Microfoundations and vision

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Abstract

This paper analyzes the standard descriptive and prescriptive use of the phrase "microfoundations of macroeconomics" as practiced since the early 1970s within the economics profession. From the descriptive point of view we maintain that what is generally meant by using this phrase is a very specific and idiosyncratic way of conceiving the relationship between individual and collective behaviour in economics. From the prescriptive point of view we argue that the requirement that sound macroeconomics must repose on this particular approach is unjustified and dogmatic. The rapid and widespread adhesion by most influential economists and economic institutions to this approach immediately after it was worked out by Lucas in the early 1970s deeply transformed macroeconomics by inhibiting the systematic pursuit of alternative approaches. We claim that this extreme form of reductionism greatly restricts the empirical scope and policy efficacy of macroeconomics. We conclude that the relationship between individual and collective behaviour is a crucial issue that has to be pursued without dogmatic a priori.

1. Introduction

The word microfoundations has been used with different meanings in the history of social sciences (see, e.g., Heath, 2010). Even in the restricted field of macroeconomics, that constitutes the object of our analysis, we find many meanings. From the descriptive point of view, "microfoundations" may simply indicate the need to understand the individual decisions, or choices or actions, underlying the behaviour of one or more macroeconomic variables, i.e. variables referring to the economy as a whole. In this broad sense successful microfoundations do not need to be reductionist in the sense that macroeconomic behaviour is derived through simple operations of addition or averaging from the choices of isolated individuals (each conceived as Robinson Crusoe in his island); they may well include the relations between individuals as well as macroeconomic constraints or even a complex interaction between microeconomic and macroeconomic variables. In the broader sense of the term the search for proper microfoundations does not exclude a parallel,

even intertwined, search for macrofoundations of the same object of analysis.[1] From the normative point of view the search for microfoundations of a certain theory or model does not need to be dogmatic since it may be advocated as a useful way to extend our relevant knowledge without questioning the validity of the theory or model to be microfounded. To take an example from physics, the long and controversial debate on the microfoundations of the second law of thermodynamics never questioned its substantial validity at the level of macrophysics.

Having this broader framework in mind, this paper analyzes the standard descriptive and prescriptive use of the expression "microfoundations of macroeconomics" (henceforth MIF) as practiced since the early 1970s within the economics profession. According to this particular view, a macroeconomic theory or model is considered to be microfounded if and only if it is derived from "classical" decision and/or game theory applied to single or "representative" economic agents. The MIF is a dogmatic view of microfoundations as it has been systematically used as a crucial argument to exclude a priory the status of scientific theory to alternative macroeconomic theories (in particular Keynesian macroeconomics) and to show that only the New Classical approach founded on MIF can be soundly used for prediction and policy. This view is quite idiosyncratic because there is a wide variety of decision theories characterized by different axioms and approaches which have widely different implications for economic behaviour, while only a small subset of them, what we call "classical" decision theory (see section 3), is implicitly considered as acceptable. This view excludes any role for macroeconomic constraints or foundations and denies the emergency of meta-individual properties at a higher level of aggregation and therefore also any ontological or epistemic autonomy to the macroeconomic level of reality. The MIF is thus reductionist as it advocates a complete reduction of macroeconomic behaviour to the behaviour of individuals, although the latter are not necessarily conceived as isolated since their strategic interaction is often taken into account through standard game theory. Notwithstanding its peculiarities, MIF's requirements rapidly acquired the status of a strong prescription: according to a widespread and influential vulgate a theory or model may be considered consistent with the requisites of sound science only if it is explicitly derived from (classical) individual choice theory. As is well known since the late 1970s or so papers lacking this particular sort of microfoundations have been systematically rejected by top economic journals and their authors found increasing difficulty to be accepted by top economic departments or to be consulted by economic organizations and mass media. As a consequence of the MIF dogma macroeconomics changed radically its nature

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[1] The exigency of proper macroeconomic foundations of microeconomics is recognized not only by most heterodox macroeconomists (e.g. many post-Keynesian economists) but also by general-equilibrium theorists who do not accept the strictures of MIF (see, e.g., Hahn, 2003).

losing the status of autonomous sub-discipline conferred to it by Keynes and assuming the role of mere application of standard microeconomics principles to the economy as a whole.

What follows aims to show the implications and shortcomings of MIF. Our criticisms of microfoundations are restricted to the dogmatic version of MIF and do not mean to deny the fecundity of a constructive reflexion on microfoundations in the wider sense of trying to build a variety of bridges between individual and collective behaviour in both directions. In this broader non-reductionist and non-dogmatic sense we believe that a thorough investigation of the microfoundations of theories and models should be a concern of any research programme in macroeconomics.

The structure of the rest of the paper is as follows. In the second section we briefly reconstruct the genesis of MIF in order to understand better its meaning and motivations. In section 3 we discuss the claim that derivation of macroeconomic propositions from up-to-date (Arrow-Debreu) general equilibrium guaranties compliance with sound microfoundations requirements. In section 4 we emphasize the idiosyncratic nature and the shortcomings of classical decision theory elected by MIF to provide the necessary ultimate foundations for macroeconomics. In section 5 we discuss the implications of MIF for the theoretical and empirical scope of models and theories. In section 6 we summarize the preceding analysis by showing that MIF is the expression of a quite idiosyncratic vision of the economy and cannot claim to be neither necessary nor sufficient condition of sound macroeconomics.

2. The genesis of MIF

The classical version of MIF has been worked out by Lucas in the early 1970s as justification of the superiority of "New classical economics", the new approach to macroeconomics that he was working out and promoting in those years, over the then traditional Keynesian macroeconomics. In particular Lucas claimed in his celebrated and influential "critique" that the absence of microeconomic foundations in Keynesian macroeconomics undermined the possibility of using it for policy purposes (Lucas 1976). This argument by Lucas provided a synthesis of the two most effective streams of criticisms to Keynesian macroeconomics emerged in the late 1960s: Friedman's monetarism and Phelps's microfoundations. Friedman's paradigm was based on a partial equilibrium approach rooted in a radical version of methodological individualism focusing on the behaviour of 'a number of independent households, a collection of Robinson Crusoe" (Friedman, 1962, p.13; see also Friedman, 1968 and the insights on this topic in Denis, 2004, p.344). Phelps's research programme was based on the requirements of proper microfoundations of macroeconomics upon general equilibrium theory (see, e.g., Phelps, 1967 and Phelps et al 1970). Lucas adopted at

the beginning Friedman's monetarism and generalized his critique of macroeconomics based on methodological individualism but reformulated both of them in terms of general equilibrium theory as advocated by Phelps (Lucas, 1981). He departed, however, from the Phelps's point of view by introducing rational expectations as a crucial ingredient of sound macroeconomic models, a bold move that allowed him to adopt a pure equilibrium method based upon stochastic general equilibrium in the Arrow-Debreu formulation. This approach ousted both Friedman and Phelps from the leadership of the anti-Keynesian counter-revolution since Friedman kept aloof from the general equilibrium approach that was considered by the younger generation the most rigorous standpoint of economic theory, while Phelps openly rejected the hypothesis of rational expectations (disliked also by Friedman) that allowed a new style of model-building immediately cherished by the young generations of quantitative economists (Phelps and Frydman, 1983). Both rebutted Lucas's pure equilibrium method emphasizing the crucial role of disequilibrium dynamics in macroeconomics. Extended criticisms from a long list of more or less orthodox economists did not stop the rapid process of diffusion of the MIF perspective advocated by Lucas and a rapidly growing group of followers. This radical turn in classical macroeconomics has been fully reflected also in the version of methodological individualism that became mainstream from then on. Friedman had openly advocated methodological individualism and had also practiced it, for example in his theory of consumption. Phelps drew inspiration from methodological individualism when he advocated, and practiced, in the late 1960s and early 1970s, a style of model building based upon models microfounded upon general equilibrium principles (Phelps et al, 1970). We have no space here to expand on the difference between Friedman's, Phelps's and Lucas's versions of methodological individualism and microfoundations. In what follows we will discuss exclusively Lucas's version of MIF that rapidly became the mainstream view of macroeconomics.

According to MIF a sound model has to avoid the use of "free parameters" such as those in which Keynesian macroeconomics indulged, as they lack proper microfoundations that make a model non-falsifiable and non reliable for policy. In particular, in his celebrated "critique" Lucas clarified that sound models must be founded on the fundamental parameters (or "fundamentals") of a general equilibrium model in the conviction that only in this case their value does not depend on the policy parameters, a necessary precondition for a reliable simulation of the effects of alternative policy rules (Lucas 1976). This argument is deeply rooted in methodological individualism since the basic idea is that a change in policy rules modifies the environment within which the individuals make their choices on the basis of their preferences, while their changed behaviour is bound to modify the other parameters of the system. However, at closer inspection, the consistency between

methodological individualism and general equilibrium cannot be taken for granted, as we are going to argue in the next section.

3. MIF and methodological individualism

When Lucas explains and advocates the MIF approach he focuses on general equilibrium. The main reason he provides is that this is the model that captures the "fundamentals" of the economic system: preferences, technology and resource constraints. In his opinion, only the fundamentals may provide solid foundations to macroeconomic models: from the descriptive point of view because the causal chains ultimately depend on them, and from the normative point of view because they are the only parameters independent of policy rules. He concedes however that the old-style deterministic general equilibrium theory is unable to capture the dynamics of aggregate variables as it does not take account of uncertainty. Proper microfoundations have thus to lie on the Arrow-Debreu dynamic version of the stochastic general equilibrium model. In this case, according to Lucas, equilibrium does not imply stationarity and its continuous existence is fully consistent with macroeconomic fluctuations. "Fundamentals" or "deep parameters" are those that govern individual behaviour: given the resource constraints and the technology, the individuals choose the option that maximizes their utility according to their preferences. MIF is thus presented as the only research strategy consistent with methodological individualism. Before discussing to what extent this claim is justified let us emphasize that Lucas's methodological individualism, differently from that of Friedman, does not advocate reduction to isolated individuals. For example Lucas adopted in his models Phelps's "island paradigm" where the crucial message comes from the interaction between Robinson Crusoes in different islands.

So far so good. The acknowledgement of the crucial role of interaction between individuals adds considerably to the plausibility and persuasiveness of MIF. Actual MIF models, however, are hardly consistent with methodological individualism, and, when they may claim to be consistent with it, they comply only with a very idiosyncratic version of it. We may distinguish three basic varieties of models that have been claimed to be consistent with MIF principles: models characterized by a representative agent, models taking account of the strategic interaction between individuals through game theory, and stochastic general equilibrium models. The models characterized by a unique representative agent, quite common in the New Classical Economics literature, can only be considered at best as a first step towards a satisfactory model and cannot claim any superiority in principle over alternative modelling styles of macroeconomic phenomena. The second variety of models that explore strategic interaction between the individuals through

game theory are, in my opinion, the most consistent with the MIF principles. Notice, however, that the strategic interaction between individuals is investigated exclusively in equilibrium (generally as a Nash equilibrium). Though these two families of models are accepted as fully consistent with the MIF approach, its exponents take pride mainly of the **"dynamic stochastic general equilibrium models"** (abbreviated DSGE or sometimes SDGE or DGE) based upon the Arrow-Debreu approach (Arrow and Debreu, 1954; Debreu, 1959, Arrow and Hahn, 1971). The crucial variables of a general equilibrium model (demands, supplies, and the system of relative prices) reflect the complex interaction between the agents of the system. This is fully recognized even by an author such as von Mises who endorsed methodological individualism though in a peculiar way:[2] "What is called a price is always a relationship within an integrated system which is the composite effect of human relations" (Mises, 1996, p.392). This is exactly what a general equilibrium model aims to represent. This is also its strength. However, for the same reason, the consistency of these models with methodological individualism is an open question.

In the literature we find that it is possible to provide game-theoretic foundations to a particular family of these models only under demanding assumptions. For example, in one of the most insightful contributions to this issue it is proved a convergence of results of a n-players game to those of a general-equilibrium model only asymptotically when the number of agents tends to infinity (Shapley-Shubick, 1969). Analogously Schmeidler (1982b) shows that the bridge is possible only when it is possible to implement distributive goals without impairing efficiency. These examples are sufficient to show that, even when it is possible to build a bridge between individual behaviour and general equilibrium, the microfoundations work only under very strict conditions. In addition, while the interaction between individuals is analyzed only in equilibrium there is no method fully consistent with MIF able to ascertain whether such an equilibrium is stable (Evans and Honkapoja, 2001). What is much worse, general-equilibrium microfoundations are meaningful only if such an equilibrium does actually exist. This is a problem that has been much undervalued in the MIF literature as the inexistence of a general equilibrium seems to be the rule rather than the exception. Chichilnisky (1995, p.80), for example argues that "the problem of nonexistence of a competitive equilibrium is pervasive... many standard economies do not have a competitive equilibrium". The trouble is that "the celebrated existence theorem of Arrow and Debreu (1954) is predicated on an untenable assumption according to which everyone owns strictly positive amount of all goods as initial endowments" (Unveren 2011, p.16). This implies that "even

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[2] For an assessment of Mises' position on methodological individualism see Denis (2012).   .

unfettered markets with the most flexible adjustment mechanism may not guarantee equilibrium and redistributive policies may very well be efficiency enhancing" (ibidem, p.iv)

We have surveyed in this section many reasons why DSGEs are to be considered a very thin and fragile bridge between standard microeconomics and standard macroeconomics. In the next section we are going to survey a further source of severe limitations.

4. MIF and decision theories

We have seen that the MIF's stance is about the consistency between a certain macroeconomic theory (model) and a given theory (model) of individual decisions by using the bridge of general equilibrium theory (DSGE model),[3] and we have ascertained in the preceding section that it is possible to prove such a consistency only under very strict conditions. We want to clarify in this section that, given the nature of the bridge (Arrow-Debreu stochastic general equilibrium model), the consistency may be asserted only for a particular kind of individual decision theory that we call "classical" decision theory. This implies that if there are theoretical or empirical reasons for rejecting classical decision theory and adopting an alternative theory, the MIF approach is bound to fail. On the other hand, the limitations of the reducing decision theory are by definition projected on the reduced macroeconomic theory.

The first example of full-fledged "classical" decision theory is the Morgenstern-Von Neumann's (1944) fully axiomatized choice theory based on "objective" probabilities interpreted as stable frequencies. The Bayesian theory suggested by De Finetti (1937) and fully axiomatized by Savage (1972) takes a different point of view on probability by assuming a subjectivist, or "personalist", point of view, but it is based on axioms that may be shown to be equivalent from the strictly formal point of view (an accessible survey of these issues may be found in Vercelli, 1999). Standard textbooks perceive the substantial formal affinity of these theories and prescribe the use of the objectivist theory for "known" probabilities, and of the subjectivist theory for "unknown" probabilities.[4] For our purposes it is more important to emphasize the analogies rather than the differences between objectivist and subjectivist theories. Both theories assume unique fully reliable probability distributions although their epistemological understanding is radically different. This is implied by a crucial axiom that is called "axiom of independence" by Morgenstern & Von Neumann and "sure thing principle" by Savage, but their formal role is substantially identical. This

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[3] We ignore in this paper the issue whether the MIF approach involves a direction (down-top or top-down) in the relation linking decision theory and macroeconomic theory, and/or a constructive process starting from one of the two polarities.
[4] Anscombe and Aumann (1963) suggest a unification of both theories within a unique axiomatized framework.

axiom ensures the absence of systematic mistakes in any instant and thus the inter-temporal coherence of choices. Therefore this theory applied to expectations formation implies rational expectations, since all the alternative hypotheses of expectations formation imply the existence of systematic mistakes. The axioms of classical theories are very restrictive and confine the field of their sound application to a very limited sub-set of economic phenomena characterized by what we may call "weak uncertainty". In this case the agent does not know which specific events *will* actually occur but knows which event *may* occur and which is the probability of each of them. This is the case with most games of chance (roulette, cards and dice). This approach may be extended with some cautiousness to phenomena that may be assimilated to them. According to the objectivist theory only phenomena characterized by fairly stable frequencies may be assimilated to this ideal-type. These are numerous in natural science but very scarce in economics. On the other hand the supporters of the subjectivist theory often claim that their own suggested approach may be applied to any kind of phenomena without a priori limitations. However its axioms are not less demanding and restrict its empirical scope quite severely. Savage (1972) himself restricts its validity to "small worlds" the behaviour of which is fully familiar to the agent. We can define the limits of application of classical decision theory by using the Keynesian concept of weight of argument (see Keynes, 1921 and 1936; Runde 1990):[5]

$$V\ (x\backslash h) = \quad K \backslash (K + I)$$

where the weight *V (x\h)* of the argument *x* conditional to the evidence *h* is given by the ratio between the relevant knowledge *K* and the complete knowledge *(K + I)* that takes account of the relevant ignorance *I* (see Vercelli, 2011 and literature there cited)). Classical decision theory may be applied only when the weight of argument *V (x\h) = 1*, that is when the relevant ignorance is an empty set or, by approximation, quite close to one. When the weight of argument is zero or close to zero we may apply decision theories under radical uncertainty (critical surveys may be found in Gärdenfors and Sahlin, 1982; Camerer and Weber, 1992; Kelsey and Quiggin, 1992; Vercelli, 1999). In the case of intermediate values we may use alternative decision theories based on Choquet capacities (Choquet, 1953), a powerful generalization of probability recently utilized in decision theory under strong -but not radical- uncertainty (following the pioneering work by Schmeidler, 1982, Gilboa, 1987; Gilboa and Schmeidler, 1989).[6] These three categories of decision theory lead to different criteria of rational choice (maximization of expected utility in the case of classical

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[5] In other words, when the weight of argument is significantly less than one and significantly more than zero.
[6] There is an extensive recent literature on two families of decision theories under strong uncertainty: multiple priors decision theory (see, e.g. Schmeidler and Gilboa, 1989) and fuzzy sets decision theory (see e.g. Ponsard, 1986). Their axioms, empirical scope, and consequences have been recently shown to be substantially equivalent with decision theory based upon Choquet capacities (see Vercelli, 1999).

theory, maximin in the case of radical uncertainty, and a weighted mix of the two in the case of strong uncertainty). As this crucial point shows, the choice of a certain decision theory has a huge impact on description, prediction and rational choice. We have to conclude that MIF is a very idiosyncratic style of microfoundations that may be justified only under well precise, and quite restrictive, assumptions.

5 MIF and alternative visions

We have seen that MIF is consistent with a quite specific family of individual choice theories ("classical decision theory") that implicitly assume a weight of argument close to one, but it is inconsistent with a variety of alternative decision theories (more or less formalized and not necessarily axiomatized) that apply in all the other cases, i.e. when the weight of argument is significantly less than one. We claim that the second case is the generic case in economics.

This implies that MIF is the expression of a narrow vision of the nature of macroeconomic processes to which we have to counterpose alternative visions having a broader empirical scope. We use the word "vision" in a sense similar to that of Schumpeter (1986) but we maintain that its role is not constrained to the "pre-analytic" phase of research but extends also to the analytic stadium of research. For the sake of simplicity we characterize a "vision" as an n-tuple of points of view on n crucial methodological and ontological issues. As we have seen, the vision underlying the MIF is characterized by a procedure of reduction to one or more individuals conceived in a very peculiar way that is often summarized by the phrase "homo economicus" (see table 1 row 1). The homo economicus is conceived as a rational decision maker in the strict sense that he always succeeds to choose the optimal option given his constraints and his set of relevant knowledge: "I think of economics as studying decision rules that are steady states of some adaptive process" (Lucas, 1976, p.218). In other words the individual so conceived never makes systematic mistakes since his rationality is "unbounded" or "substantive" (to use the terminology suggested by Simon, 1976 and 1982). This also implies that in this view the individual does not need to learn in the sense of extending his relevant knowledge since the latter is already complete by assumption; the only learning that is consistent with the "new-classical" assumptions and that is indeed necessary to satisfy them through time is the immediate updating of the data set by including in it the realizations of the relevant variables (see Vercelli, 2005). The economic system microfounded according to the MIF strategy undergoes a further series of idiosyncratic limitations (see table 2 row 1). It is assumed that the system is always characterized by one, and only one, equilibrium and that this equilibrium is stable from the dynamic and structural point of view. In a DSGE model this

equilibrium typically is a stochastic equilibrium path that is indexed by a fully reversible "logical" time that excludes any factor of economic irreversibility such as transaction costs and sunk costs. Causality is conceived as mutual interdependence or as exogeneity (as in the case of "Granger causality"; see Vercelli, 1992). Taking account of all the features that characterize the MIF strategy we have to conclude that its empirical scope, i.e. range of sound applications to the empirical evidence, is restricted to a "closed world" that is to stationary or ergodic time series, and is deprived of genuine innovation, unexpected contingencies, structural change, irreversible processes, and evolution. Between such an idealized Olympian world and the real world of economics there is a huge and deep chasm that may be partially disregarded only in the rare periods that may be characterized by a tranquil steady state.

To emphasize the idiosyncratic nature of the MIF strategy we describe two alternative paradigms that are detectable in economic analysis. Although we can identify eminent economists that pursued a research programme partially overlapping with one of these two alternative visions, we prefer to express them in their pure form as "ideal-types" to avoid exegetic quibbles that would be beside the central point of this paper. We just limit ourselves to a hint: we believe that Simon's vision is close to the second one while Keynes's vision as we interpret it is close to the third one (see Vercelli, 1991, and 2002).

The second vision that we could define as "algorithmic behaviourism" conceives of the individual as a set of algorithms that may be simulated on a computer. The "homo algorithmicus", as we may define the individual in this view, is characterized by procedural rationality and strives to approximate a satisfactory result by taking into account the limitations of his knowledge and skills (a case in point is the "satisficing" criterion introduced by Simon, 1956). The homo algorithmicus is aware that he is liable to make systematic mistakes and struggles to eliminate, or at least minimize, them by genuine learning that reduces his relevant ignorance and by relying adaptive expectations that aim to reduce the systematic prediction mistakes. The economic system microfounded according to this vision is characterized by broader equilibrium requirements. The existence of an attractor is sufficient while its stability depends on the strength of the learning process assisted by adaptive expectations. The irreversibility of time is recognized at least to some degree, as path-dependency is taken explicitly into consideration. Causality is assimilated to the order of computation of variables that involves also endogenous variables (as in "Simon causality). Taking account of all the features of this vision we may say that its empirical scope is much broader than that of the MIF vision as it extends to disequilibrium processes and irreversible time. Its empirical scope extends to an open world characterized by unexpected events and structural change, although

the emphasis remains focused on adaptive systems. In the MIF vision the adaptation of the homo economicus to its environment is complete since economics has "to focus on situations in which the agent can be expected to "know" or to have learned the consequences of different actions so that his observed choices reveal stable features of his underlying preferences" (Lucas, 1986, p.218). In the alternative vision suggested by the second vision here prospected the process of adaptation is analyzed while it deploys itself without ignoring its shortcomings (systematic mistakes, slow convergence to equilibrium or even a possible divergence from it). Lucas is aware of the viability of this second alternative vision but claims that it is the realm of psychology not economics: "experimental psychology has traditionally focused on the adaptive process by which decision rules are replaced by others" (ibidem, p.217). The logical link between the adaptive approach of psychology and the equilibrium approach of economics is clearly traced: "I think of economics as studying decision rules that are steady states of some adaptive process" (ibidem, p.218). Notice that this distinction is reminiscent of that between *context of discovery* and *context of justification* which has been one of the basic tenets of positivist philosophy of science and in particular of logical empiricism (see. e.g., Suppe, 1977). Lucas recognizes that the assumptions of economic theory (in his own version) may work well empirically only if "one assumes that people have long ago hit on decision rules suited to their situations-"rational" rules-and utilizes theories about these rules to predict behaviour" (Lucas, 1986, p.232). He admits that "this is certainly not true of all problems of interest" (ibidem), but he maintains that the method of economics is powerful only under the strict assumptions of the first paradigm.

Finally we may envisage a third ideal-typic vision that, for want of a better terminology, we may call "dialectical behaviourism", where the individual is conceived as *homo faber* since he seeks adaptation to the environment also by shaping the environment in such a way to fit his own needs. His rationality is not the fruit of a complete adaptation to the environment as in the first paradigm or the mere instrument of a better adaptation to a given environment as in the second vision but rather the source of a creative design of adaptation that involves the transformation of the individuals, of society and the environment itself. This sort of designing rationality is based on learning in the genuine meaning of progressive correction of systematic mistakes, while expectations aim not only to correct predictions but also to the achievement of the rational design underlying the activity of the *homo faber*. To this end the *homo faber* has to understand the full dynamics of the systems under investigation without limiting constraints on the number, existence and stability of equilibria. The time is considered as irreversible in the strong sense of evolutionary processes, while causality is typically conceived as probabilistic (Vercelli, 1991, 1992).

Comparing the three ideal-typic visions, we see that the empirical scope of the second one encompasses the first one's and the third's one encompasses the second's one. Unfortunately the increasing realism is associated with increasing difficulties in formalization that have encouraged many economists to take shelter in the first vision shunning in particular the third vision. We believe on the contrary that the "rights" of real problems should always come first.

6. Concluding remarks

In the light of the critical analysis deployed above we feel authorized to conclude that MIF is not a necessary requisite of sound theorizing as is claimed by its advocates including most academics and editorial boards as well as private and public organizations' decision makers, but as an idiosyncratic vision about how a market economy works, which are the requisites of sound macroeconomics and which is the role of MIF to comply with both. In the end we may observe with Solow (2008) that MIF is not a robust and compelling scientific principle but rather, to use his words, a "rhetoric swindle" meant to discredit Keynesian economics, to "kill" macroeconomics as an autonomous discipline and to inhibit the development of alternative macroeconomic approaches. A famous scientist remarked that "the only way to reduce biology to chemistry is murder" (Piaget). This is true also of macroeconomics. The only way to reduce macroeconomics to homo-economicus microeconomics is to kill macroeconomics as an autonomous discipline spoiling it of its inner life (emergent properties). We believe on the contrary that we need a vital and lively macroeconomics: autonomous but with sound methodological and institutional foundations.

To this end we need non-dogmatic microfoundations in the sense –different from that supported by MIF- of a clarification of the assumptions about individuals and how the interaction between individuals causes emergent macro properties. This requires the reference to a decision theory different from the Classical decision theory. We need at the same time also macroeconomic foundations of the individual behaviour since the macroeconomic and institutional environment introduces crucial constraints and sets relevant objectives in the decision process of individuals. Non-dogmatic micro and macro foundations are important as part of institutional (dependency on history) and methodological foundations (critical awareness) of economics.

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Synoptic table 1: individuals' features

	Microfounding individuals	Rationality	Expectations	Adaptation to the environment	Learning
Vision 1 (MIF)	Homo oeconomicus	substantive	rational expectations	pre-established harmony	updating
Vision 2 (algorithmic behaviorism)	Homo algorithmicus	procedural	adaptive expectations	adaptation to	adaptive
Vision 3 (dialectical behaviorism)	Homo faber	designing	proactive expectations	adaptation to and of	creative

Synoptic table 2: systemic features

	Equilibrium	Stability	Time	Causality	Empirical scope
Vision 1 (MIF)	**unique**	**dynamic & structural stability**	**reversible**	**exogenous (Granger causality)**	**closed & stationary world**
Vision 2 (algorithmic behaviorism)	**unique attractor**	**weak stability**	**irreversible (path-dependency)**	**algorithmic causality**	**open & adaptive world**
Vision 3 (dialectical behaviorism)	**multiple attractors**	**no ex ante constraints**	**irreversible (evolution)**	**probabilistic causality**	**open & evolutionary world**

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