Paper Title: Assessment of a strict microfoundations approach to macroeconomics – highlighting the consequences of using the 'representative agent' to construct macroeconomic models

Natasha Tiwana, King's College London (2013-2016)
natashatiwana@hotmail.com

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Introduction:

A key component in economics is designing optimal macroeconomic policies in a way that minimises social costs or maximises social welfare. General equilibrium theory (GET), and in particular, representative agent models, are often used as the theoretical framework upon which such macroeconomic policies are devised. The rationale behind this is the belief that macroeconomic regularities follow from microeconomic assumptions (Rizvi, 1994). Hence carrying out micro-level analysis seems crucial for macro-level prescription.

This essay will, however, highlight the problems that arise when using representative agent modelling to understand macroeconomic phenomena and prescribe welfare-maximising policies.

The importance of developing and using accurate models for economic policy design cannot be emphasized enough. Especially after the financial crisis of 2008-09, it is evident that the current macroeconomic models are insufficient for providing accurate predictions about the economy, and implementable solutions to economic crises. If a country wishes to pursue growth enhancing economic policies, it is vital to develop workable models and this paper will show that representative agent models, referred to as Dynamic Stochastic General Equilibirum (DSGE) models, do not provide such satisfactory microfoundations for macroeconomics.

DSGE models try to explain aggregate economic functions based on the derivation of decision rules of economic agents, with assumptions about preferences, by solving inter-temporal optimisation problems (Del Negro, Schorfheide, 2012). However, as many economists have begun to argue, DSGE models are "too stylized to be truly able to describe in a useful manner the dynamics of the data" (Tovar, 2008, p.2).

Three fundamental issues with equilibrium prove the use of microfoundations for policy design problematic. The first deals with the plausibility of whether

such a point exists at all. The second is concerned with the assumption that this point is single and unique. However, several academics identify the possibility of plurality of equilibrium. The final issue contends with the idea of stability: that is, if the economy is at any point away from equilibrium, it will tend to move in the direction of, and eventually arrive at equilibrium.

However, proving all the above conditions are met is challenging. The focus of this essay will be to examine the subsequent challenges of proving uniqueness and stability of equilibrium for macro-level phenomena using the representative agent model. It goes on to explore alternative methods to inform policy design. It first examines agent based modelling, an alternative from within the general equilibrium framework that allows for heterogeneity between agents as well as interactions among them, which the representative agent model assumes away. It then goes a step further to explore an external alternative, of a more macro-grounded approach, taking into account the role of institutions and historical context that impact an economy.

A macro-foundations approach is one that explores and involves the role of social structures, relations, norms, and institutions within the individual decision making process. However, it also treats these social structures as being reproduced over time, by the actions and coordination of the individuals within that particular society (Smithin, 2004). Hence, such an approach seems favourable, in the sense that it does not take either the extreme individualistic approach that the microfoundations approach takes, or an extreme aggregate approach, where only aggregate entities are considered and the individual components that comprise them ignored.

Setting the stage:

Rizvi defines the term 'strict microfoundations' as the practice of taking the General Equilibrium Theory model of perfect competition, and deviating from it only minimally, if at all, to develop macroeconomic models (1994, p.357). Thus, in its extreme form, the microfoundations approach utilises the representative agent model of GET to derive macroeconomic principles. The microfoundations approach treats individual choice as fully specified and as an essential explanatory factor of macroeconomic variables. Such a treatment collapses all the individual agents into a single 'representative' agent, eliminating issues with regard to interactions and coordination.

However, it may not always be the case that strictly microeconomic assumptions are made. At times assumptions can allow for interactions and variations among multiple economic agents, and can suggest a more economy-wide character. Then, to some extent, macroeconomic assumptions are used to construct other macroeconomic fundamentals, and this can be done without dismissing the GET framework completely (Rizvi, 1994, pp.357-8). In doing so, economists construct, what are referred to as, agent-based models. One of the defining features of these models that lacks in the representative agent model is of market heterogeneity (LeBaron, 2006). The incorporation of heterogeneity is crucial to the explanation of changing economic patterns, such as large and sudden shifts in the economy, particularly market crashes.

Idealisation is the process of simplification of otherwise complex events, in order to develop a cohesive and workable model (Hoover, 2010). The construction of the representative agent model can then be thought of as an idealisation of the GET model of the economy. However, if all the very real and likely complexities are assumed away, a model loses its power to explain anything significant. This brings us to the idea of 'concretisation' – the adjustment of an idealised model to incorporate for essential, though complex, features of the real-world, relevant to what the model wishes to explain (Hoover, 2010). The shift from strict microfoundations to a combination of microeconomic and macroeconomic assumptions can thus be understood as the process of concretising the idealised model.

Though the idea of equilibrium has been a core concept in economic theory since Adam Smith's formulation of the 'invisible-hand' mechanism of the market, Leon Walras first proposed the theory of General Equilibrium in 1870. The theory was later modelled to prove the existence of a Walrasian economic equilibrium by Arrow and Debreu in 1954. The core idea of the theory is that the market automatically balances supply and demand of all individuals in the economy.

An equilibrium position is one such that supply equals demand for every market in the economy. The equilibrium condition assumes the following: each consumer acts to maximise his utility; each producer acts to maximise his profits; and there is perfect competition in the market, that each producer and consumer takes prices as given, rather than having any power to manipulate them.

Proving the existence of an equilibrium point is important for two reasons. Firstly, if GET is used as the basis for microfoundations of macroeconomics, it is vital that the model describes a possible reality. Secondly, the first theorem of welfare economics states that such a Walrasian equilibrium would be pareto efficient, i.e. no one individual can be made better off, starting from equilibrium, without making another worse off. Hence, for welfare reasons, the proof of existence of a Walrasian equilibrium is essential (Arrow and Debreu, 1954, p.265).

The representative agent model of general equilibrium can be considered a subset of the broader theory of general equilibrium. Where the general equilibrium framework can involve the behaviour of multiple agents, and allow for heterogeneity, the representative agent model assumes that choices of all the diverse agents in one sector of the economy can be considered as the choices of one particular 'representative' agent (Kirman, 1992, p.117).

Such a model eliminates the need for coordination, and, in that sense, trade, as it considers one agent in isolation. If a representative agent model is to be used as

an effective microfoundation, the fulfilment of all its assumptions must be possible. If this is not the case, continuing with such microfoundations can be misleading, and have adverse effects.

Representative agent model:

The foundation of economic activity has two seemingly conflicting features: economic phenomena occur due to individual actions, be it of production or consumption, yet such individual actions are often presented as aggregates, in the form of market prices, national income and so on (Foley, 2004, p.82). Such duality presents a challenge to economists and policy advisors alike – what should the focus of economic models be on: micro-level actions and theories; or macro-level statistics and conceptions?

The microfoundations approach requires the theorization of individual economic agents, whose actions generate the aggregate conditions of an economy. The representative agent model, in particular, requires the development of a single 'representative' agent to derive lessons for the entire economy.

The Neoclassical 'homo-economicus' or rational economic man is the conceptualisation of the representative agent used in this particular type of microfoundations approach. There are certain features of this agent that must be mentioned here for any significant evaluation. Firstly, the representative agent is "a scale model of the whole society" (Foley, 2004, p.84), that is to say the link between the representative agent and the actual individuals that make up the aggregate economy is purely quantitative. There is no specification of the distribution of endowments possessed by different agents. However, some individuals contribute more than others to the behaviour of the aggregate representative agent, and this is not accounted for. Secondly, the rational economic man seems to possess a preternatural capability of perfect knowledge. He is able to assess all the relevant information about a certain situation, such that he can always act optimally, and maximise his utility. From this, another point is established: the key aim of the entire process of economic activity is for each individual to generate the highest possible level of utility for himself. Thirdly, since only a single rational agent is considered in the representative agent model, there is no need for coordination of agents.

The extreme simplicity of the model, compared to real-world phenomena has caused economists to continue to implement it as a microfoundation for macroeconomics because the problems associated with the model, examined below, look difficult enough to make ignoring them a lot more attractive (Kirman, 1992, p.133).

However, it is not difficult to come up with these problems. It is hard to imagine one representation to fit a diverse, heterogeneous combination of individuals, and even if this were possible, it remains questionable whether the aggregate effect of individual behaviour is the same as the behaviour of a single representative individual.

The most common picture of an economy one can draw is that of a multitude of individuals pursuing their self-interest within the limited scope of the economy in which they function. Yet, these individual activities unintentionally create a coordinated order at the macro level. What is striking, and to a significant degree, worrying, is that the models used to understand and predict such features of the economy consist of no such coordination (Kirman, 1992, p. 117).

The very purpose of using a representative agent general equilibrium model is that it provides the necessary theoretical set-up that ensures a unique and stable equilibrium, which would otherwise, with the inclusion of variations in individual tastes and endowments, not be easily ensured. Such a set-up is crucial for the application of satisfactory microfoundations, as will become increasingly clear with the illustration of the kinds of problems that arise when equilibria are neither unique nor stable. The issue taken up in this chapter, however, is that though such a theoretical framework seems ideal, it is unrealistic and misleading.

The starting point of any critique will be to outline the assumptions made about this representative agent, and then to follow with arguments of why such assumptions do not hold for all individuals within an economy.

As stated above, the representative agent possesses certain attributes, namely perfect knowledge, and complete rationality in his expectations, and actions. In particular, this implies complete, transitive, and non-satiated convex preferences for the agent. Completeness implies that all possible bundles of consumption, given an individual's budget constraint are known and can be ranked in order of preference, whether they are discrete or continuous. Transitivity refers to consistency of preferences, that if bundle A is preferred to bundle B, and bundle B is preferred to bundle C, then it must be true that bundle A is preferred to bundle C. Non-satiation is the idea that more is always better, that utility always increases with increased consumption. Lastly, convexity of preferences refers to the idea that a mixture of goods is always more preferable to extremes.

Given the above assumptions, within a representative agent model, a market equilibrium that is Pareto optimum is found, as shown by the results proven by Arrow and Debreu in the 1950s. At such a point, the general equilibrium of the market is unique and stable. However, as emphasised earlier, the lack of realism of the model, due to the strict assumptions outlined above, calls into question the accuracy of its findings for predictions of the real economy.

The rest of this chapter will elaborate on how uniqueness and stability cannot be ensured. If the equilibrium is not unique, it is possible that one of the equilibria is Pareto superior to another, but the wrong one is realised. If it is not stable, such a point may never be realised or even if it is, the market may easily move away from it, given any small shock (Ackerman, 2002). Finally, it also attempts to illustrate the consequences of using such a model for macroeconomic policy predictions, in light of the financial crisis of 2008-09.

Kirman states, "there is no more misleading description in modern economics than the so-called microfoundations of macroeconomics which in fact describe the behaviour of the consumption or production sector by the behaviour of one individual or firm" (1989). The representative agent approach to microfoundations has earned itself such a reputation for a number of reasons.

For the case of uniqueness, several academics including Hahn (1973) and in particular, Edgeworth, in his 'limit theorem' (1881) identify the possibility of plurality of equilibria in a range of achievable outcomes referred to as the 'core'. In the Edgeworth box, for example, there are only two goods and two people, with no production but only exchange between agents, identified by intersections of their respective indifference curves. Here, a contract curve is formed as the combination of all points of tangency of the two individuals' indifference curves, which is the set of feasible Pareto-optimal allocations that cannot be blocked by either agent. Hence, all points on the contract curve, within the lens-shaped area of the indifference curves (core), formed by initial endowments are possible equilibria. The representative agent model, based on the choices of a single, isolated rational agent, assumes away any form of interaction between agents, and thus produces a unique equilibrium point. However, in actual economies, interaction between agents plays a fundamental role in determining the choices and preferences of individuals. These interactions include, but are not limited to, market interactions of a multitude of individuals, though even with the simplest case of two agents, Edgeworth proves the existence of multiple equilibria. It is then incomprehensible how we can understand macroeconomic events when the model used assumes away the need for coordination, the key characteristic of macroeconomic phenomena (Colander et al., 2008).

For the case of stability, we need it to be true that the cumulative effect of economy-wide individuals' behaviour be predicted by the aggregation of the behaviour of the rational, representative agent. However, such an assumption faces many challenges. Hoover (2010) identifies three distinct theses, relating aggregates and individuals, that exist within the microfoundations approach. The first is rather uncontroversial, claiming individuals lie behind aggregates in the sense that without individuals there would be no aggregates. The second is a suggestive claim, stating how individuals behave conditions how aggregates behave. The third and most dominant view is that aggregates are nothing else but summary statistics reflecting individual behaviour. Kirman (2006) highlights the naivety of assuming a linear scaling-up relationship between individual and

aggregate behaviour, as suggested by this last thesis, imagining that behaviour at the individual level can be assimilated to that at the aggregate by simple summation. As Sonnenschein (1972), Mantel (1974), and Debreu (1974) show in their explanations of aggregate excess demand functions, it is impossible to derive general results for global uniqueness and stability, with assumptions on individual actions, unless the entire economy can be assumed to behave like a single rational representative agent. This is because the only conditions derived on aggregate excess demand from even the strongest conditions on individual preferences are homogeneity of degree zero, satisfying Walras' law of the sum of excess market demand to equal zero due to budget constraints, and existing as strictly positive (Rizvi, 2006). As there exist functions that satisfy these conditions but are not stable nor do they possess a unique equilibrium, such properties cannot be guaranteed with assumptions on individuals (Kirman, 2006). Thus, even with the strongest assumptions on individual behaviour, there is very little that is known about aggregate behaviour.

The main issue then is that the conditions for uniqueness and stability are not only the standard, already restrictive, assumptions for individuals, but additionally, also the condition of how individuals relate to one another – particularly implying that they have identical and homothetic preferences (Kirman, 1992) (Hoover, 2010). Homotheticity implies that all individuals demand goods in the same proportion. This is highly unlikely, for example, an individual with a higher income is likely to spend a smaller proportion of his income on necessities such as food than an individual with a much lower income. Hence, these additional conditions are highly unrealistic.

Firstly, it is not the case that every individual has identical, utility-maximising preferences. In fact, individuals display a vast heterogeneity of behaviour, and mapping this varied behaviour as that of one utility maximising individual seems far from accurate. Convexity of preferences is empirically the most vulnerable of the above assumptions. For there to be a market-clearing price, it is necessary that preferences are convex, as this insures demand and supply are continuous, and can be adjusted to changes in initial endowments. This would mean that an

individual's excess demand equals zero. However, this is not always the case. As Arrow (1986) notes, it is completely plausible for individuals to prefer extreme bundles, rather than mixtures, such as preferring to reside full-time in one city, rather than part-time in two distant cities. In such a situation, demand is not continuous, and it may be possible that there is no intersection between demand and supply, and hence no competitive equilibrium. However, a line of argument based on the relative size of each individual to the economy as a whole indicates that even if an individual may not have continuous, convex preferences, this has no significant effect on the existence of equilibrium for sufficiently large economies. Still, reconciling such an argument with the representative agent leads to further trouble. The representative agent follows the rule of price taking, under perfect competition, satisfied by the assumption of a sufficiently large number of individuals, however the representative agent model implies the presence of only one agent, namely the representative agent himself. Thus, as Hoover (2010) states, "the representative agent is – inconsistently – simultaneously the whole market and small relative to market."

The remaining assumptions may be weakened, whilst maintaining the existence of equilibrium. However, as Kirman (1989) points out, if the existence of equilibria is all that we are interested in, then remarkable results have been obtained for large economies. The matter remains troublesome when attempting to ensure uniqueness and stability. For agents to have complete and transitive preferences, they must have perfect knowledge of all the possible consumption choices available to them, not only in the present, but in all future contingent markets as well. This implies that individuals completely understand the economy and can forecast the evolution of the economy, as well as the evolution of their choices in future markets, within this economy (Kirman, 2014). Rational expectations theory suggests that individual beliefs about the future should coincide with how the future actually unfolds, allowing for a normally distributed random error in forecasting. However, for individuals to possess perfect knowledge of the future economy is highly implausible, especially when the economy is as complex as the economies of the real world witnessed today,

with unanticipated changes, and structural breaks, making predictions based on past information redundant (Hendry and Mizon, 2010).

It is evident that individuals at large do not possess the characteristics of the representative agent, and do not have identical preferences. This would imply that the resulting aggregate excess demand functions are not as well behaved as modelled by the representative agent's excess demand function, leading to instability of equilibria. The idea is that if significant divergence is allowed, the possibility for nearly anything to happen exists, and thus stable predictions no longer hold. However, Kirman and Koch (1986) show that no matter how close individuals' characteristics are to each other, stability and uniqueness cannot be ensured and the Sonnenschein-Mantel-Debreu result still holds.

Secondly, homotheticity is also implausible. Homothetic preferences require individuals with different incomes to demand goods in the same proportions. However, this would, in effect, ignore distributional considerations and deem income effects insignificant. Homotheticity is, thus, implausible in a world where distributional considerations matter.

Counter-intuitively, yet interestingly, Grandmont (1992) has presented results in favour of incorporating heterogeneity in economic models, in an attempt to increase stability. He argues that if agents have significantly diverging preferences, then aggregate excess demand will have gross-substitutability and the resulting equilibrium will be unique and stable. Then rather than forcing the straitjacket of individual maximising behaviour on agents, it is sufficient that they respect their budget constraints for well behaved aggregate demand to hold.

Nonetheless, representative agent modelling has severe consequences for accurately predicting macroeconomic phenomena and designing optimal policy choices. For the concept of equilibrium to hold any significance in real-world economies, it must be characterised by some degree of stability. Morishima (1984) explains that even if a general equilibrium model is designed, possessing

an equilibrium solution, it is of little use to the real economy if there is no means to realise that solution. Hence, policy predictions made on such a model would present implications that do not correspond with those of the actual economy.

The financial crisis of 2008-09 presents overwhelming evidence against the claim for a strict representative agent-based microfoundations approach to macroeconomics. Before the crisis, however, academics had assured policymakers of the benefits of DSGE modelling, in particular of the foundations of rational expectations, to such an extent that they, somewhat blindly, believed in its results as accurate predictions of economic trends. Macroeconomic fluctuations in output, employment, investment, and consumption were then explained in terms of exogenous technology shocks (Wright, 2009, p.1). As Kirman (2014) points out, this complacent satisfaction led macroeconomists to not only fail to predict the crisis but even contribute to its occurrence to some extent. With the onset of the crisis, policymakers were quick to express their dissatisfaction with the economic models at hand. Adair Turner (2010), Head of the UK Financial Services Authority, claimed that "bad or rather over-simplistic and overconfident economics helped create the crisis" and that the "dominant conventional wisdom that markets were always rational and self-equilibrating" proved inaccurate.

The fundamental cause of the onset and acceleration of the crisis is identified as the neglectful rapid extension of credit given to individuals wishing to buy homes. The capacity of the borrowers to pay back was ignored, housing loans increased, and these were distributed among banks worldwide, apparently diversifying risk. It is important to note the interconnectedness that this distribution highlights, for this forms the key argument against macroeconomic modelling on representative agent frameworks (Colander et al., 2009). Nonetheless, the housing loans market continued to expand, despite a weakening of the U.S. economy and a halt in the rise of house prices. At this stage, banks began to reassess their risk, and evaluate the potential losses from such subprime loans. Again, interconnectedness and reactionary feedbacks played a key role. It was not any one bank that began a reassessment of its position, but in

fact, the whole range of banks involved. This led to a collapse of interbank lending, and eventually brought the entire system down (Eichengreen, 2008).

It is evident from the above explanation, and the obvious global consequences, that the crisis was a series of highly integrated and correlated events. Kirman (2010) describes the onset of the crisis as "a story of contagion, interdependence, interaction, networks, and trust" and correctly notes that none of these features are illustrated in a representative agent framework. The macroeconomic models used to understand the economy left out crucial features of the functioning of that very economy, and thus were unable to predict periodic peaks and troughs. Individual interactions and herd behaviour played a key role in the onset of the crisis, but were not given any recognition in existing models.

Agent Based Modelling:

With the failure to predict the financial crisis or to offer a viable solution out of it, the representative agent framework is no longer a satisfactory tool for macroeconomic modelling. It has become clear that improvements in this field need to be made in order to better understand the economy, in all its complex dynamics, and to implement, more accurately, policies for economic growth. One solution is offered from within the general equilibrium framework, with the application of agent-based modelling.

Frank Hahn, a proponent of neoclassical economics, himself came to realise the shortcomings of a representative agent general equilibrium framework. Though he continued to believe in the importance of having an equilibrium notion, he did require it to possess several additional features, such as "information processes and costs, transactions and transaction costs and also expectations and uncertainty" (1973, p. 8).

Agent based models reflect the evolutionary nature of the economy by incorporating micro-activity in a disequilibrium setting, and allowing the development of macro-level equilibrium through the spontaneous and transformative interaction of heterogeneous agents (Nell, 2010). Such models treat macro-level phenomena as emerging from micro-level actions, rather than being mere aggregates of them. Actions that occur on the micro-level, then, generate macro-level effects, and these effects in turn provide new contexts and new information for agents acting at the micro-level. Thus, there is a clear interaction between the two levels, and macroeconomic phenomena cannot be understood through the reduction of an economy to a representative agent (Veetil and Wagner, 2015).

The distinctive foundations of such models lie in their understanding of individuals as 'black box' sources of unpredictability rather than 'white box' sources of predictable, fully rational, optimising behaviour (Wright, 2009). Agent based models, then, treat individuals as making choices, following simple rules

that could result in the macro-level patterns that exist. (Harper and Lewis, 2012). Such an approach highlights, ironically, the fact that reducing randomness does not yield stronger explanatory power for the model rather it forms artificially neat systems. If the purpose of macroeconomic modelling is accurate predictions, then neat results are irrelevant, when the real economy is more accurately described as a 'messy' system, at the core of which exists an essential randomness of choice order.

Agents display rule-following behaviour, rather than the perfectly optimising behaviour displayed in standard economic models. Thus, in the multi-agent systems, "agents are processes implemented on a computer that have (they control their own actions); social ability (they interact with other agents through some kind of "language"); reactivity (they can perceive their environment and respond to it); and pro-activity (they are able to undertake goal-directed actions) (Gilbert and Terna, 2000, p. 60). The model is designed to define the cognitive and sensory capabilities of agents, the actions they can carry out, and the initial characteristics of the environment in which they exist. Then, possible outcomes can be observed when any simulation is run.

With the incorporation of coordination and interaction, it is hoped that such methods would yield better predictions for macroeconomic policy implementation, with stronger empirical support than the representative agent DSGE models.

However, there remains much work to be done in developing wholly satisfactory agent based models, to the extent that wholly satisfactory microfoundations are even possible. Major challenges identified by Farmer and Foley (2009) include the need to specify how agents behave, in particular, how they choose between the various behavioural choice-sets available to them in different circumstances. This is largely done by simple rule-following, which is only sometimes able to represent real behaviour. At other times, it may fail to do so, and thus report inaccurate findings. However, attempting to incorporate all the possible specifications of behaviour and choice into models leads to rapid complication,

which may itself threaten the credibility of results, making it hard to determine the existence and direction of causation.

Other difficulties remain in the neo-classical structure of excluding historical contexts, institutions, and real-time structural changes, treating time as reversible, and ignoring extreme complexity, and individuals' informational limits and learning (Hodgson, 1992). Ingrao and Israel (1990) examine the mathematical formulation of general equilibrium models and highlight their external inconsistency with real economies.

A Macrofoundations Approach:

Until the financial crisis of 2008-09, when the failure of existing models was highlighted by policymakers and academics alike, the belief that microeconomics could replace macroeconomics was becoming increasingly popular. It assumed that all macro-level phenomena were simply the result of aggregated micro-level functions and thus, macroeconomics did not necessarily afford itself an independent place in economic theory. However, now it is clear that microfoundations cannot replace macroeconomic theory.

The current neoclassical model is devoid of any institutional or social context. Hayek (1949) and, more recently, Boettke (2006) raise concerns about this omission, which causes a shift in focus, from the understanding of the impact of changing societal structures to a reduced, oversimplified constrained optimisation problem.

The main argument being presented is an ontological one, that there are certain features of the economy that are inherently 'macro' features, not derived from micro-level actions. In considering macroeconomic fundamentals, Hoover (1995) explains that it is easy to understand the reduction of aggregate levels of total employment to their individual components, as they are measured in the same units and preserve a close analogy with those individual components. However, clear reduction and linkages are not always found. For example, considering the notion of a general price level, it is hard to imagine it being formulated as a simple aggregated average level of prices. He gives the following example:

"A simple average will not of course work: (10¢/orange + 20¢/apple + $27,948/Volvo station-wagon)/3 does not convey any useful information. One cannot add apples and Volvos, as they say."

Instead, an estimate of the price of money is determined, through indexes assigned to goods in accordance to the proportion of national income spent on them. Here, the aggregate, in this case the general price level, is fabricated out of

components in a way that alters the structure of the components, so that there is no direct analogy with the components. Hence, the reduction of such concepts in a microfoundations aggregating approach would yield inaccurate results.

Such variables are known as 'emergent' macro variables, and they are not completely reducible to the properties of their micro-level elements. (Harper and Lewis, 2012). Not only do they develop properties that do not exist at the micro-level, and that constrain individual action, but they also transform individual agents through repeated interactions, and processes of socialisation, defining and changing norms, habits, preferences and so on (Hodgson 2002). Agent-based models, discussed above, do not consider such transformational powers of macro-level phenomena.

Wagner (2010) highlights the explanatory irreducibility of emergent macroeconomic phenomena, in that they cannot be replaced by descriptions of their individual components alone. He argues that these phenomena have to be explained non-reductively, "as the unintended outcome of an ongoing (non-equilibrium), institutionally-structured process of interaction between a multiplicity of micro-level agents" (Harper and Lewis, 2012, p. 21). Thus, emergent institutions, such as the structure and legal framework of a society, are indispensible to the understanding of economic conditions and it is important to consider macrofoundations for micro-level actions.

The key features to be incorporated include the societal structures within which economic activity takes place. These structures are strongly defined by the dominant moral norms that develop within a society. Etzioni (1988) argues that all human choices are considered in two dimensions: the self-interest derived from a choice, as well as the ethical background of the individual making the choice. Smithin (2004) describes the dominant social institutions that shape ethics and norms, as continually reproduced interdependencies, that shape individual action, and that evolve over time with changing individual behaviour.

The general equilibrium framework, assuming purely utility maximising motivations, ignores any such moral and institutional considerations, and thus, offers only a partial account of individual choice processes. Hodgson (1992) emphasises the importance of non-contractual elements, such as trust and moral norms, as foundations for market-based contractual systems, and claims that the failure of the general equilibrium project to deal with such elements causes it to lack meaningful sense for the real economy it is built to depict. Saari (1996) follows the same line of argument and claims that "we should be suspicious about models which always are stable" such as the DSGE models. Instead of modelling artificial stability, it is important to be able to model and understand economic booms and slumps, and this is only possible through the development of a more accurate model of the economy.

Once the presence of a moral dimension is accepted, an additional feature, namely feedback loops, must be incorporated in the model. Hodgson explains that morally motivated actions tend to involve learning and demonstration effects, "for instance, altruism encourages further altruism, trust engenders trust, and so on" (1992, p. 758). In this sense, positive feedbacks reinforce a certain kind of behaviour and generate norms. Thus, the positive feedback effect creates more of an evolutionary trajectory of the economy.

The evolutionary view of an economy, then, leads to the admission of a third feature, namely path dependency and irreversibility of learning. The argument for path dependency claims that present and future circumstances of a society, in this case more particularly of an economy, rely on and are conceived from the historical experience of that society or economy. If an economy is preconditioned by its historical experience, then surely a one-fit-for-all theory cannot apply. It is also important to understand what role the past plays in shaping the present. The evolutionary view allows us to incorporate real-time structural changes into the economy, another feature lacking in general equilibrium models that consider time reversible. Thus, the past defines the specific 'learning' of local knowledge that individual agents acquire, and as Hodgson expresses, "what is learned by agents cannot easily be unlearned" (1992, p. 758).

Ackerman (2002) offers an interesting and somewhat compelling argument, extending the justification of the inclusion of institutional and social structures not only to increase realism in the models, but also to explain the norm of stability experienced by most economies. He claims that since markets are only occasionally unstable, the widespread stability experienced by economies may in fact be exogenous to the market. Thus, he suggests, "exogenous factors such as institutional contexts, cultural habits, and political constraints may provide the basis for stability, usually damping the erratic endogenous fluctuations that could otherwise arise in a laissez-faire economy" (2002, p. 135).

Hence, macroeconomic models should be designed taking such an evolutionary approach. This is because it allows for the incorporation of essential features of the economy, such as prevailing norms and structures that define the choice space for individuals. It also allows for the understanding of disequilibrium and equilibrium situations, possibly providing greater predictive power and advisory tools for policy-makers in times of crises. Nonetheless, a complete abandonment of microfoundations is not suggested. Microfoundations, undoubtedly do provide valuable insights into the functioning of individual actions, and should continue to be used. However, agent based models should replace representative agent models for reasons already explored, mainly the allowance of heterogeneity between agents. Additionally such models should be complemented by what may be termed macrofoundations of microeconomics to ensure a holistic understanding of the economy.

Bibliography:

Ackerman, F. (2002). Still dead after all these years: interpreting the failure of general equilibrium theory. Journal of Economic Methodology, 9(2), pp.119-139.

Arrow, K. (1986). Rationality of Self and Others in an Economic System. The Journal of Business, 59(S4), p.S385.

Arrow, K. and Debreu, G. (1954). Existence of an Equilibrium for a Competitive Economy. Econometrica, 22(3), p.265.

Boettke, P. (2006). The battle of ideas. Wellington, N.Z.: New Zealand Business Roundtable.

Colander, D., Föllmer, H., Haas, A., Goldberg, M., Juselius, K., Kirman, A., Lux, T. and Sloth, B. (2009). The Financial Crisis and the Systemic Failure of Academic Economics. SSRN Electronic Journal.

Colander, D., Howitt, P., Kirman, A., Leijonhufvud, A. and Mehrling, P. (2008). Beyond DSGE Models: Toward an Empirically Based Macroeconomics. American Economic Review, 98(2), pp.236-240.

Debreu, G. (1974). Excess demand functions. Journal of Mathematical Economics, 1(1), pp.15-21.

Del Negro, M. and Schorfheide, F. (2012). DSGE Model-Based Forecasting. FRB of New York Staff Report No. 554. [online] Available at: http://ssrn.com/abstract=2018451.

Edgeworth, F. (1881). Mathematical Physics: An essay on the application of mathematics to the moral sciences. London.

Eichengreen, B. (2008). Origins and Responses to the Crisis. University of California, Berkeley, Unpublished Manuscript.

Etzioni, A. (1988). The moral dimension. New York: Free Press.

Farmer, J. and Foley, D. (2009). The economy needs agent-based modelling. Nature, 460(7256), pp.685-686.

Foley, D. (2004). The strange history of the economic agent*. New School Economic Review, 1(1), pp.82-94.

Gilbert, N. and Terna, P. (2000). How to build and use agent-based models in social science. Mind & Society, 1(1), pp.57-72.

Grandmont, J. (1992). Transformations of the commodity space, behavioral heterogeneity, and the aggregation problem. Journal of Economic Theory, 57(1), pp.1-35.

Hahn, F. (1973). On the Notion of Equilibrium in Economics an Inaugural Lecture. London: Cambridge University Press.

Harper, D. and Lewis, P. (2012). New perspectives on emergence in economics. Journal of Economic Behavior & Organization, 82(2-3), pp.329-337.

Hayek, F. (1949). Individualism and economic order. [Chicago]: Univ. of Chicago Press.

Hendry, D. and Mizon, G. (2010). On the Mathematical Basis of Inter-temporal Optimization. Department of Economics, University of Oxford.

Hodgson, G. (2002). Reconstitutive downward causation: social structure and the development of individual agency. In: E. Fullbrook, ed., Intersubjectivity in

Economics: Agents and Structures, 1st ed. London and New York: Routledge, pp.159-180.

Hodgson, G. (1992). The Reconstruction of Economics: Is There Still a Place for Neoclassical Theory?. Journal of Economic Issues, 26(3), pp.749-767.

Hoover, K. (2010). Idealizing Reduction: The Microfoundations of Macroeconomics. Erkenn, 73(3), pp.329-347.

Hoover, K. (1995). Is Macroeconomics for Real?. Monist, 78(3), pp.235-257.

Ingrao, B. and Israel, G. (1990). The invisible hand. Cambridge, Mass.: MIT Press.

Kirman, A. (2010). The Economic Crisis is a Crisis for Economic Theory. CESifo Economic Studies, 56(4), pp.498-535.

Kirman, A. (2014). Is it rational to have rational expectations?. Mind Soc, 13(1), pp.29-48.

Kirman, A. (2006). Demand Theory and General Equilibrium: From Explanation to Introspection, a Journey down the Wrong Road. History of Political Economy, 38(Suppl 1), pp.246-280.

Kirman, A. (1989). The Intrinsic Limits of Modern Economic Theory: The Emperor has No Clothes. The Economic Journal, 99(395), p.126.

Kirman, A. (1992). Whom or What Does the Representative Individual Represent?. Journal of Economic Perspectives, 6(2), pp.117-136.

Kirman, A. and Koch, K. (1986). Market Excess Demand in Exchange Economies with Identical Preferences and Collinear Endowments. The Review of Economic Studies, 53(3), p.457.

LeBaron, B. (2006). Agent-based Financial Markets: Matching Stylized Facts with Style. Post Walrasian Macroeconomics: Beyond the DSGE Model, pp.221-235.

Mantel, R. (1974). On the characterization of aggregate excess demand. Journal of Economic Theory, 7(3), pp.348-353.

Morishima, M. (1984). The Good and Bad Uses of Mathematics. In: P. Wiles and G. Routh, ed., Economics in Disarray, 1st ed. Oxford: Basil Blackwell.

Nell, G. (2010). Competition as market progress: An Austrian rationale for agent-based modeling. The Review of Austrian Economics, 23(2), pp.127-145.

Rizvi, S. (2006). The Sonnenschein-Mantel-Debreu Results after Thirty Years. History of Political Economy, 38(Suppl 1), pp.228-245.

Rizvi, S. (1994). The microfoundations project in general equilibrium theory. Cambridge Journal of Economics, 18, pp.357-77.

Saari, D. (1996). The ease of generating chaotic behavior in economics. Chaos, Solitons & Fractals, 7(12), pp.2267-2278.

Smithin, J. (2004). Macroeconomic theory, (critical realism) and capitalism. In: P. Lewis, ed., Transforming Economics: Perspectives on the Critical Realist Project, London and New York: Routledge.

Sonnenschein, H. (1972). Do Walras' identity and continuity characterize the class of community excess demand functions?. Journal of Economic Theory, 6(4), pp.345-354.

Tovar, C. (2008). DSGE Models and Central Banks. Economics Discussion Papers, [online] 2008-30. Available at: http://www.economics-ejournal.org/economics/discussionpapers/2008-30.

Turner, A. (2010). Economics, conventional wisdom and public policy. Institute for New Economic Thinking, Inaugural Conference, Cambridge.

Veetil, V. and Wagner, R. (2015). Alternative Micro-foundations for Macro Theory: Additive and Ecological. GMU Working Paper in Economics, [online] (15-02). Available at: http://ssrn.com/abstract=2552321.

Wagner, R. (2010). Mind, society, and human action. London: Routledge.

Wright, I. (2009). Implicit Microfoundations for Macroeconomics. Economics E-Journal, 3(2009-19), p.1.