Alternative approaches for the Reformulation of Economics.

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Why do we need new approaches? A short overview.

In the last decades most of advanced and developing economies have undertaken a deep structural transformation. This profound structural change, caused by the transition from a manufacturing economy to a service-based one, is among the causes of the current crisis (see Delli Gatti et al. 2012). The dereculation of the banking system with the consequent redirection of banking activity from the credit sector to the financial one[1], and the liberalization of financial markets, the globalization and the delocalisation of production with the resulting labor market flexibility are just some of the many transformations affecting the socio-economic system in the recent decades.

All these serious changes have been poorly described by mainstream economics. Emblematic is Queen Elizabeth's question at the London School of Economics during a discussion on the 2008 financial crash: "Why did nobody notice it?", asked the Queen. As reported by Catullo et al. 2015, "economists, after some time, explained why no one foresaw the timing and severity of the crisis by laying responsibility on the failure of the collective imagination of many bright people. But why was the imagination of so many economists so limited? According to the eight contributions presented in this special edition, this was not an "imagination failure", but rather the failure of a paradigm (Lakatos, 1976) unable to explain and predict crises of these dimensions".

Based on the lessons taken from the recent socio-economic transformations, the Society for Economic Science with Heterogeneous Interacting Agents (ESHIA) tries to re-formulate and integrate the pillars of mainstream economics[2]. Therefore, what our scientific community proposes is the formalization of a descriptive and non-

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[1] According to our view, banking activity in "credit market" indicates the loans granted to firms with production purposes. On the other hand, the activity in "financial market" refers more specifically to financial speculation in the stock market.

[2] A discussion on how ESHIA has re-modeled the pillars of mainstream economics is beyond the scope of this work. A detailed analysis can be found in other studies (see, for instance, Kirman 2010; Bargigli and Tedeschi 2013, 2014).

normative theory, able to grasp the complex dynamics of social systems. The economic crisis, in fact, has been accompanied by a profound dissatisfaction with the dominant paradigm. The Nobel Laureate Paul Krugman has recently commented that most macroeconomics of the past 30 years was "spectacularly useless at best, and positively harmful at worst". In line with this view, in his opening address to the ECB Central Banking Conference on 18 November 2010, the ECB President, Jean-Claude Trichet said that "in the face of the crisis, we felt abandoned by conventional tools", and went on to call for the development of complex systems based approaches to augment existing ways of understanding the economy.

Rethinking Economics.

In our vision, the "Economy" is the result of the interaction of many heterogeneous agents. Relationships may be "real" - i.e. pertaining to production, employment, consumption, investment, technology adoption - or "financial", i.e. concerning borrowing/lending. In our opinion, therefore, externalities are much more pervasive than the average economist is ready to admit. In fact, we believe that an externality is the unavoidable outcome of agents' direct (indirect) interaction which indeed occurs on a massive scale in the economic realm. The careful analysis of the dynamic relationships which govern the interaction among individuals, at the micro-level, and economic sectors, at the macro-level, will be the key element for the reformulation of a "Bottom-up Economics" (see Delli Gatti et al. 2011; Kirman 2010).

Why has the mainstream in economics long neglected the interaction and its consequences on the socio-economic system? One answer to this question goes as follows: Contemporary economics hypothesized/ postulated a Representative Agent for each class of individuals (households, firms, banks). This shortcut simplifies the analysis to a great extent. However, this simplification is a serious drawback because it ignores by construction some fundamental features of the economic dynamics. It is worth noting that ESHIA has spent many years (ever since the early 90s) just collecting a long list of real and financial stylized facts ruled out by construction in a Representative Agent framework. In fact, facts such as volatility clustering, fat-tailed distributions, financial and real bubbles, business fluctuations, bankruptcies and many more, are difficult to reconcile with a rational representative agent. Therefore, the Economics that we propose must go beyond the current state of the art and focus on the evolution of the complex socio-economic system.

What we propose.

In order to foster our understanding of the economic dynamics, the eight works selected for this special issue embrace a broad range of topics which are crucial for comprehending the current socio-economic system. Topics such as the accumulation of real and financial capital, the transformation of financial and pension systems, and the emergence and impact of coordination in social systems are the many important subjects we dealt with. These arguments are certainly heterogeneous, but unified by a common vision of the economic system: economics is the result of the interaction of many heterogeneous agents following different behavioral rules often

neither "rational" nor optimal.

Let us now go into the details of the eight selected papers.

The work of Ozel et al. can be considered a classic in the literature of ESHIA. This paper, in fact, starting from the well-known Eurace agent-based model, investigates the impact of the money injection via mortgage loans on the housing market. Interestingly enough, the model reproduces a non-linearity in the granting of mortgage loans. An additional amount of endogenous money helps to increase and stabilize the aggregate demand. However, an excessive granting of mortgage loans is detrimental to the macroeconomic performance and destabilizes the economic system.

The recent economic crisis has undermined another cornerstone of mainstream economics, that is the theory of savings. To this end three of the selected papers (see Gosselin et al.; Biondi & Righi; Kiraly & Simonovits) deal with the effect of the real and financial capital accumulation from different angles. Firstly, Gosselin et al. present an analytical model where the intergenerational capital accumulation is investigated in a highly heterogeneous society where agents attribute distinct social and personal values to a large number of goods. Authors show that the dynamics of capital accumulation strongly depends on agents' social and individual values. Specifically, they show that the volatility of these values is the key ingredient to determine the extent of capital accumulation. In particular, their results show that large variations in social values generally hinder accumulation.

Secondly, the paper by Biondi & Righi focuses on the financial accumulation process and its effect on inequality. Using a computational approach, authors show how the so-called financialization of the economy is responsible for the increasing social inequality. Moreover, Biondi & Righi show that carefully designed taxation policies play a crucial role in mitigating inequality.

Finally, the paper by Kiraly & Simonovits investigates the problem of financial accumulation from the point of view of the pension system. The main objective of this paper is to analyze how learning to save in a voluntary pension scheme affects the consumption smoothing of shortsighted individuals as well as the cross-sectional consumption inequality. Authors present two models. In the first dynamic model, which can be solved analytically, learning consists in shortsighted consumers following a simple saving rule that depends on publicly available information. Both cross-sectional consumption inequality and the variance of consumption over the life cycle decrease over time and reach a steady state.

The second model is agent-based, and workers learn to save from their acquaintances: they choose the "relative propensity to save" of the agent that has the highest average future consumption in their "neighborhood". Some inequality is preserved in this case and the authors conduct various robustness exercises to analyze the effect of changing the model parameters on the variance of consumption.

A key topic of the ESHIA literature is the definition of micro-foundations of agents behavior. The objective is to identify behaviorally plausible strategies to represent the behavior of agents. Without entering into merits and/or limitations of the mainstream microfoundations, this approach clearly dominates the way economists

model agents' behavior. Following different lines of research, the economic literature presented in this special issue identifies, at least, another way to define agents' behavior in the market. We refer to agent-based economics, that is, the application of computational techniques to reproduce micro-/meso- and macro-dynamics via a bottom-up approach (see, Arthur 1993; Clark 1997; Tesfatsion and Judd 2006; Shoham et al. 2007). Following this last line of research, the paper of Polach and Kukacka is explicitly concerned with the ability of agent-based models to describe micro behavior in financial markets. Specifically, the authors extend the well-known Brock and Hommes (1997) asset market model by modifying the utility function of the agents to take the prospect theory described by Kahneman and Tversky into account. The prospect theory claims that agents have different attitudes between gains and losses, and in particular that agents are loss averse. The presence of loss aversion has an effect on stock markets as it changes the behavior of agents depending on where they lie with respect to their reference point. The idea of the authors is to analyze whether the output of the model described in Brock and Hommes changes when taking the Prospect Theory in the definition of agents' utilities into account.

The following two works by Garcia-Gallego et al. and Gonzalez-Avella et al., selected for this special issue, deal with the important topic of coordination and possible mechanisms to encourage it. An important question is why traders' expectations/actions are often coordinated. Claude Trichet (2001) remarked: "Some operators have come to the conclusion that it is better to be wrong along with everybody else, rather than take the risk of being right or wrong alone". This "mass-uniform" behaviour was already present in Keynes (1936) who called it "animal spirits".

The research question Garcia-Gallego et al. address is whether and when communication can lead to coordination. To this end, authors implement an experiment based on the sender-receiver set-up considered in Gossner et al. (2003, 2006), where optimal strategies of communication between sender and receiver are designed using blocks. By adding a specific channel for communication between players, so that, players have the possibility to write free messages and design their strategies at no cost, Garcia-Gallego et al. show how this chat is effective on transmitting information and, therefore, efficient in creating coordination. The paper by Gonzalez-Avella et al., instead, explores under what circumstances a population could achieve the socially efficient outcome of a coordination game. Specifically, the authors investigate, via a computational learning process, the situations in which the population, divided into two sub-groups, can reach internal social aims such as acceptance or approval.

Finally, the paper of by Garcia-Segarra and Gines-Vilar opens the reflection on a key point of economic literature, that is, the concept of equilibrium and its Pareto-optimality. Authors mathematically prove that some bargaining solutions may remain unaltered despite the Pareto optimality is not reached. The paper focuses on the axiomatic approach to n-agent bargaining problems, introduced in the seminal paper by Nash (1950). A group of agents, can achieves a feasible utility vector, $x \in S \subset \mathbb{R}^n$, if they unanimously agree on it. Otherwise, they will end up at the utility corresponding to the disagreement point, $d \in S$. It is assumed that the feasible set S is compact, convex and contains a vector strictly greater than d in all its coordinates. A solution for these

situations is a function that associates a feasible utility allocation to each bargaining problem. In this context the authors introduce a new axiom, stagnation proofness. It says that for each bargaining set S with an unfeasible utopia point $(m(S) \notin S)$, there is at least one superset S' with the same utopia point $(m(S') = m(S))$, such that for at least one agent, the solution in S' is greater than the solution in S. Stagnation proofness, together with weak Pareto optimality, scale invariance and a restricted version of strong monotonicity, is used to characterize the SIP-solutions, a family of solutions generated by strictly increasing paths connecting the disagreement and the utopia points, d and m(S).

Concluding remarks

As stated by Mr. Trichet' s words: "the key lesson we would draw from our experience is the danger of relying on a single tool, methodology or paradigm. Policy-makers need to have input from various theoretical perspectives and from a range of empirical approaches. ...we need to develop complementary tools to improve the robustness of our overall framework. ...In this context, we would very much welcome inspiration from other disciplines: physics, engineering, psychology, biology. Bringing experts from these fields together with economists and central bankers is potentially very creative and valuable. Scientists have developed sophisticated tools for analysing complex dynamic systems in a rigorous way. These models have proved helpful in understanding many important but complex phenomena: epidemics, weather patterns, crowd psychology, magnetic fields. Such tools have been applied by market practitioners to portfolio management decisions, on occasion with some success".

Our contribution seeks to do exactly what Mr. Trichet is calling for. In order to reformulate economic theory, we need to understand the influence that economic systems have on agents and the way by which heterogeneous individuals create complex environments. Interaction is the missing link between heterogeneous micro behaviors and emerging macro phenomena: it helps us to better understand the bijective mapping between individuals and environment.

References

1. Arthur, W. B. (1994). Inductive reasoning and bounded rationality. The American economic review, 84(2), 406-411.

2. Bargigli, L., Tedeschi, G., (2013). Major trends in Agent-Based Economics: Editorial. Journal of Economic interaction and coordination 8 (2), 211-217.

3. Bargigli, L., Tedeschi, G., (2014). Interaction in agent-based economics: A survey on the network approach. Physica A 399, 1-15.

4. Brock, W., & Hommes, C. (1997). A Rational Route to Randomness. Econometrica, 65(5), 1059-1095. doi:10.2307/2171879.

5. Catullo, E., Palestrini, A., Gallegati, M., (2015). Towards a credit network based early warning indicator for crisis. Journal of Economic Behavior & Organization, 50, 78-97.

6. Clark, A. (1997). Economic Reason: The Interplay of Individual Learning and External Structure. in The Frontiers of the New Institutional Economics, Academic Press, Chapter XII (pp. 269-290).

7. Delli Gatti, D., Desiderio, S., Gaffeo, E., Cirillo, P., Gallegati, M. (2011). Macroeconomics from the Bottom-up. Ed. New Economic Windows, Springer.

8. Delli Gatti, D., Gallegati, M., Greenwald, B-C., Russo, A., Stiglitz, J-E., (2012). Mobility constraints, productivity trends, and extended crises, Journal of Economic Behavior & Organization, 83 (3), 375-393.

9. Gossner O, Hernandez P, Neyman A (2003) Online matching pennies. Discussion Paper 316, The Hebrew University of Jerusalem.

10. Gossner O, Hernandez P, Neyman A (2006) Optimal use of communication resources. Econometrica, 74(6): 1603-1636.

11. Keynes, J.M., (1936). The General Theory of Employment, Interest and Money. Macmillan, London.

12. Kirman, A., (2010). Complex Economics. Individual and Collective Rationality. Ed Routledge. ISBN 9781136941689.

13. Nash JF (1950) The Bargaining Problem. Econometrica 18(2):155-162.

14. Shoham, Y., Powers, R., Grenager, T. (2007). If Multi-Agent Learning is the Answer, What is the Question? Articial Intelligence 171, 365-377.

15. Tesfatsion, L., Judd, K. L. (Eds.). 2006. Handbook of computational economics: agent-based computational economics (Vol. 2). Elsevier

16. Trichet, J.-C., (2001). Preserving financial stability in an increasing globalized world. Keynote speech delivered at the Fifth European Financial Markets Convention.