrium and game theory only revived an assumption that has been present in economic theory for a long time. For instance, as Loasby in this volume shows, Alfred Marshall insisted on the temporal variability of the nature and economic preferences of men as well as the variety of their types of knowledge. Orléan’s chapter in this volume also shows how Keynes emphasized the diversity of agent beliefs and expectations in financial markets and studied how this diversity could be reduced through the emergence of market conventions. Finally, as Arena and Festré note in their chapter, the Austrian tradition delved deeply into the fundamental heterogeneity of agents’ subjective beliefs and knowledge as well as the contrast between ‘innovative’ and ‘imitative’ types of behaviour.

The increasing presence of the concept of belief in contemporary economics is also due to the recent simultaneous but distinct rise of the theory of ‘knowledge-based economies’ and of the ‘economics of the mind’. The former focuses on the role played by the concept of tacit knowledge in innovation processes or entrepreneurial decisions. We are all very well aware of the way in which this concept is connected to the structure of knowledge and beliefs of the different agents and communities within particular firms (see also the chapters of Cohendet and Diani, Loasby, Arena and Festré, Ngo-Maï and Raybaut in this volume).

‘Economics of the mind’ provides a new kind of explanation of decision making, the formation of rules and market interaction. First, it shows how decision making cannot be limited to the field of expected utility theory, as Boudon sets out in this volume. Secondly, the degree of confidence of agents in their own beliefs and therefore belief updating also require serious consideration – as the contribution of Tallon and Vergnaud shows. Thirdly, a convergent pre-existing path does not predefine rule formation as Novarese and Rizzello argue. Finally, market interaction cannot be reduced to the study of the properties of equilibrium states but implies an analysis of the relationship between individual behaviour, beliefs and market organization,

as stressed in the contributions of both Orléan and Ngo-Mai and Raybaut in this volume.

As we just noted, the concept of beliefs plays an increasingly important role in the recent advances of economics and especially of game theory (see, for instance, the contributions of both Schmidt and Tallon and Vergnaud in this volume). These advances must not hide however that it is also crucial to identify the main analytical problems that the introduction of this concept has brought along.

The first problem that arises is the compatibility between economic rationality and a serious attempt to take individual beliefs into account. Even if economic rationality cannot be reduced to its instrumental dimension, it is clear that, very often, this first problem is reduced to the question of the compatibility between the existence of beliefs and the theory of the rational choice. If one takes this reductionist approach, the main problem following the introduction of the concept of beliefs in economics can be identified with the search of the logical conditions necessary to define rational and consistent beliefs.

The requirement of instrumental rationality implies a strict separation of the spheres of the preference system, of the rules of the game and of the scheme of beliefs. The usual preference system must remain unchanged after the inclusion of the influence of individual beliefs on the process of economic choices. Technically, agents must still have a preference ordering because it is only when preferences are ordered that agents will be able to begin to form beliefs about how different actions can satisfy their preferences in different degrees. The rules of the game must be defined perfectly independently of both the preference system and the scheme of beliefs. In order to fulfil this condition, individuals are assumed to know the rules of the game perfectly, i.e., they are assumed to know all the possible actions and how these combine to yield particular pay-offs for each agent. In the context of game theory, this assumption obviously implies the notion of common knowledge. Individual motives for choosing specific actions must also be independent from the rules of the game, which structure the set of possible actions.

The requirement of consistency implies a characterization of the scheme of beliefs that allows the formation of an equilibrium ensuring the compatibility of different individual schemes. One of the first consequences of this requirement is the definition of the concept of belief within economic theory. For instance, as noted by Guesnerie in this volume, the requirement of consistency in the tradition of General Equilibrium theory implies the assimilation of individual beliefs to pure probabilistic expectations on future prices. In the same way, Walliser's distinction between 'structural', 'factual' and 'strategic' beliefs appears to be a prerequisite of the condition of con-

sistency. Clearly, this first problem disappears if we decide to drop the theory of rational choice and tackle the consistency requirement in a different way. This however does not imply that new problems will not emerge.

The second problem is related to what Hargreaves Heap and Varoufakis (2004) call the notion of ‘consistent alignment of beliefs’, which, according to them, ‘means that no instrumentally rational person can expect another similarly rational person who has the same information to develop different thought processes’ (Hargreaves Heap and Varoufakis 2004, p. 28). From this standpoint, ‘your beliefs about what your opponent will do are consistently aligned in the sense that if you actually knew what her plans were, you would not want to change your beliefs about those plans. And if she knew your plans, she would not want to change the beliefs she holds about you and which support her own planned actions.’ (ibid. p. 28). This notion implies the reduction of all agent reasonableness to strict instrumental rationality. It contradicts Boudon’s argument (in this volume), which supports the idea that there exist rational beliefs that are not founded on the search for self-interest, that are not consequentialist and that do not require a cost-benefit calculation. It also obviously contrasts with pragmatist views that see beliefs as the establishment of a certain habit determining the way in which agents will act when appropriately stimulated. This definition implies that the various individual habits related to different individual beliefs can correspond to various ‘good reasons’.

A third problem concerns the relations between the individual and the collective dimensions of beliefs. According to standard economic theory, it is clear that all social relations, institutions or structures derive from interactions between initially and *ex-ante* asocial agents. From this standpoint, collective magnitudes or structures do not exist as such but are only the result of the aggregation of microeconomic magnitudes: Guesnerie and Walliser’s contributions stress this particular feature of modern mainstream economic theory. Although this is the predominant conception, others are conceivable. Orléan and Ngo-Mai and Raybaut’s chapters share the idea that there exist collective beliefs which cannot be reduced to pure shared beliefs. This viewpoint always presupposes some autonomy of social entities vis-à-vis microeconomic behaviours. An interesting example is provided by ‘team thinking’: in this case, collective intentionality (see, for instance, Gilbert 1989 and Tuomela 1995) replaces individual intentionality and some behavioural autonomy is attributed to the team considered as a whole. Another example is provided by Keynes’ typology of beliefs (see Arena 2004). In the *Treatise on Probability*, certain beliefs are assimilated to pure knowledge. They correspond to cases in which the ‘weight’ of argument is related to the maximum ‘degree of rational beliefs’. Rational beliefs are tantamount to probabilistic beliefs; they correspond to the situation in

which the weight of argument is associated to an intermediate ‘degree’. Now, non-rational beliefs correspond to *collective* or conventional beliefs. In this last case, the weight of argument tends to zero and real knowledge is replaced by *collective* beliefs elaborated thanks to the interaction between agents. These beliefs are the result of a social convention, which creates what can be called collective knowledge.

As described earlier, the compatibility between the rational theory of choice and the introduction of beliefs presupposes the independence of preference sets, schemes of beliefs and rules of the game. Recent developments in the new field of ‘psychological games’ (Hargreaves Heap and Varoufakis 2004, Chapter 7) suggest that this independence could be abandoned (see also Schmidt’s contribution in this volume). From this standpoint, beliefs could be directly related to and constitute the agents’ preferences, a position that could imply the abandonment of the strict separation of preferences from the rules of the game. Alternatively, it could also be possible to start from some social practices or shared rules (as Hargreaves Heap and Varoufakis 2004 remind us, Wittgenstein related them to what he called ‘forms of life’) and derive preferences and rules mutually and simultaneously from them. In this context, the agents’ perception of their preferences is ill-defined before the game is played and instrumental rationality must be defined after the characterization of prevailing norms of behaviour, as it appears in Novarese and Rizzello’s chapter in this volume. This route is new to game theory and only appears in its most advanced developments (see the contribution of Schmidt in this volume).

However, its way had already been paved by older approaches. For instance, pragmatist thinkers in the social sciences related individual and collective beliefs directly to social rules. A good example can be found in Peirce’s process of ‘fixation of beliefs’. Most of the methods he described in order to determine agent beliefs (the ‘method of tenacity’, the method of ‘authority’ and the ‘*a priori* method’, see Peirce 1897/1966, pp. 101–12) generate beliefs which can be true or false, instrumentally rational or non-rational. However, they allow the elimination of what Peirce called states of doubt (Peirce [1897] 1966, pp. 98–101) and the discomfort that is associated with them. The last method of fixation of beliefs analysed by Peirce is the ‘scientific method’. This method clearly differs from the first three in that the fixation of beliefs is no longer a purely human endeavour, in the sense that the ideas that are fixed are ultimately determined by what we wish to believe. Therefore, it proceeds from the recognition that nature does not accommodate itself to agents’ beliefs but that agents’ beliefs must accommodate themselves to nature. In other words, according to this last method, as Peirce would have it, preferences and beliefs are, to a large extent, constituted by social rules and practices. Another example could be provided

by the second Wittgenstein who, in his *Philosophical Investigations*, criticizes the idea of a strict separation of action from shared rules. Shared rules limit what can be done but it makes no sense to think of them as distinct from actions since they are also enabling. Rules cannot be understood independently of the actions which exemplify them. Actions and belief structures are, therefore, mutually constituted in the agents practices of a given society or a given economy.

These insights show how much work still needs to be done. A serious investigation of beliefs within economics seems to imply the need for a multidisciplinary approach. This is why this book includes contributions related to various disciplines such as mathematical economics, history of economic thought, economic analysis, experimental economics, sociology, social philosophy and economic methodology. We hope it will be interpreted more as an incentive to further research on the role of knowledge and beliefs in economics than as a final assessment of what has already been done.

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