



RECONSIDERING COMMUNICATION REGARDING ECONOMIC PHENOMENA. SOME HINTS FROM A COMPLEXITY APPROACH

PIERCARLO FRIGERO

Working paper No. 40 - January 2017



Reconsidering communication regarding economic phenomena. Some hints from a complexity approach.

Piercarlo Frigero

Department of Economics, Mathematics and Statistics - University of Turin

Abstract

This paper, inspired by the notion of complexity and the use of network analysis, is presented as a short survey on communication in economics when it is addressed to people who approach the subject neither for study nor for professional purposes. Their perception of the economic system has also been shaped by events interpreted by opinion and political leaders.

Its main contribution is an attempt to avoid current misunderstandings arising from a mechanical notion of the economic system and a consequent excess of confidence in what political economy can do in pursuing welfare. To do this, after a brief review of useful perceptions of phenomena both at system level and at firm level, we will propose some hints arising from complexity and network theory for an alternative viewpoint on political prescriptions and for a better appreciation of the entrepreneurial function.

At the end, we will conclude with some teaching suggestions along with final remarks about understanding economics.

Keywords: Complexity Economics, Economic Education and Teaching of Economics, Political Economy, Theory of the firm.

JEL codes: A20, B59, P47, L20

1. Understanding and communicating economics.

Common people need to understand economics. The adjective *common* refers to people who do not approach economics either for study or professional purposes and have no time to spare in an attempt to become experts. They are people who vote and are politically active. They have a perception of the economic system shaped by events interpreted by opinion and political leaders, communicating through the so-called mass media. Prevailing interpretations are often a follow up of mainstream theories. These theories are popularized and simplified, and have basic ideas or implicit concepts which are suggested and not always directly expressed.

This paper is a reflection on some hints suggested by the complexity approach and useful to avoid the widespread belief that an appropriate goal, contingent on the honesty and competence of both economists and policy makers, could be quite easily reached thanks to an economic policy, steered by some cultural or moral values. This misconception stems from a deterministic view of the economic system, intended as a mechanical device which needs to be repaired when broken.

This essay is not an attempt to carefully discuss how this interpretation is suggested by prevailing theories and paradigms. We, instead, acquire this insight as a point of departure with the purpose of exploring some relevant alternatives.

Section 2 introduces perceptions of an economic reality which have inspired this study. Section 3 contains references to complexity and the refusal of determinism. In section 4, the notion of network is used to present an original perspective to policy prescriptions. Section 5 deals with the theory of the firm with the explicit aim of introducing variety and creativity. Section 6 concludes the paper with some references to prevailing paradigms, teaching suggestions and final remarks about understanding economics.

2. Perceptions of economic phenomena

Knowledge requires some perceptions of a situation to be investigated. These perceptions are essential to define a set of problems to explore. It is, otherwise, merely a description, even as an outcome of a careful collection of data.

The perceptions which have oriented this paper are now to be explained. They are either at system level (contradictions, patterns of dynamics, and catastrophic changes) or at firm level (the nature of entrepreneurial job, imperfect market, and creativity).

2.1 System level.

2.1.1 Contradictions

A first perception, at system level, is the belief that it is useful to go beyond Lionel Robbins' definition, "Economics is a science that studies human behavior as a relationship between limited resources and unlimited wants which have alternative uses", because this statement might suggest that the study of individual choices could be disconnected from social relations. Choices are, instead, interrelated in a network of reciprocal influences which eventually lead to what we call *contradictions*, characterizing every economic system and differentiating it from a deterministic model.

With the word *contradiction*, here we intend the difficulty to recognize all the relevant costs and benefits connected to different states of the system, as well as the impossibility to evaluate them with an objective function necessary for social choice.

However, the problem is not merely a matter of identifying patterns of distribution between social groups and through time, nor is it the discovery of some satisfactory method pertaining to a decision theory. It implies a political issue, i.e. a form of communication aimed at clarifying the limits of efforts which try to take all the subjects involved into account, especially when a consensus to accept present losses in return for uncertain future benefits is needed. An example would be the so-called sacrifices needed to restore the financial balance in public accounts with uneven distribution of burdens, given that some people will not be affected at all or affected at a completely bearable measure.

Therefore, the consciousness of ineluctable contradictions is the first step to recognizing what we call *complexity*.

2.1.2 Patterns of dynamics.

A second perceived characteristic, which determines some difficulties in understanding economic phenomena, is the existence of multiple patterns of temporal dynamics.

Several types of dynamics may be represented through systems of differential equations provided that these mathematical devices, and the connected econometric estimations, will not be intended as the discovery of a hidden reality due to the very nature of the economic system, because it is impossible to recognize *true* parameters and they change over time.

Time series analysis involves the study of borders and discontinuities. It also explains how very small variations in parameters might be the source of considerable changes in system behavior (the presence of bifurcations).

Following this stream of thought, we encounter the catastrophe theory (Woodcock and Davis, 1982) with some useful hints needed to interpret economic phenomena and to classify variables according to their role in a sudden jump of system behavior. The simple example of the so-called cusp catastrophe will do the job.

In this case, there are several types of variables influencing the state of the system. The first type accumulates a potential of change, while another type determines if it happens suddenly or progressively. When interpreting an economic phenomenon we, therefore, need to recognize the forces acting as a potential and the forces which can delay the change and govern its intensity.

In 1973 oil prices rose suddenly after a long period of stability in a very imperfect market, which ended when the world demand increased and it became easy for the OPEC countries to collude. Accelerating demand determined the potential, while the degree of market imperfection delayed adjustment and a set of random circumstances (the war in the Middle East) explained the sudden jump.

The cusp catastrophe also portrays what is called hysteresis, when the reverse path is hindered due to time dependence, and the system will never be the same. In this perspective, what matters is the variety of evolutionary patterns and the attempt to interpret them with a typology of different trajectories.

During these years, for example, it is very interesting to show the reaction patterns in regards to the financial crisis and try to ascribe them to differences in productive structures and institutions, the weaknesses inherited from the past, entrepreneurial dynamism, or constraint arising from the inefficiency of the public administration.

2.1.3 History matters

Featuring a variety of dynamics is not just a mere description of reality. It is, however, a way of stating the relevance of time in economic phenomena, not only as the so-called logical time but as a sequence of events which is the very object of knowledge and political actions and which takes place in historical time.

There are at least three reasons for the statement: *history matters*. The first is related to causal links which explain such sequences, the second results from the persistence and heritage of values, culture and institutions, and the third is the refusal of determinism, intended as predestined outcomes of social dynamics. Quoting Kohn (2004, p. 318), “Growth does not mean movement along an equilibrium path but rather the unfolding of a complex process. At any moment the potential of the economy is not completely realized: unexploited opportunities for mutually advantageous exchange abound. Indeed the potential of the economy is not defined; it depends on the initiative and ingenuity of individuals. Individuals engaging in trading, innovation, and institutional change generate the process of growth, not only discovering potential but also creating it.”

Kohn also quotes Buchanan and Vanberg (1991), “history is an open-ended evolving process, and the future is not predetermined, merely waiting to be revealed, but it is continuously *originated* by the pattern and sequence of human choice”.

2.2 Firm level

A very important part of teaching and communicating economic phenomena concerns the nature of the firm and the characteristics of entrepreneurship.

Firms are considered here as social institutions dedicated to producing goods with the purpose of satisfying people's needs. *Social institution* means an organization which has arisen through an evolutionary process and is accepted because people recognize its function in producing and searching for efficiency while lowering costs and prices.

A presentation of the firm always implies some degree of ambivalence, with both good and bad feeling about it. Good feelings arise from its social function in innovation and labor, resulting in a variety of products and job opportunities. Bad ones are due to the fact that human labor is treated as all other goods when individual competences are not relevant (e.g. unqualified and low level manual jobs).

However, there is yet a more puzzling question. In regards to market competition, there is what Schumpeter called *creative destruction*, with bankruptcies not always being replaced by new entering firms. Continuous change may be viewed as a challenge, being a source of opportunities, but also as a threat. In fact, neither an optimum expected outcome from creative destruction nor a satisfactory one is guaranteed either in the case of a free market economy or in government interventions.

Moreover, there are other remarks to note when the role of the entrepreneur is taken into consideration. According to Baumol's (1990) distinction between productive and unproductive activities (innovation as opposed to rent seeking), it is worth noting that in a decentralized economic system, the owners of the firms, whether they are individuals, shareholders, or even workers as in cooperative ownership, have two goals: to produce in order to satisfy people's needs, and to make money in every way possible. Hirsh (1981) remembered that *possible* may signify that laws are formally respected but substantially violated every time it is convenient to do so.

After these premises, we will ignore negative representations of the management of the firms and will focus only on innovation as the main function carried out by entrepreneurs.

In this respect, no matter the type of ownership, a firm will always attempt to produce what others are not able to do, giving rise to imperfect markets. Moreover, in the presence of increasing returns to scale and being firms able to freely dispose of their produced surplus, industries will evolve towards an oligopolistic structure, as well explained by Robin Marris (1972).

Indeed, free market economy shows a great variety of firms with differences in size and organizational patterns. This all leads to another puzzling question because it may cause both inefficiency and signal areas of backwardness, but it may also constitute proof that a production structure evolves according to a *conscious* process of trial and errors.

Variety is the outcome of changes determined by innovations. However, bounded rationality, which is unevenly distributed, and some type of competitive selection guarantee its persistence (Hoopes et al. 2003), not to mention technical discontinuities, with minimum optimal dimensions differentiated from one role to another along the supply chains.

Having said this, the main perception of the characteristics of a firm remains: the conscious pursuit of innovations, which, in a non-deterministic view, suggests the interesting topic of *creativity*.

3. Suggestions from the complexity theory.

Our starting point was the refusal to conceive the economic system as a mechanical device. This statement might be accepted with different interpretation. Firstly, it may be stated that the economic system is not the outcome of some collectively conceived project (Boero et al. 2015). Secondly, notwithstanding the efforts of planners or simple policy makers, it is impossible to define an ideal system, and recent history has proven that such an attempt might even be dangerous for individual freedom and for the expected status of welfare to be reached.

To avoid misunderstandings, it is not only a matter of managing a bulk of components and their interrelations. In that case, it might be better to define the system as *complicated* in the sense of *involving many different and confusing aspects*, or *tricky* ones, being difficult to understand.

In the attempt to clarify the metaphors, it is eventually possible to reach the paradigm of the so-called *complexity*. Unfortunately, the need for a definition still remains, but it is better to avoid refining and, instead, to sum up the basic characteristics of this vision from the literature available.

3.1 The characteristics of complexity.

As stated by Durlauf and Young (2001)¹, the hallmarks of this theoretical approach “is, first to explicitly model a socioeconomic system as a collection of heterogeneous

¹ Quoted by Kirman (2016) p. 545.

individuals. Second, individuals interact directly as well as through prices generated by markets. Peer groups, social networks, role models, and the like have a prominent place when it comes to determining individual behaviour. Third, individual preferences, beliefs, and opportunities are themselves influenced by the interactions that characterize the system.”

So *Complexity*, for present purposes, is defined by:

- a set of interrelated agents, whose behaviors were useful for the preservation and change of the system they have given rise to without the action of a central coordinating unit, even if nobody could ensure that future dynamics will assure its persistence or determines decay or even disruption;
- the whole is more than the sum of the parts, that is, the sum of agents, acting individually, is not as valuable as the result of their interrelated actions (e.g. managers are useful to the firm because their actions are interrelated);
- changes are not only due to external shocks, but are endogenously determined because decisions made by the agents shape the system continuously;
- some criteria to judge the quality and intensity of changes and recognize the so-called *insurgencies*: new and unexpected states, or patterns of a future trend.

A system with such characteristics is obviously difficult to understand and predict in the future, but the source of difficulties is the interacting agent’s behavior, and not only a matter of assess and computing quantitative relations. Complexity, in other words, asks how individual behavior might *react to* the pattern they create together, and how that pattern would alter itself as a result (Arthur 2013).

Time, in the sense of historical time, is the relevant dimension of this approach, because sequences of changes sometimes lead to *insurgencies* which shape the system in a new and unexpected way.

Here, as a relevant characteristic of complexity, we highlight the existence of unavoidable *contradictions* related to the outcomes. In order to recognize and evaluate them, some criteria for judgments are needed. For example, globalization is perceived as a force involving highly contradictory changes, creative destruction is useful in shaping new and more efficient industries, but consequences are difficult to assess and predict. In both cases, *contradictory*, as proposed in the previous paragraph, means that present cost versus future benefit distributions are difficult to judge, even when the positive balance might be remarkable if perceived through rough estimates.

A remarkable source of interest for the complexity of an economic system lies in an attempt to study the genesis of institutions such as market and firms, trying to find some logical proof of their necessity, because they result from elementary behavior of free evolving agents. In this case, however, a warning may prevent another form of belief in hidden forces to be discovered and eventually recognized as *natural*. If complexity is considered as a departure from a deterministic view of history and society, then, starting from an initial endowment, a system might experience a variety of outcomes.

Cairney (2012) explains how the complexity theory might present some deterministic features. For example, validating some recurrent patterns through agent based models highlights the functioning of a specific system broadly reproduced by the model but not the discovery of a hidden and true reality. The same might also be said of econometric validations. Agent based models might be very useful in that they offer the researcher a tool to explore reality through changing hypothesis about agents' behaviors. Nevertheless, the metaphor of the ants and the anthill is just a device to model complexity; human beings and social institutions are just more *complex* agents, and indeed, the challenges for social sciences resides in dealing with non-deterministic behaviors.

3.2 Organized complexity.

With the aim of expanding this idea, we must call to mind the distinction between disorganized and organized complexity (Weaver 1948), rooted in the distinction between predicting one single agent's behavior (e.g. behavior of a billiard ball played by one of the players) or the outcome of a great number of agents, with unknown and sometimes undefined determinants of choices.

In disorganized complexity, probabilistic behavior and outcomes prevail, as in the example of a multitude of objects interacting. However, the existence of a great middle region separates the task in order to analyze the behavior of one agent at a time (as in methods largely used with case studies by schools of management) from the analysis of average values and moments of distributions of the performances of a high number of agents. In this middle region, there are problems which show the essential features of "organization".

Weaver demonstrated some examples from economics, underlining the fact that, in every case, there is a sizable number of interrelated factors which interrelated into an organic whole, but not in a helter-skelter manner. In all of these instances, the main

feature is the existence of an *organic whole*, and the adjective deserves a broader understanding. This *whole* is the state of the system, shaped by continuous interactions between agents with some degree of consciousness. They have a hierarchy of goals, a final one (at least satisfying, as profits or utility) and a set of intermediate targets, selected according to some rationally bounded procedures.

This feature is quite different from a *swarm*, i.e. a set of agents merely reacting step by step, even if they are able to learn by doing so and to record effects of past actions on very simple and predetermined objectives.

In the notion of complexity we use here, the question is: to what extent does a problem involving conscious behavior of firms, each one with a defined history, differ from exploring the results of interrelation between agents who are represented as anonymous entities? We presume to recognize the consciousness of agents as a matter of fact and not as a subjective value judgment, so the main interest resides in assessing what might be defined as *progress* or an *innovation*, each one intended as an outcome of something like *unexpected creativity*.

3.3 Dealing with determinism.

We will now go back to the program of this paper. If our purpose is to explain economic phenomena without unattainable political expectations, we should dismiss the idea that a social system is like a mechanical device to be repaired when malfunctioning and restored to its original function. This would imply what may be defined as a deterministic² conception of social evolution either intended as sequences of exactly forecasted events and institutional changes, or as projects planned by wise governments with the aim of reaching a detailed state of the social system. The complexity approach gives some hints which lead to the consideration that the history of its evolution is largely unpredictable.

However, it does not imply denying the existence of causal links, recurrent trends, statistical uniformities and constraints to be recognized and interpreted, neither limiting knowledge to recorded correlations and descriptions of events verified during historical time. K. Menger (1983) highlighted the task of social sciences as a search for recurrent causal relations and phenomena occurring repeatedly in the same form.

² Drakopoulos and Torrance (1994, p. 177) present notions of determinism, with this short introductory definition: “In essence, determinism is the doctrine that every event is shaped down to the last detail by a prior set of events and conditions”.

Drakopoulos and Torrance (1994, p. 179), according to the so-called *critical realism*, pointed out “that the ultimate referents of explanation should not be events but rather generative structures”, a notion explained in Graça Moura and Martin (2008) as causal mechanisms that are efficacious independently of the conditions under which their empirical identification occurs. They are said to act *transfactually*, in that they produce effects even if they are not precisely actualized, or, alternatively, to act as *tendencies*.

From the complexity approach, what follows is that an economic system is open (Lewis 2003), meaning that it is always possible to add something new to the existing patterns of knowledge, including new choices and new behaviors, stemming from new technologies and giving rise to institutional changes. This is the source of unpredictability, but its very origin is the freedom of choice, as the basic characteristics of agents, who are indeed always able to refuse expected habits and practices³.

For present purposes, the refusal of an extreme view of determinism is suggested by *variety* as one of the main and amazing features of all outcomes of economic phenomena, particularly all related to the productive structures and their components (firms and firms relations).

Dealing with variety also leads us to disagree with the notion of *equilibrium*, intended as an unavoidable and permanent result of a set of causal links. Arthur (2013, p. 3) argues that “.. the economy is always open to reaction. This isn’t merely because of outside shocks or external influences, but because non equilibrium arises endogenously in the economy. There are two main reasons for this. One is fundamental (or Knightian) uncertainty, the other is technological innovation.” He also presents complexity economics as built “from the proposition that the economy is not necessarily in equilibrium: economic agents (firms, consumers, investors) constantly change their actions and strategies in response to the outcome they mutually create. This further changes the outcome, which requires them to adjust afresh.”

4. Suggestions from network theory.

“In general, complexity studies how such changes play out. Or, to put it another way, complexity studies the propagation of change through interconnected behaviour”

³ “Choice presupposes that the social world is open in the sense that events could have been different”. “The fact that the reality of human choice entails that if a person *chose* to do *x* in situation *y*, then she could also have undertaken some other course of action *z*, gives us a *prima facie* reason to believe that the socio-economic world is quintessentially an *open* system” (Lewis 2003, p. 58).

(Arthur 2013, p. 11). A network is a set of interconnected nodes, and its shape characterizes the functioning, change and evolution of a system, so that network analysis is an attempt to classify and use the characteristics of the networks in order to interpret structure of power (hierarchy of nodes) and propagations of changes.

Two points of view lead to two different type of networks. In the first one, economic agents are linked through input-output or financial relations or partnership in project, such as research or exporting activities or advertising. In the second, phenomena are linked because goals and political issues are linked through causal effects (a financial crisis has real consequences upon production and employment, the choice of welfare institutions has an impact on the labor market), or linked merely through financial constraint (as in choices between competing goals requiring public expenditures).

The financial crisis has recently enhanced the interest in studying networks, starting from the evidence of increasing interdependence and the speed at which information flows in the worldwide network of the economic system. Schweitzer *et al.* (2009) deal with instability and systemic risk and highlight that big disruptions at system level do not need large perturbations to occur. Moreover, most networks of interest exhibit qualitative changes of regimes in their characteristics, with phase transitions, bifurcations, catastrophes, so that network analysis is the relevant complement of the complexity theory.

As we will discuss in the following paragraph, network analysis becomes very interesting for industrial economics when input-output relations are analyzed. Here we quote Acemoglu *et al.* (2012, p. 1981) who, from the point of view of the entire system, demonstrate through formal proof and an application to the network structure of US economy, that, where each sector relies equally on the outputs of all other sectors, the symmetric structure of this economy ensures that independent sectorial shocks average out rapidly, while if intersectorial input-output linkages exhibit no such symmetries, even when the number of sectors is large, shocks from one of them propagate strongly to the rest of the economy, generating significant aggregate fluctuations.

In input-output relations, if a small number of sectors play a disproportionately important role as input suppliers to others, the intersectorial network structure may generate sizable aggregate fluctuations. “Higher variations in the degrees⁴ of different sectors imply lower rates of decay for aggregate volatility”. What matters is not only the

⁴ It is the so called “degree centrality” of a node: the number of its direct links with others.

first order degree of sectors (number of sectors supplied by sector i), but also the second order “where the second-order degree of sector i is defined as the weighted sum of the degrees of sectors that demand inputs from i , with weights given by the input share of i in the production technologies of these sectors”.

However, the main interest lies on the supply chain analysis. A supply chain is intended as a set of links between firms, rooted in supply and use relations, i.e. revealed through flows of intermediate goods, but also conveying information, and even shared values useful for the pursuing of final goals (Tachizawa and Wong 2015). A supply chain is, therefore, a network with “hard” types of ties, e.g. materials and money flows, and “soft” types of ties, e.g. *friendships* and sharing-of-information, diffusion of tacit knowledge. Therefore, the relevance of its role in the context of the whole productive system, as well as the quality of its management, may be analyzed through the same concept, indexes and structural equivalences between networks, as developed in social network studies (Borgatti and Li 2009).

4.1 Firm and industry level

The consciousness of not dealing with automata, but with firms and organizations having a history and endowed with innovative capabilities, leads to the refusal of a deterministic view of the economic system, and suggests new perspectives of research in differentiating the roles of the agents according to their position in the network of interrelations. Therefore, what is now needed are some hints to transform traditional description⁵ of, say, an industry, into a structured analysis of the roles, which also enables us to cope with variety.

Network theory is aimed at recognizing common patterns in different graphs, for example, modern industries are shaped as *modular production networks* (Sturgeon 2002, Sturgeon et al. 2008), with relations between large companies, fighting in an oligopolistic arena, but sharing common suppliers, which, in turn, are sometimes of huge dimensions. Moreover, patterns of recent industry organization no longer show a set of captive relations between large firms and their suppliers, while firms producing component are linked to customers, regardless of their ownership (Frigerio 2015).

⁵ This methodological change emerged in the 1990s to link the concept of the value-added chain directly to the global organization of industries and gained popularity as a way to analyze the international expansion and geographical fragmentation of contemporary supply chains and value creation (Gereffly 1999, Gereffly and Lee 2012, Frigerio 2005 and 2015).

Power along a supply chain is distributed unequally because only few firms take an active role in coordinating the flow of goods and lead the others towards product and process innovations.

Network analysis may help in detecting these potential roles, with concepts and indexes defining and measuring the relevance of any single role in the chain.

Analysis of roles is a methodology to detect and measure: the position of any single firm in respect to the others, some recurrent patterns starting from the elementary ones (line, star, circle), the evidence of close-knit groups (cliques) and eventually, the so-called isomorphism, that is comparing the whole graph, or parts of a single network, with others of the same nature.

A degree centrality distribution (number of direct links of every node), for example, is useful to sort out the role of the *hub*, i.e. relevant firms at the center of a star. The ego net of the firm (the subset of firms directly connected to it) in this case is pictured as spokes connecting the centre of a wheel.

The hub, as an elementary pattern of the graph, may be the starting point to sketch what might be an analysis of roles. Firms directly and exclusively connected to the hub may have a lesser degree of autonomy than the ones also connected between them or to other ego nets. In a *captive network*, big companies (hubs) have an entourage of suppliers, lacking autonomy and completely dependent on their sole customer's orders.

Studying the ego net of a hub leads to a number of interesting interpretations, depending on the shape of the firms linked to one main supplier (or buyer). High density of the ego net (with firms linked with each others) provides the ego with redundant resources and may enhance its market power when exchanging information about prices, while sparse ego nets give rise to *structural holes* (Borgatti and Li 2009), with more independence of the firms connected to the hub, but more benefit for the hub itself because it gains in a variety of suggestions about technology when innovative capabilities matter. In exploring this topic, different notions of centrality are used and measured. *Closeness* is defined as the sum of distances to or from all other nodes, where distance is graph defined, theoretically in terms of the number of links in the shortest path between two nodes. Instead, *eigenvector centrality* mirrors “the idea that a node that is connected to nodes that are themselves well connected should be considered more central than a node that is connected to an equal number of less connected nodes” (Borgatti and Li 2009, p. 15).

Not always easy to interpret and detect are the roles of *brokers* connecting cliques, that is, subsets identified through appropriate algorithms. Brokers are not always relevant firms in terms of degree centrality. Sometimes they are not, but could enhance communication of innovative perspectives because linked with two or more sub-graphs. Network software analysis enables the identification of several types of brokers but, for present purpose, a general concept is sufficient.

Identifying cliques require more than formal definitions. When a subset of firms appear highly linked or constitute a characteristic area of the network, it is very interesting to know why. This might lead, for example, to analyze the productions of complex components with firms performing complementary tasks.

Mathematical methods set up by network analysis are difficult to arrange for industrial economics and the analysis of supply chain. The effort, however, is worthwhile and very intriguing because they have a double utility, i.e., producing classifications to be interpreted and a gain of accuracy because the same criteria may be applied in different situations in order to generalize the obtained results (Bolatto, Frigero, Grimaldi 2015).

4.2 System level: policy prescriptions

When defining nodes as connected issues of political economy and a set of related goals to pursue, complexity arises from the number of interrelations that give rise to some feedback difficult to identify, sometimes unintended or unexpected, and difficult to judge. However, political dynamics exhibit characteristics of complexity also through insurgencies which are sometimes identified as *punctuated equilibria* (Cerna 2013), that is, a process of changing beliefs including values, imaging of society, preferences and interpretations of phenomena which determine periods of rapid change after periods of extreme stability. Public and elite understandings of public policy problems may indeed change over time, because policies have typical images subject to rapid changes, which create or destroy consensus (Baumgartner 1991).

Links in networks can also represent flows of income and their changes as a result of current economic activity or distributional consequences in allocation of benefits and costs when changing institutional rules. In these cases, nodes are social groups classified according to the ownership of a detailed typology of production factors or according to their positions inside or outside the labor market and the sources of capital earnings. Noteworthy are cases of changing welfare institutions, as new rules of taxation or pension fund accumulation are set, or cases of institutional changes,

affecting educational levels or health protection indexes and the probabilities that a member of a social group might be able to reach the desired success in education or in health preserving cares.

In all cases, the attention is focused on expectations about what a government can do and, in this respect, there are different ways of thinking. Some argue that market failure begs for correction and it cannot be corrected through the action of individuals and disequilibria, e.g. a state of persistent unemployment might be avoided through well timed actions. Kohn (2004) derives these alternatives from conflicting paradigms in economics. For the so-called *value paradigm*, the theory is able to define preferred states to be reached as political goals, in an extreme view a Walras-like equilibrium, while for the *exchange paradigm* there is no ideal state of the economy, and intervention cannot, therefore, be taken as an attempt to attain it.

In practice, it is quite difficult to imagine that advocates of government interventions believe in an abstract perfection, including the belief to reach and maintain a supposed state of equilibrium. Therefore, it is better to develop another way of thinking when discussing the sector of political economy, and present a more pragmatic perspective.

A very popular message of network theory is the advice that it is useless and burdensome to try to simultaneously influence an entire system made up of several interconnected parts. In alternative, relevant nodes, defined as the ones highly connected to the others, are needed to be chosen and changed according to selected goals.

What intended here, as a suggestion of network theory, is that, given that the goals are interrelated, it is better to sort out some critical ones, defined as those areas of policy action that, when improved, could enhance welfare at a satisfying speed and quality.

Policy makers are effectively surrounded by an infinite number of 'signals' or information which could be relevant to their decisions from, for example, interest groups, the media or public opinion. Since they are *boundedly rational* and do not have the ability to process all signals, they must simplify their decision-making environment by ignoring most (negative feedback) and promoting few (positive feedback) to the top of their agenda (Cairney 2012).

These strategies are manifestly opposed to the display of a whole set of policy prescriptions in a supposedly exhaustive but also exhausting attempt to picture what an excellent society would be.

5. The theory of the firm

5.1 Entrepreneurship and variety

In this last paragraph we intend to highlight how a firm may be interpreted as a complex object. There is a long tradition of introducing the firm as a system, explaining that the sum of its components (net value of assets and liabilities, functions and coordinated capabilities) results in a whole which is qualitatively different and, therefore, more valuable.

Indeed, a firm is a set of decision units, either in a functional organization or in a multidivisional form, and choices are the outcome of integrating information using different criteria of interpretation, conflicts and negotiations. As a complex object, different points of view are useful to highlight numerous problems that the entrepreneurial function must be able to solve or, at least, for which it will try to find a satisfying solution. A firm can be studied as a production function or a computing procedure aimed at maximizing profit, as an organization structured in conflicting roles, as a bulk of incomplete contracts, incentives, and ownership rights, or even as a set of coordinated competencies.

The entrepreneur appears as a versatile subject, who cannot be substituted by a computer, even if it were programmed to process a huge amount of perfect information. Bounded rationality (Simon, 1955, 1978) should not be intended as something to correct because it represents a defect in a free market system, or to cope with as a source of noises and errors, but rather the main character of the evolutionary dynamic and the basis of the aptitude to take risks in order to gain profits.

However, Colombatto (2011) warns that, from a subjectivist stand-point, the distinction between rational and bounded rational behavior is simply irrelevant and the critical concept is, in fact, consciousness supplemented by the satisfying criterion which drives human action and implies a trial-and-error discovery process. Arthur (2013, p. 4), instead, states, "To the degree that outcomes are unknowable, the decision problems they pose are not well defined. ... There might be intelligent behaviour, there might be sensible behaviour, there might be farsighted behaviour, but rigorously speaking there cannot be deductively rational behaviour".

We are able then to fully enhance the notion of complex dynamic perceiving variety in the context of industrial economics with an attempt to describe and interpret what happens in an imperfect market, the only reality we know, arising from the endeavor to produce what other firms are not able to do.

This is the essence of the entrepreneur's function, as proposed previously by Schumpeter. It is directed to innovate in a proper and valuable sense, provided that there are sufficient capabilities and the appropriate dimension, in other words, a fruitful endowment of resources.

Pursuing that function, entrepreneurs cause variety, since not every firm is able to lead the frontier of technology, and a relevant share, guided by satisfying behavior, is only able to engage in an activity without outstanding technological improvements. In short, when we depart from the maximizing vision of an abstract entrepreneur and accept the challenge of complexity, we obtain some hints to explain the actual features of the economic system with large innovative businesses, newly born firms, fighters for survival and appeased ones, according to some models of competitive selection.

5.2 Creativity

A real firm differs from an abstract actor of a complex system, because it exerts a conscious role of decision maker⁶. We can define an entrepreneur in that way, stressing that he has three main tasks, to coordinate the internal system, solve complex problems and innovate in a complex environment, i.e. *exercising creativity*.

It might be worthwhile explaining the desire to explore the notion of *creativity*, and not settle with some other usual references to innovations.

In a real complex economic system, agents are not automata without consciousness. They choose goals and try to reach them, even without maximizing results. Of course, consciousness is also imperfect because information is incomplete and suitability of means to goals is largely unknown. It is also useless to try to evaluate it or discuss to what extent an entrepreneur and a manager are really conscious of what they are doing, as trying to assess human freedom is just a waste of time. Entrepreneurs and managers sometimes perceive the need to change and try to innovate products and technologies. They are able to do so because the economic environment is not completely predictable.

⁶ “...what is really unique about humankind is not the fact that we pursue our self interest under conditions of competition. This applies to all species. .. What makes us unique is our capacity to reflect upon, understand, act upon, and significantly reshape the universe that surrounds us. (Evensky 2012, p. 2). “The conception that human beings make choices is certainly widespread. Clearly, choice presupposes that the social world is open in the sense that events could have been different. It presupposes, moreover, that human beings are intentional, that they have some conception of their activity.” (Graça Moura, Martins 2008, p. 205).

Otherwise, the system would be deterministic, and forecasting would be difficult only for limits of information and computing while profits would fade away.

Creativity is the result of the managers' *versatility*, i.e. the ability to choose between a huge set of alternatives in problems perception, possible outcomes and solution paths, without expecting to master the entire decision tree and, instead, simplifying it through their subjectivity, which other managers have in different features.

In conclusion, we propose several steps to go from maximizing behavior of a firm to creativity.

There is the notion of bounded rationality, not as a failure of the brain but as a source of novelty because management, recognizing where it is useless to process all the information needed and relate calculus, devises a project of development, just like a chess player who does not search for the best but chooses a set of new strategies, giving rise to a new game⁷ every time.

Searching consciously for something new is perhaps a proof of creativity and we believe in the creativity of the actors of the economic system, including family, policy makers and union representatives, for the same reason we admire a famous recorded chess game.

6. Conclusion

This paper is an attempt to correct a deterministic representation of the economic system: a bias observed when it is necessary to communicate basic methods of analysis, as in the teaching of economics, or when presenting economic phenomena in popularized approaches, e.g. in communicating programs and goals of actions for political purposes.

How cultural and political perception of the economic system is conditioned by prevailing paradigms and methods used in scientific research is an issue that deserves a careful analysis of the literature, including documents and studies of main institutions and research centers. However, even without an in-depth examination, it is easy to recognize the prevailing need to assume reality as a starting point, avoiding theoretical constructions and modeling which pursue a formal coherence, without being able to explore critical events and dangerous tendencies. Regardless of the recent financial crisis, there is a widespread request addressed to professional economists and social

⁷ The chess game metaphor is freely drawn from Simon (1955).

researchers to tackle the current problems perceived, explaining where and when to advocate institutional and behavioral changes.

This appears as a recurrent topic in recent discussions of paradigms and methods in economics. For present purposes, we recall the distinction quoted above, in paragraph 4.2, proposed by Kohn (2004), and presented by Douglass (2012) in a survey of published works of Nobel Prize winners.

Meir Kohn (2004) argues that two methodologies, the value paradigm and the exchange paradigm, dominate modern economics. He suggests that the neo-classical, equilibrium-focused, *value paradigm* is being replaced by the more successful *exchange paradigm*. In contrast, the exchange paradigm makes no assumptions about the outcome of the process of exchange. Its theory is built, instead, on individual behavior rather than on trading equilibrium.

Kohn, presented this change as a refusal of the so-called *Hicks-Samuelson research program*, which oriented researchers to appreciate models as outcomes of deductive theorizing and to use them to test the relevant statement of the disciplines. However, he also noticed that, “the principal response of mainstream economics [to the failings of the Hicks-Samuelson research program] has been increasingly to turn away from this program in favor of an entirely different one: the application of econometric methods. While econometrics was developed originally to test or to estimate the models devised by theorists, today’s applied econometrics is largely atheoretical” (Kohn 2004, p. 306). The debate may eventually lead to recognizing that formalized models are to be used just as heuristic devices, useful to confirm or refuse links between relevant variables and better if identified through some structured hypothesis of the agents’ behavior.

However, researches are to be rooted in questions and problems or aspects of the socio-economic world, considered to be sufficiently important or interesting or of concern as to warrant sustained and systematic examination (Lawson 2015).

This approach is often identified as *social ontology*, i.e. the systematic study of the nature and basic structure of social reality. Trying to fully understand this label and the effort of the school pursuing that program, some brief comments are worth noting. Firstly, a criterion must be specified when defining problems which deserve concern and research. According to Lawson, the realm of economics may be found in studying all social structures and processes bearing upon the material conditions of well-being.

The noun *ontology* usually refers to a presumed nature of what exists (in this case, hidden in the characteristics of the economic system) but, just to avoid notions of

metaphysics and ambiguities about nature, here we prefer to interpret it *as a set of concepts and categories useful to define the essential characters of the economic domain*⁸. In this sense, we accept Lawson's proposal to approach social reality recognizing it as intrinsically dynamic, highly interconnected and organic, and structured in different levels. If we also identify the fundamental category of *emergence*, we turn back to the perceived characters of the economic system mentioned in the previous paragraph explaining the notion of *complexity*.

In any case, if we examine articles and paper or current economic policy debates, mastering the entire system, both in theoretical constructions and in political programs, appears to be impossible. It may seem better to recognize some relevant trends and evolving phenomena or to prepare for a detailed analysis of specific questions and fields of practical engagement. Very often economics is oriented to assess the results of laws and efficiency of institution, such as in monetary, fiscal, labor and industrial policies. Financial market analysis tries to improve portfolio choices or explore procedures that might improve investment decisions.

6.1 Teaching micro and industrial economics

In teaching economics, the intention of founding macro analysis on microeconomics persists. However, this is sometimes justified only as an exercise to grasp some links between different layers of the system. In this context, there is always the risk of communicating an exaggeratedly abstract image of real phenomena, limiting educational programs to initial training and neglecting to clarify the difference between exploring trends and attractors with a background of implied differential equation systems, and the discovery of some hidden natural tendencies towards a supposed but, actual, ever changing equilibrium.

Still taught with reference to the so-called neoclassical paradigm, microeconomics becomes an introduction to decision theory with the hypothesis of rational behavior defined as the use of maximization procedures. The difference with applied mathematics resides in the fact that the proposed methods of choice should be translated into plain words for an elementary understanding, pretending that consumers and managers, even if unable to maximize an objective function under constraints, will be able to achieve the same results through elementary reasoning. The purpose of teaching will be, in that case, to explain and prove the truth of common behavior. This

⁸ Oxford dictionary.

interpretation is well-known thanks to the analogy of driving a car along a highway or playing billiard (Maclup 1967). Unfortunately, the task of managerial education is not so simple, because the main question remains: according to which empirical procedures do managers solve complex problems like profit maximization in conditions of bounded rationality? The core of managerial economics are not methods used as theoretical approximations in an effort to understand basic principles of choices, but feasible procedures, with a sound understanding of problems and limits of knowledge and information in a context of uncertainty⁹. After all, managerial economics is an applied decision theory, translated into operational prescription for use in real situations.

As regards to industrial economics, this is perhaps the main field to overcome traditional teaching and the so-called structure - conduct and performance paradigm with three main perspectives:

- enlarging the notion of market power, as price over marginal cost, and recognizing the hierarchical structure of the supply chains, with the use of network analysis;
- enhancing the role of the theory of the firms, intended as an investigation on the sources of variety in productive structures and ultimately as an example of complexity;
- redefining the never-ending discussion on industrial policy, selecting well defined goals without expecting to substitute entrepreneurial function with government intervention.

6.2 *Understanding economics*

As stated several times in this essay, there is a recognized need to popularize economics. Understanding the discipline cannot be reduced to persuading people about some scientific laws which limit the satisfaction of needs due to scarce resources, but should help also to enhance the need to change some features of the existing societies.

Instead of attempting to discover some supposed natural laws, it is better to recognize complexity, even if the word *complexity* may appear as an escape route in order to justify inaction, in the same way as mentioning natural laws might appear as a device to give up some worthy desires and any attempts to fulfill political values.

Italian universities, according to the UNESCO educational goals, have explicitly recognized the need to promote the so-called *third role*, organizing open source diffusion of research results, enhancing connections between firms and academic labs,

⁹ A reference is Selda and Velupillai 2011.

and giving rise to activities focused on interacting with the society aimed at dissemination, i.e. public understanding of science (Laredo 2007).

Today economics and other social disciplines directly linked to political engagement are largely involved in cultural reactions to worldwide changes due to globalization. The diffusion of market capitalism, as a unique model of organizing a society, sharpens the need to find new ways of interpreting a critic role of culture and suggests an extended use of the model: *exit-voice and loyalty* (Hirschman 1970 and 1993) in order to understand prevailing attitudes towards politics.

Actually, the *exit choice* has no real alternative (in contrast with the sixties, when programs of true Communism were, after all, a concrete reference). However, the perceived need for radical change and the persistent demand for a *new development model* require new suggestions to become operational.

The other alternative: “voice”, as a program of action inside the existing economic and political institutions to promote changes through an evolutionary process, requires some methods of approach to avoid a useless complacency towards the existing powers.

How can economics, as a social discipline, contribute to knowledge and enhance wisdom and creativity to tackle contradictions arising from technological change, evolving organizations, and new problems at a worldwide level? We have perceived the need to discuss the understanding of the economic system as an attempt to look ahead, and now we would like to summarize the essential conclusions as follows:

- an interpretation of the economic and the social system requires selecting nodes of the network connecting agents and institutions to pursue desired results;
- a method of action based on complexity and network perspectives is a clear alternative to a complete and full-scale, and sometimes boring, program for a society;
- all this implies, in turn, a procedure to select between alternative goals, avoiding the belief that there are states of the system maximizing welfare without conflicts and contradictions;
- economics may not only try to guarantee accountability of policies, but above all, help when contrasting outcomes require a discussion on social and ethical values, and an effort to achieve a consensus through a democratic process of social choice¹⁰.

Turin University.

Piercarlo Frigero

¹⁰ Amartya Sen (2009) identified democratic institutions and the arena of free and careful debate about people’s needs as a pragmatic solution to the unsolvable problem of an objective notion of justice.

References

Acemoglu D., Carvalho V.M., Asuman Ozdaglar A., Tahbaz-Salehi A., 2016, “The network origins of aggregate fluctuations”, *Econometrica*, Vol. 80, No. 5 (September), 1977-2016.

Arthur W.B., 2013, “Complexity economics: a different framework for economic thought”, SFI working paper: 2013-04-012.

Baumgartner, F. and Jones, B. (1991), ‘Agenda dynamics and policy sub-systems’, *Journal of Politics* 53(4): 1044-1074.

Baumol W.J., 1990, “Entrepreneurship: Productive, Unproductive, and Destructive”, *Journal of Political Economy*. 1990. vol. 98. no. 5, 893-921.

Boero, R., Morini, M., Sonnessa, M., Terna, P., 2015, “Agent-based Models of the Economy”, Palgrave, Macmillan.

Bolatto S., Frigero P., Grimaldi S., 2015, “Specializzazione e diversificazione verticale lungo le filiere internazionali dell’aeronautica”, *L’industria* n. 1, 21-73.

Borgatti, S. P., Li, X., 2009, “On social network analysis in a supply chain context”, *Journal of Supply Chain Management*, 45 (2), 5–22.

Buchanan, J. M., Vanberg V.J., 1991, “The market as a creative process”, *Economics and Philosophy*, Vol.7(2), 167-186.

Cairney P., 2012, “Complexity Theory in Political Science and Public Policy”, *Political Studies Review*, Vol 10, 346–358.

Cerna L., 2013, “The Nature of Policy Change and Implementation: A Review of Different Theoretical Approaches”, OECD

Douglas B., 2012, “Economic Methodology and Nobel Laureates: Confirmation of a Methodological Paradigm Shift”, *American Journal of Economics and Sociology*, Vol. 71, No. 5 (November), 1205-1218.

Drakopoulos S.A., Torrance T.S., 1994, “Causality and determinism in economics”, *Scottish Journal of Political Economy*, Vol. 41, No. 2, 176-193.

Durlauf S.N., Young H.P., 2001. “The New Social Economics.” In *Social Dynamics*, edited by Steven N. Durlauf and H. Peyton Young, 1–14. Washington, DC: Brookings Institution Press; Cambridge, MA and London: MIT Press.

Evensky J., 2012, “HES presidential address: what’s wrong with economics?”, *Journal of the History of Economic Thought*, Volume 34, Number 1, March, 2-20.

Frigero P., 2005, “Network analysis of research supply chains and competitiveness”, *Review of economic conditions in Italy* n.1 , 91 – 128.

Frigero P., 2015, “Sistemi d'impresa: necessità dell'analisi delle supply chain”, in: “Zanetti G. Evoluzione della grande impresa e catene globali del valore”, Laterza, Bari.

Gereffi G., 1999, “International trade, and industrial upgrading in the apparel commodity chain”, *Journal of International Economics*, 48, pp. 37-70.

Gereffi, G., & Lee, J. (2012). Why the world suddenly cares about global supply chains. *Journal of Supply Chain Management*, 48 (3), 24–32.

Graça Moura M., Martins N., 2008, “On some criticisms of critical realism in economics”, *Cambridge Journal of Economics*, 32, 203–218.

Hirsch F., 1976, “Social limits to growth”, London ; Henley : Routledge & Kegan.

Hirschman A.O., 1970, “Exit, voice and loyalty: responses to decline in firms, organizations, and states”, Harvard university press, Cambridge, Mass. 1970.

Hirschman A.O., 1993, “Exit, voice, and the fate of the German democratic republic: an essay in conceptual history”, *World Politics*, Vol. 45, No. 2 Jan., 1993, 173-202.

Hoopes D. G., Madsen T., Walker G, 2003, “Why is there a resource-based view? Toward a theory of competitive heterogeneity” , *Strategic Management Journal* 24, pp. 889-902.

Kirman A., 2016, “Complexity and Economic Policy: A Paradigm Shift or a Change in Perspective? A Review Essay on David Colander and Roland Kupers’s *Complexity and the Art of Public Policy*”, *Journal of Economic Literature*, 54(2), 534–572.

Kohn M., 2004, “Value and exchange”, *Cato Journal*, Vol. 24, No. 3, 303-339.

Laredo P., 2007, “Revisiting the Third Mission of Universities: Toward a Renewed Categorization of University Activities?”, *Higher Education Policy*, Volume 20, Issue 4, 441–456.

Lawson T., 2015, “The nature and state of modern economics”, Routledge, New York.

Lewis P.A., 2003, “Recent developments in economic methodology: the rhetorical and ontological turns”, *Foundations of Science* 8, 51–68.

Magee G.B., 2005, “ Rethinking invention: cognition and the economics of technological creativity”, *Journal of Economic Behavior & Organization*, Vol. 57, 29–48.

Marris R., 1972, “Why economics needs a theory of the firm”, *The Economic Journal: the Quarterly Journal of the Royal Economic Society*, Apr 1, 1972, Vol.82(325), p.321-352.

Machlup F., 1967, “Theories of the Firm: Marginalist, Behavioral, Managerial”, *The American Economic Review*, Vol.57(1), pp.1-33.

Menger C., 1883, "Untersuchungen über die Methode der Socialwissenschaften, und der Politische Oekonomie insbesondere", Verlag von Duncker & Humblot, Leipzig.

Schweitzer F., Fagiolo G., Sornette D., Vega-Redondo F., 2009, White D.R., "Economic Networks: What Do We Know and What Do We Need to Know? SFI WORKING PAPER: 09-038.

Selda Y.F., Velupillai, K. V., 2011, "Behavioural economics: classical and modern", ASSRU Department of Economics University of Trento, Discussion Paper Series, 14 October.

Sen A.K., 2009, "The idea of justice", The Belknap press of Harvard university press, Cambridge Mass.

Simon H. A., 1955, "A Behavioral Model of Rational Choice" The Quarterly Journal of Economics, Vol.69(1), pp.99-118.

Simon H. A. 1969. "The Sciences of the Artificial", Cambridge, MA: MIT Press.

Simon H.A., 1978, "Rationality as Process and as Product of Thought", The American Economic Review, Vol. 68, No. 2, pp. 1-16.

Sturgeon T., 2002, "Modular production networks. a new American model of industrial organization.", Industrial and Corporate Change, 11(3), pp. 451–496.

Sturgeon T., Van Biesebroeck J., Gereffi G., 2008, "Value chains, networks and clusters: reframing the global automotive industry", Journal of Economic Geography 8 pp. 297–321.

Tachizawa E. M., Wong C.Y., 2015, "The performance of green supply chain management governance mechanism: a supply network and complexity perspective" Global Supply Networks, Volume 51, Number 3, 19 – 32.

Weaver, W., 1948, "Science and complexity", American Scientist, 1 October, Vol.36(4), pp.536-544.

Woodcock A., Davis M. 1978, "Catastrophe theory", New York , E.P. Dutton.

DEPARTMENT OF ECONOMICS AND STATISTICS
UNIVERSITY OF TORINO
Corso Unione Sovietica 218 bis - 10134 Torino (ITALY)
Web page: <http://esomas.econ.unito.it/>
