

DISCOVERY, CREATIVITY AND COMPLEXITY: AUSTRIAN MARKET PROCESS THEORY AND THE ECONOMY AS A COMPLEX SYSTEM.

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Abstract: Applications of complexity theory to economics promise to take it beyond the mechanistic equilibrium concept common to neoclassical economics. The central purpose of this type of analysis is explaining the establishment of bottom-up emergent orders through out-of-equilibrium processes where evolutionary selection mechanisms are crucial in giving stability to the aggregate structure. The purpose of our work is making sense of complexity theory in terms of Austrian market process theory. That effort is justified by our belief that the Austrians can give a strong theoretical content to complexity as its theory of the market will be shown to be highly compatible with the general determinants of a complex system with evolutionary characteristics. It is specially noted how an internal controversy of the school on the history of economic thought, the debate about equilibrium, was crucial in permitting the evolution of market process theory in the direction of complexity theory through its discussion of entrepreneurship and its implications for the market process.

Key-words: Austrian School, Complexity, Evolutionary, Entrepreneurship, History of Economic Thought.

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Introduction.

What is called market process theory is the central apparatus used by economists associated with the Austrian school of economics as a form of explaining market phenomena such as competition, entrepreneurship and innovation. It is, in a way, one of the characteristics that defines Austrian economics as a heterodox school of thought, separated from and in many ways opposed to the dominant paradigm, orthodox neoclassicism. Some difficulties arise out of this relationship: is Austrian economics substantially different? Are gains from “theoretical” trade open to be acquired by studying its relationship to other programs developing inside the discipline of economics? It’s our aim to showcase that both questions have a positive answer by studying the relationship between the Austrians and the complexity approach as articulated by William Brian Arthur at the Santa Fe Institute. That is explained by focusing on how market process theory can be articulated around the notion of a self-organized complex system.

It will also be shown how complexity theory is closely related to evolutionary theory. As Bak & Chen (1999) have elaborated beforehand, there is convergence between both theories as evolution showcases many properties that make it a process that leads to the emergence of complex systems. In a way, it can be said that the evolutionary perspective in economics naturally led us towards understanding the economy as a complex system. Essential characteristics of this system would be the emergence of intertwined structures in out-of-equilibrium processes that possess endogenous novelty and selection mechanisms that guarantee order and control variation.

A central implication for Austrian market process theory would be that entrepreneurial competition is an evolutionary process that will present characteristics such as disequilibrium, novelty, adaptation, selection and order. In presenting the market process as showcasing these characteristics we are not doing something necessarily new, as many, if not all these “defining” elements were clearly present to a greater or lesser degree in the works of the five economists we are studying: Carl Menger, Ludwig Von Mises, Friedrich Hayek, Israel Kirzner and Ludwig Lachmann. Even beyond that, many authors have previously tried articulating both theories in conjunction, such as Vihanto (1990), Witt (1992), Vaughn (1999), Barbieri (2001, 2013), Koppl (2009) and Rosser (2011, 2015), while others have studied the connection between Austrian economics as represented by Hayek’s thought and the precursors of complexity theory in physics, such as Oliva (2015) and Lewis (2016). The main difference is that in our work we are firstly trying to give those defining elements of market process theory a more complete articulation with Arthur’s complexity theory and evolutionary economics. In second, this paper aims at showcasing how the equilibrium debate was crucial in permitting the theoretical evolution of the Austrian understanding of markets towards complexity. Such effort is important, as it not only promises to make possible a conciliation between different points of view about the nature of the market process (such as in the Lachmann x Kirzner debate) but also is useful in permitting a bridge to be built between the Austrian school and the broader economics profession, as it becomes more closely related to the complexity movement.

I. Complexity and Evolution.

The complexity approach arose out of dissatisfaction with the excessive mechanicism, reductionism and determinism that plagued modern science. As in Prigogine & Stengers (1984, p.177) complexity theory in physics meant a move from deterministic and reversible processes

towards stochastic undetermined processes, with a change of emphasis towards disequilibrium as a fountain of spontaneous self-organization and the notion that the system will present a unique, historical and thus irreversible path along which it evolves (p.169). That change of perspective in the natural sciences is important because, as pointed out by Mirowski (1989), neoclassical economics was greatly influenced by thermodynamic equilibrium systems as developed by nineteenth century physicists. If such a deterministic vision of physics cannot maintain itself, what is to be said about the much softer social sciences? As exposed by Buchanan & Vanberg (1991), what is suggested in complexity theory is a generalized perspective (hence, interdisciplinary) that brings analytical focus to the creativity and open-endedness² inherent to the evolution of disequilibrium systems. Complexity as a scientific stance has as its *leitmotif* that the future is not given, as if it were the unfolding of a carpet, but is instead something created in the unraveling of an evolutionary process (p.168).

In greater detail, it can be said that a complex system is both structured and varied, presenting order and unpredictability, with order being sustained by how individual elements will interact between themselves producing rich and complex patterns (Goldenfeld & Kadanoff, 1999). The aggregate results of heterogeneous ingredients that make part of the system will both interact locally and react to the aggregate result that they together create. Important consequences are that complex systems show the capacity of self-organization, are inherently uncertain and can constantly reorganize out of endogenous shocks, which means that they are also adaptive (Bak & Chen, 1991, p.51-53). If the economy behaves as a complex system, for example, we should not expect it to be found in a stable and “determined” equilibrium state, but instead it would work as a self-organized system with endogenous and unpredictable variation.

That vision of complexity in economics was mainly developed by William Brian Arthur. For him, complexity theory meant for economics the proposition that agents continually adjust their behavior to the patterns that they together create and, by being human and hence different from ions in a spin glass, they also engage in strategy and prediction-making by considering the results and consequences of their own and others purposive behavior (Arthur, 1999, p.108). For the author, that means that the economy as a complex system will present many characteristics such as multiple equilibria, unpredictability, lock-in, inefficiency, path-dependence and asymmetries. The scientific analysis of economic processes becomes a task of studying the evolution of a complex system along historical time, where nonlinear adaptation, variation, selection and emergent self-organization are key features of the economic system. For Buchanan & Vanberg (1991, p.167) that implies a change from determinism towards non-teleological open-ended evolutionary processes. As showcased by Barbieri (2013, p.49), in contrast to neoclassical economics:

The CA [Complexity Approach] in economics [...] models markets as adaptive systems in which over time (not statically), coordination patterns (not necessarily

² The distinction between a close-ended and an open-ended system deserves some elaboration. A close-ended system in physics is one where energy is not transferred from and to the system. In economics, that implies the notions of exhaustion and statics of a Pareto-optimum state where agents maximize submitted to restrictions and no agent can or even would change his position on the system, as any change would imply a loss of utility. An open-ended system in physics is one where energy and matter can be transferred from and to the system, making it variable in its configuration. In economics, that implies on the notions of dynamics and creativity of individual choice that make the market process an undetermined and continuous process in time that is not exhausted in a predetermined point, but instead is constantly moved by endogenous forces in a process of spontaneous self-creation.

equilibria) emerge (it is not assumed) that show continuous adaptation to change (not optimality). These patterns are obtained by decentralized interaction (not coordinated by a Walrasian auctioneer) between heterogeneous agents (not by representative agents), with partial (not perfect) knowledge, the result of a learning process from which unanticipated results or novelty frequently arises. Additionally, agents act according to a set of rules (rather than maximization of known functions).

The meaning of economic phenomena being described as open-ended evolutionary processes lead us towards understanding the fundamental characteristics that an economic theory needs to present for it to be evolutionary. For that we follow the synthetic characterization given by Dosi (1997), where hence we should focus on (1) dynamics first, that being, explanations have to take into account the process of how what is to be explained became what it is; (2) theories need to be explicitly microfounded, that being, they need to be constructed in terms of the agent's purpose and behavior; (3) agents imperfectly understand the reality they inhabit, they present bounded rationality; (4) the imperfect comprehension of reality leads to path-dependent learning, which explains agent heterogeneity; (5) agents are continually able to discover new patterns, be they organizational, technological or behavioral, the system showcases the constant appearance of novelty; (6) the collective interaction among market participants perform as selection mechanisms that control variation; (7) as a result of heterogeneity, novelty and selection aggregate phenomena are understood as the collective outcome of far-from-equilibrium interactions with emergent properties.

As showcased above, both complexity and evolution are intertwined in their descriptions of economic phenomena. Next, we will be able to understand how that relationship was previously conceived in the literature, by focusing on the relationship between complexity, evolution and Austrian economics.

II. How complex are the Austrians?³

In trying to integrate market process theory to complexity a series of questions have to be addressed. As noticed above, what interpretations have been given and the specific approach taken in this work have to be carefully exposed. Specifically, what we need to understand is how the history of economic thought (from now on, HET) was used not only as a doctrinal discipline but also as a tool for theoretical advancement. The history of the discipline becomes not only the stage of controversy that promotes scientific discoveries, but also the source of scientific contributions in the present.

First, we need to understand the sources of the controversy. After “years in the wilderness” (Lachmann, 1986, p.xiii) a series of events helped to bring Austrian economics back as an autonomous research program in modern economic theory. Some internal elements have received attention, such as the pedagogical role played by the publication of books such as Mises's *Human Action* ([1949] 1999) and Rothbard's *Man, Economy and State* ([1963] 2009) contributing to the effort of maintaining alive the ideas inherited from Menger and his disciples in Vienna (Salerno, 2002). External events that also received attention were the growing dissatisfaction with Keynesian macromanagement, persistent stagflation and Hayek's Nobel Prize win in 1974. In conjunction all of these events help explaining how young economists became interested in the Austrian tradition once

³ One would notice that this section's title is also the title of one of Rosser's papers referenced and analyzed below (Rosser, 2010).

again, preventing it from becoming a closed chapter on the HET, as said by Kirzner on his experience as a PhD student⁴.

By occasion of that resurgence of interest the Austrian revival took off with the organization of the South Royalton Conference⁵ in 1974, where its three main names in the second half of the twentieth century were present: Murray Rothbard, Israel M. Kirzner and Ludwig M. Lachmann. That event would lead to the publication of a book (Dolan, 1976) and other conferences along the decade that also led to new books, such as Spadaro (1978) and Rizzo (1979). It is the work that was done by the economists associated with the post-revival movement after South Royalton that pushed Austrian economics in an ever more experimental direction, with consequences being original theoretical developments and a more identifiable and demarcated separation from the neoclassical mainstream of the end of the twentieth century.

That effort at reconstruction and advancement was not, of course, without important controversies. Along the 80's and 90's intra-school debates⁶ happened, such as (1) the dehomogeneization of Mises's and Hayek's work (Salerno, 1993)⁷; (2) the debate about the use of hermeneutics in economic theory (Rothbard, 1989); (3) the controversy about entrepreneurship and equilibrium in the market process. That last debate is the focus of our attention, as it will be argued that the confrontation of ideas elaborated by authors who took part in the controversy that made possible the explicit connection between market process theory and the complexity approach.

At first, Koppl (2009) identifies Austrian economics as being largely compatible with the BRICE approach (that being, (B) bounded rationality, (R) rule-following behavior, (I) institutions, (C) cognition and (E) evolution). Clear connections between Austrian and complexity theory are found in Menger's theory of institutional evolution and Hayek's spontaneous orders leading to complex structures through an evolutionary process. The author also notices genuine Austrian contributions to complexity, such as the limits to economic analysis and the comprehensive methodology (*verstehen*) in the works of Mises giving a "humanistic" content to complexity, instead of its heavily mathematical focus.

Vaughn (1999) explores the Hayekian connection⁸, with compatibility being found in Hayek's focus on (1) the disperse character of the ends aimed by agents in markets; (2) the limits of agent's knowledge to the circumstances of time and place; (3) plan-revision and strategy-making in market interactions; (4) emergent properties resultant of entrepreneurially motivated innovation in market dynamics and (5) constant change submitted to path-dependence. Those elements are simultaneously identified by Rosser (2015), with explicit reference to Kirzner's theory of entrepreneurship and

⁴ For that story, along with a vision of Ludwig von Mises's life and work from the perspective of one of his students, see Kirzner's talk on "Why is Mises Important?" at Hillsdale College, in 2016 (Available on: <https://www.youtube.com/watch?v=z--RXkHkSec&t=8s>).

⁵ An extensive report on the conference, with the title "Austrian economics on the rise" can be found on the Libertarian Forum of October 1974 as written by Richard Ebeling, being republished at: <https://mises.org/library/austrian-economics-rise>

⁶ Even though the current objective of the paper makes it impossible for a comprehensive exploration of the topic, the author wishes to make clear his position that such debates can be unproductive, by making specific differences overly important while a broader and more fruitful area of commonalities is heavily present and cannot be forgotten.

⁷ For a further exploration of the debate, see Andrade III (2018).

⁸ Vaughn also points out how the analytical tools of complexity theory are promising for further refining and improving market process analysis beyond the restrictions of imaginary constructions with no computational techniques.

Lachmann's theory of expectations with elements (3), (4) and (5) identified by Vaughn. Further exploring the Hayekian connection, Rosser (2011) makes explicit reference to how Hayek used the concept of emergence in spontaneous order theorizing and unified the concepts of computational complexity and dynamic complexity in the context of the socialist calculation debate and the theory of the mind. In both cases Hayek made use of the self-reference problem, whereas the central planner would need to know how to predict its own reaction to its own plan and the mind would need to understand itself to explain itself.

Further exploring the theme, Rosser (2010) makes the claim that Austrians that wanted to make the connection with the complexity approach would be limited without taking into account contributions made by Lachmann and Shackle, with their focus on the implications of fundamental uncertainty to the economic system and the constant emergence of surprise and novelty on the market process. For the author, the Austrian insistence on the use of equilibrium constructs would limit the convergence with the out-of-equilibrium focus that is characteristic of complexity analysis. It is at that moment, though, that he makes a point that in our interpretation is mistaken. Rosser identifies the Misesian contribution to market process theory with the "neoclassical" tradition inside Austrian economics due to the use of equilibrium constructs on showcasing market phenomena, such as the difference between profit and interest and how market clearing is achieved. Even though the use of the construct has merely an instrumental value in Mises's work (meaning that it has no relationship to equilibrium states ever being achieved on reality), his contribution is in our perspective essentially dynamic due to its focus on entrepreneurship under conditions of uncertainty in a out-of-equilibrium process of rivalry.

It is on that paper that Rosser identifies, even if implicitly, what is needed for Austrian economics to be adequately identified with complexity theory: its transformation into an out-of-equilibrium analysis of market phenomena. It is our contention that this transformation happened as a consequence of the equilibrium debate between Kirzner and Lachmann. We will further showcase not only how the results of debate opened the market process towards complexity, but also how Misesian economic calculation works as a foundation for an evolutionary and out-of-equilibrium resolution to the problem of equilibrating and disequilibrating tendencies in the market process. In that sense, our focus moves towards past interpretations of the debate in Vaughn (1992, 1999) and Barbieri (2001).

Vaughn identifies the debate as between one side that largely agrees with the general orientation of neoclassical economics due to its focus on convergence to an equilibrium inherent in the data of the system (Kirzner) and the other side seeing the market process as one that does not reach any stable point or single path determined by the underlying variables of the system (Lachmann). That leads the Austrian approach to a dichotomy between either being a supplement to the largely correct but heavily deficient neoclassical paradigm or a radical challenge to prevalent economic orthodoxy. The author identifies herself with Lachmann's approach, as Kirzner's perspective is seen to be limited by its difficult in dealing with destabilizing entrepreneurial action and the relationship between uncertainty and entrepreneurship⁹. Lachmann's perspective, on the other hand, offers a vision of entrepreneurship as centered on the exercise of interpretation of past data of the market and expectation-formation under conditions of uncertainty. Vaughn, however, identifies

⁹ Kirzner's original (1973) contribution focuses on single-period entrepreneurial arbitrage where uncertainty is absent.

limits to Lachmann's perspective, as she observes that the author did not manage to create a general theory of the market process. That is due to what Barbieri (2001, p.79) identifies as being the central problem of the author's contribution: the excessive focus on the theoretical limitations implied by equilibrium analysis in recognizing the autonomy of choice may lead to the unintentional consequence of misunderstanding the connection between individual action and the underlying realities surrounding action. As synthesized by the author:

By emphasizing subjective elements, such as creative but fallible entrepreneurial knowledge, the Austrians were able to depart from the mechanistic model of competition offered by Neoclassical theory, treating the economy as out of equilibrium and showing the importance of diversity of opinions for competition to result in a process of error correction. But with the radical subjectivism and rejection of the notion of equilibrium, the Austrian tradition risked denying any regularity in the markets and thus falling into a kind of historicism (Barbieri, 2013, p.64).

Both Kirzner and Lachmann are seen as unable to, on their own, conceive a general theory of the market process that simultaneously starts from individual action under constraints and takes into account the fact that economizing activity happens under conditions of time and ignorance (Vaughn, 1992, p.271). That leads to both interpreters of the debate proposing an evolutionary reconstruction of market process theory. As Barbieri (2001, p.80) contends, that would permit Austrian analysis to take into account the autonomy of the human mind and the impacts of underlying realities on choice.

What alternatives were offered in that sense? Witt (1992) recognizes a general agreement between Austrian economics and evolutionary theory due to the focus on agents learning and discovery inserting constant novelty on the system, with the subjectivistic focus on individual decision-making leading to a greater understanding of innovative activity. In a similar manner, Vihanto (1990) contends that Austrian economics contributes to solving the problems of coordination (that being, how individuals with imperfect knowledge can rapidly coordinate their actions due to changes in the system) and innovation (the possibility of learning and discovery of new products, resources and institutions).

A further contribution was given by Barbieri (2001, 2013). By reorganizing market process theory in terms of Popper's evolutionary epistemology, the author conceives the market process as one of entrepreneurial conjectures and refutations being made through the competitive process. Due to the imperfect nature of knowledge there are always opportunities for further discoveries and improvements on the economic system, as individual conjectures are tested and thus refuted or confirmed by residual profit and loss obtained by entrepreneurs. That perspective is closely related to complexity theory, as Barbieri (2013, p.65) notices how evolutionary computational models showcase how order can be achieved under the lack of omniscience as long as correction mechanisms are present. Revisiting the equilibrium debate is, thus, a way of showcasing the evolution of market process theory towards complexity. Still, is it justified to reinterpret the debate?

Following Angeli (2012) the study of the HET can be conceived as a way of finding alternatives to prevalent economic thought. Forgotten – and thus rediscovered – theories and debates of the past can serve as the basis for scientific advancement in the present, as emphasized by Rothbard (1995). That is further explained by Angeli's (2012, p.62-64) conception of the study of the HET as a Kirznerian discovery process where past authors and controversies allow for the exploration of unperceived opportunities for “theoretical gains from trade” due to the larger

profession's involuntary ignorance of past contributions. As Boulding (1971) pointed out, past contributions can make part of the discipline's extended present due to the role they are able to play in allowing for the solution of present-day theoretical conundrums. By revisiting the history of the discipline, we hope not only to showcase how market process theory became identifiable with complexity theory, but also to further deepen that connection by analyzing Mises's contribution¹⁰ to the theory of the market process by explaining how economic calculation permits entrepreneurial rivalry to lead to order under disequilibrium.

III. Composing complex patterns.

Following our previous discussion, it is now time to understand how there is a methodological foundation for the understanding of complex phenomena on the part of Austrian economists. That is explained by how a methodological choice on what type of analysis is to be carried out influences the positive answers that are given to the questions asked by the researcher. If neoclassical formalism was found to be incapable of correctly understanding evolutionary processes that lead to the emergence of organized complexity, why did the Austrians manage to do just that? The answer is to be found both on the problem-situation faced by the agents that inhabit our imaginary constructions but also on the type of explanation that was chosen as the most appropriate for correctly understanding social phenomena.

First, we need to understand the foundation for the Austrian method: Menger's compositive or causal-genetic explanation of social phenomena. In reaction to the dominant German Historical School of his time, Menger challenged the proposition that no behavioral constants are available to serve as the foundation for a general theoretical explanation of historical institutions. Menger turned the historicist challenge on its head, and instead offered a different proposition: the only possible way of understanding aggregate social phenomena is understanding how institutions are composed from the individual economizing behavior of individual agents. The basic procedure is one of analyzing the valuation relationship established between an individual's ends and his available means for the attainment of said ends. Menger's archetypal example was his theory of the emergence of money, where out of the economizing behavior of individuals who only have their own preference-satisfaction in mind a social institution that greatly increases social welfare emerges even if that was not the planned outcome. This type of theoretical explanation not only approximates Menger from "invisible-hand explanations" but also to the complexity approach.

In complexity theory, preference is given to theories that respect and emphasize the emergent nature of the phenomena to be explained. The local exchanges between individual agents in markets lead to complex structures generally shared by all individuals, such as institutions. As in Menger, complexity theorists aim at answering: "How can it be that institutions which serve the common welfare and are extremely significant for its development come into being without a common will directed toward establishing them?" (Menger, 1886, p.146). The answer for that question is to be found in theoretically explaining "the origin and change of 'organically' created social structures"

¹⁰ It is not under the scope of this paper to further discuss objections raised against Mises, such as the accusation of his apriorism being incompatible with evolutionary theory. Those objections can be seen as an excessive focus on issues of "Euclideanism" on the part of Mises that ignores how the meaningful nature of social phenomena and the pervasiveness of understanding play a crucial role in the works of Mises. For more, see Lavoie (1986), Ebeling ([1994] 2018) and Boettke & Leeson (2006).

(ibid, p.147). The organic, or spontaneous nature of phenomena is also emphasized by Arthur (2021) who shares the perspective that the economy is not given but instead is constantly developing due to the actions, strategies and beliefs held by agents.

As correctly emphasized by Jaffé (1976, p.521) the Mengerian perspective also gets us far away from the neoclassical perspective. Instead of focusing on utility-maximizing equilibrium states, the focus on realism and subjectivism also entails the possibility of error and learning in a continuous process.¹¹ If for the other economists of the marginalist revolution the focus of a term such as “marginal utility” was on the marginal (as in calculus), for Menger, it would be the utility (Caldwell, 2004, p.30). We move from infinitesimal steps to discrete steps, and thus acknowledge the temporal and irreversible nature of singular individual choices. We also analyze how individual choices are capable of composing complex patterns that showcase what Hayek would later call “organized complexity”. It is towards that framing of social phenomena as examples of organized complexity that we move next.

Hayek’s discussion of complexity (Hayek, 1955, 1967) is one where he is trying to both understand the nature of complex phenomena and the appropriate way of studying such phenomena. It is by correctly framing how theoretical analysis of complex phenomena should be carried out that we can understand the congenitally Austrian point of view that when faced with phenomena that are hardly capable of being formalized and empirically tested, we should prefer explanations that increase our degree of intelligibility of said phenomena instead of its predictability. Since the foundation of science is, for Hayek, the recognition of patterns in nature and society, we should aim at discovering causal relationships that explain the aggregate patterns we perceive in our investigations.

In this context, a phenomenon is considered complex when the minimum number of elements of which the instance of a pattern has to exhibit in order for it to have all the attributes of said class of patterns is too high (Hayek, 1967, p.4). Studying these kinds of phenomena throws light into how the structural relationships between its constituent elements are crucial, as new patterns emerge as the number of elements increase and general characteristics will be seen independently of individual values obtained for particular elements (ibid, p.4-5). In contrast with simple phenomena, investigating complexity carries with itself the fact that (1) the aggregate result of the interaction between its constituent elements is more than a sum of its parts; (2) the overall outcomes of said interactions showcase self-organizing properties and structure-maintaining mechanisms; (3) the structural relationship between said constituent elements is crucial for understanding the aggregate result. Important implications are that the difficulties in explaining the constituent variables due to their computational complexity makes explanations differ from predictions, and hence, the future of the system itself is unpredictable and dependent on the patterns created by local interactions.

Still, our incapacity at completely describing the variables that are part of a complex phenomena cannot be seen as admitting that we are incapable of studying them. Perceiving the pattern’s existence is also recognizing the possibility of studying it even if the symmetry between a prediction and an explanation is lost. We can gain knowledge of complex phenomena by making pattern predictions and, as a consequence, giving explanations of the principle about the general facts

¹¹ Take into account how Menger’s theory of social evolution entailed the ever-greater knowledge about how to best satisfy means-ends relationships. For more, see Beck & Witt (2015).

surrounding the occurrence of an observed fact. For Hayek, the evolutionary process in biology is an example of pattern predictions where we “test” if the particular combination of assumptions in our theory is appropriate to arrange observed facts in a meaningful order (Hayek, 1955, p.203-4). Even though the specific modifications of a species in time may be impossible to predict, the general pattern studied can exclude many concurrent explanations of how species evolve and, as a consequence, our theory gains explanatory power (Hayek, 1967, p.8).

For economic theory that means recognizing, just as Arthur (1999, p.108) and Hayek (*ibid*, p.8) did, that the economy’s complex nature impedes planning its future. Limits are imposed on how much economic theory can explain the emergence of social phenomena: we can understand the process of formation of certain structures under certain conditions in a general level, but not its specific details. In a sense of economic efficiency, for Hayek, even though the specific circumstances of where the system maximizes its results is unknown or undescribed, understanding how the system obeys a certain pattern of causal relationships allows understanding the conditions for how it conceivably achieves said efficiency criteria. Following Weaver’s (1948) typification, by investigating the emergence of order in the system we are studying how it achieves what Hayek would call “organized complexity”.

In general, it can be said that (1) Menger’s compositive method directs the researcher’s efforts towards studying emergent processes that are characteristic of complex systems; (2) valuing the subjective nature of choice and the problem-situation of the agents valuation process leads us towards recognizing the existence of path-dependence, heterogeneity, learning and error-correction; (3) Hayek elaborates on how the emergent nature of phenomena leads to the analysis of the structural relationships that constitute the system and recognition of their unpredictable nature; (4) recognizing the system’s complex nature does not mean giving up its scientific study, as pattern relationships are formed due to the interactions of its constituent elements.

IV. To Equilibrium and Beyond.

Moving from equilibrium analysis towards complexity was, in great part, a consequence of how Austrian analysis changed towards market process theory after the socialist calculation debate¹². Until the clash with the market socialists, Austrians did not recognize themselves as a heterodox group that rejected many central postulates of neoclassicism. As put by Mises ([1933] 2003, p.228) no essential differences could be noticed between what he would call “modern subjectivist economics”, that being, the schools of economics that resulted from the marginal revolution. Even if there were the Anglo-American, Lausanne and Vienna schools of economics, no differences other than modes of exposition (graphs, systems of equations and verbal logic) of a very broad common-sense point of view about economic analysis supposedly existed.

That general agreement would not last. After the socialist calculation debate Austrians were forced to realize how they differed from their neoclassical peers not only in *how* they exposed economic theory but also on *what type of theory* would be considered adequate, as noted by Kirzner (1988). If market process analysis moved towards complexity, neoclassicism headed in the opposite direction, ever more centered around equilibrium analysis. As Hahn (1984, p.43) would have it,

¹² Comprehensive histories of the debate can be found in Lavoie ([1985] 2015) and, from an evolutionary-austrian perspective, in Barbieri (2004).

thinking about economics is thinking about equilibrium not only as a central organizing concept, but also as something that establishes the limits of economic analysis. The outcome is that equilibrium theory is a mechanism that defines the scope of what is scientific in economics and the study of disequilibrium is a logical impossibility.

The basic reference for what is equilibrium theory is the perfectly competitive model, not only because other elaborations, such as monopolistic, imperfect and oligopolistic competition have that model as their background but also because that is what the market socialists used as their basic reference in their feud against the Austrians in the socialist calculation debate. The perfectly competitive model requires a series of states to be present for its efficiency properties to be visualized: If there is (1) perfect information; (2) a (infinitely) great number of buyers and sellers and (3) perfect resource mobility, the logic of the model determines that (4) agents treat prices as given (and are infinitely small, which means they cannot exert market power and influence the vectors of price and quantity) and (5) prices are exactly equal to marginal costs ($P = MC$). If these requirements are fulfilled, optimality conditions result in the form of the first and second welfare theorems (respectively, an economy in general-equilibrium is Pareto-efficient and regardless of how resource endowments are distributed the decentralized price mechanism will result in a Pareto-efficient equilibrium).

In the socialist calculation debate, Oskar Lange appropriated the model and reconstructed it with the objective of showing how a socialist economy, with no private resource ownership, would be capable of achieving the same efficiency properties of a perfectly competitive market economy. All it would take is for the central planning board to direct production by state-owned firms by postulating two simple rules: (1) produce in a way that minimizes average costs; (2) establish marginal-cost pricing. If firms obeyed these rules, all the central planning board would have to do is, through a process of trial and error, observe excess-demand or excess-supply in specific markets and correct prices charged or quantities produced until the equilibrium price-quantity vectors are reached. Such an exercise not only supposedly proved that a centrally planned economy was possible but also that it would be arguably preferable to the decentralized market process with its misallocations of resources, monopolies, profit and loss, etc.

Mises and Hayek strongly disagreed with the model's findings. They would emphasize what is not taken into account when doing equilibrium analysis and how explaining the requirements for an equilibrium state to be reached is not explaining the process by which equilibrium is ever attained. Because the Misesian argument against socialism was one of dynamic adaptation to a complex problem-situation (choosing the most economical production possibility in face of the multiplicity of possible production methods in a scenario where production decisions have to adapt to changing preferences, resource availabilities and technological conditions) the market socialist answer was, effectively, a non-answer.

The equilibrium model does not restrict itself to the case of the perfectly competitive model. As exposed by Arthur (2021) there are other variations in the form of classical game theory (which strategies or movements of a player are consistent with another's) and rational expectations theory (which prediction methods agents should utilize to, on average, have their predictions statistically verified in the system's data). The general vision remains nonetheless the same: a deterministic

perspective about economic events where the outcomes of interactions between agents are tautological exercises that lead to a final state already contained in the model's premises.

A possible objection would be that questioning a model's ability in representing reality is a useless exercise because science will always require some type of abstraction and simplification. That, of course, is permissible. What is questioned is how valid it would be to transfer the model's simplicity to the complex reality it supposedly should illuminate, being even used as a ruler to judge reality by how closely it approximates the efficiency properties showcased in the model. If the image that the model portrays of phenomena is excessively simplified or distorted, and thus insufficient in increasing our intelligibility of what is being studied, we should arguably try going beyond such a perspective towards alternatives that offer an expansion of our explanatory capacity. We follow Boettke when he summarizes that:

(...) it was forgotten that market institutions and practices arise in large part precisely because of deviations from the perfect-market model. Just as the friction between the soles of our shoes and the sidewalk enables us to walk, the imperfections of the real world give rise to the essential institutions and practices that make economic life possible. The complexity of both institutions and individuals is impossible to model precisely, so it was pushed aside by simplifying assumptions (Boettke, [1997] 2013, p.275).

Our point of view is closely associated with Arthur's (2021, p.137) critique of the model, where he states that the central deficiency of it is how it severely limits the analyst's point of view. Arthur comments that equilibrium analysis, by definition, does not permit the creation of new products, arrangements, institutions and strategies. In essence, novelty is expelled from the system and the historically irreversible (and thus, path-dependent) evolutionary process is not permitted by the model's restrictive assumptions. That critique points the way towards where our efforts should be aimed at: appreciating and investigating how the real world's imperfections lead to the emergence of a series of behaviors, characters and institutions that bring order to real-world economies. Disequilibrium should not imply chaos, but instead it would illuminate the spontaneous self-organizing properties of the complex system that modern economies are in a way that showcases how what is an inefficiency in the static model is an adaptive virtue to a changing reality. That which in static analysis is an unchangeable inefficiency could be, on the contrary, an opportunity for entrepreneurial creativity to step-in and correct said inefficiency.

Different contrasting examples can be given on how equilibrium theory fails in taking care of what is important in a dynamic reality.

Choice theory: Following Kirzner (2018, p.127-29) the postulate of "Robbinsian " maximization reduces the individual to an automaton that maximizes previously known means (his budget constraint and goods basket) to given ends (his utility function). The Misesian notion of human action as purposeful behavior is excluded from this type of analysis as no deliberate effort towards improving one's state of affairs is present. Such a postulate on choice theory limits the reach of economic theory, as assuming that all information is known and given to all implies perfect knowledge, which by itself implies the absence of change (as change is, in effect, change in means-ends relationships, in an actor's valuation). Without the Misesian notion of purpose we are also incapable of explaining how a process of mutual learning and knowledge acquisition ever

happens in the competitive market process. If decisions converge, we have an equilibrium state, if they do not, we have disequilibrium.

If the Misesian notion of purposeful action is adopted, in contrast, we are able to postulate how adaptation to disequilibrium happens since agents not only are capable of maximizing to a given means-ends relationship but also have the capacity of changing and discovering such relationships by reacting to differences in expected and realized outcomes in the competitive market process. Following Lachmann (1978), choice is not only undetermined (involving an act of interpretation of past events) but also creative (because the interpretation of the past involves forming conjectural expectations about the uncertain future).

Knowledge and Information: The neoclassical notion of knowledge implies that it is, in a certain way, previously known as information. All relevant information in the system is liable to be formally articulated and hence capable of being transmitted and exchanged in markets. The decision of knowing or not knowing an existing piece of information is a question of balancing the expected marginal benefits and costs of an additional unit of information obtained through outright purchase or search. In such a framework, the system is capable of achieving a state of optimal ignorance.

From the point of view of Austrian subjectivism, that framing is severely flawed. Individual knowledge is different from information, being frequently tacit and incapable of being formally articulated. It is practical and contextually relevant to conditions of time and place. Instead of the economically-relevant knowledge being possibly transmitted, transacted and found, it will also have an essentially non-exchangeable, non-articulated element. An agent's knowledge will hence be fallible. He will not be able to acquire other agent's private and tacit knowledge, and he will as a consequence engage in an act of understanding when trying to make predictions about other people's choices.

Time and Change: Following O'Driscoll and Rizzo (1996), it is observed how doing equilibrium theory necessitates logical simultaneity between choices and prices in a way that collapses the future into the present.¹³ The concept of Newtonian time is what allows it by turning time into a spatial variable represented either by segments (discrete time) or points (continuous time) in a single line. As a consequence, time is conceived as (1) homogeneous (the passage of time does not imply change); (2) mathematically continuous (it is possible to separate time into points independent of one another)¹⁴; (3) causal inertia (the system's initial configuration determines all possible sources of change, time is *not* a cause).

In opposition, market process theory follows the Bergsonian notion of real, subjective time. Contrasting Newtonian time, there is (1) dynamic continuity (past experiences lead to expectation-formation); (2) heterogeneity (the continuous experience of reality and its effect on memory turns the passage of time a source of change in the system); (3) causal efficacy (time brings

¹³ As in O'Driscoll and Rizzo (1996, p.105) all decisions are taken in a singular primordial instant whereas the future is the unrolling of a tapestry that exists in the present, in such a way that the Newtonian present and future that the model represents exist simultaneously, much in the same way as how points in a line coexist (ibid, p.108).

¹⁴ An important implication of this point for the authors is the fact that all adjustments in the system have to be infinitely fast and, as such, instantaneous (which brings into doubt why any adjustment is ever necessary?). Any change in the system has to be exogenous, in such a way that the system does not exhibit the capacity of endogenously creating change since all possible adjustments are realized in a primordial instant.

endogenous novelty into the system due to its effect on knowledge acquired and possessed by agents).

Risk, Uncertainty and Entrepreneurship: Following Knight's (1921) definition neoclassical economics deals with situations of risk, or class probability in Mises's ([1949] 1998, p.107-110) definition. In such a scenario, the singular result of any event is unknown but the set of possible outcomes of the class of which that event is a part of is known, with its respective probabilities thus known and defined. An important implication is that, following the postulate of perfect knowledge, even if there is risk the probability distribution of future events is known and agents' actions converge. The same set of information about probable events is shared by all agents and the final decision is a tautology, a result of the informational premise: the probability distribution.

Austrians, in contrast, follow the concept of uncertainty or case probability (Mises [1949] 1998, p.110-113). The set of possible future events and their probability distributions are unknown and there is no formal decision rule that agents necessarily have to follow. In these situations (Hoppe, 2007), where the complete account of individual members and their diverse attributes is not present, no numerical statement of probability is possible (and if it is asserted, it is arbitrary). Events that are submitted in the category of case probability are unique and hence, incapable of being defined as parts of a class.

It is also valid to emphasize the relationship between entrepreneurship and uncertainty: only in situations where there is uncertainty the future is unknown and there is a possibility for the manifestation of entrepreneurship. In situations of case probability, or uncertainty, lies the opportunity for the act of imagining future means-ends relationships that will not necessarily be verified. Following Mises ([1949] 1998, p.582) "the real entrepreneur is a speculator, a man eager to utilize his opinion about the future structure of the market for business operations promising profits". In situations of uncertainty entrepreneurs will have to engage in acts of understanding or judgment, making their decisions based on conjectures about the future formed in an act of interpretation of the past. It is in situations of uncertainty that lies the possibility that, by buying factors of production in the present, an entrepreneur can achieve economic profit (or loss) in selling consumer-goods in the future.

Competition and Monopoly: When transitioning towards market theory more limits to equilibrium analysis appear. By not taking into account the possibility of learning and the existence of uncertainty in the Knightian sense neoclassical market theory cannot take into account the role exercised by the entrepreneur. There is no space for entrepreneurial profit and there is no knowledge acquisition through trade in markets with dispersed knowledge in the Hayekian sense (1948). As a consequence, there is no form of explaining the emergence of innovation. The unintended consequence of equilibrium analysis is the undue negligence of the entrepreneur. When uncertainty is absent there is no possibility of conjectures being formed about the future and for competitive acts of rivalry to take place. If not for the *ad hoc* insertion of exogenous change into the model, there is no possibility for endogenously generated change. As in Kirzner (2018, p.99):

The model constrained his (the entrepreneur) decision-making (...) He was free neither to strike out imaginatively with a new quality of product, nor to innovate boldly with a new technique of production. The profit maximizing price-quantity configuration was marked out rigidly by the mathematics of the firm's circumstances,

leaving no scope for entrepreneurial competitiveness, drive, and daring. The behavioral and informational assumptions underlying these models assured effortless maximization and virtual omniscience, undisturbed by the harrowing doubts typically inspired by an uncertain world, and immune to the threats posed by aggressive, visionary industrial pioneers.

The negligence of the entrepreneur derives from the fact that in economics the meaning of competition changed from its colloquial use (a process of rivalry) to signify its opposite (the absence of rivalry). The hypotheses surrounding the perfectly competitive model meant the elimination of the notion of a competitive process in favor of the notion of a competitive state, as pointed out by Hayek (1948, p.94). In that sense, a series of acts that in a theory of process are competitive are instead seen as anti-competitive in static analysis.

A quick example can be seen in product variation: in a perfectly competitive model such an act means the relative monopolization of a producer that aims at exploiting a situation where he can earn monopoly rents by pricing his product above its marginal cost, absorbing consumer surplus and creating a comparatively inefficient state of affairs. In process analysis, an act of product variation can be understood instead as an attempt by entrepreneurs at adapting to changing consumer preferences. Appealing to heterogeneous tastes in an uncertain world, entrepreneurs will engage in product variation to better satisfy their consumers, conjecturing which combinations of goods and services will have the greatest chance at satisfying consumer demand. Instead of being an inefficiency, it is an adaptive virtue of the market to a changing reality.

All in all, considering choice as (1) a creative activity that aims not only at predicting the future but also at creating it through purposeful action and (2) learning as an adaptive exercise in a dynamic world allows for correctly appreciating the role of entrepreneurship as the driving force of the market. As will be seen in the next section, the entrepreneurial function is simultaneously responsible for adapting to the underlying realities of the market economy and for engaging in the creative-destruction that promotes change. As restricted as this description of markets is, it is an exercise at an explanation by principle attempting to “pattern-predict” the dynamics of the entrepreneurial market process.

V. Discovery and/or(?) Creativity in the Market Process.

The question that surrounds this section’s subtitle is closely related to what market process theory is: the study of the disequilibrium dynamics and the nature of entrepreneurship for economic analysis. For Kirzner entrepreneurship is an adaptive mechanism of discovery of the underlying realities surrounding markets, for Lachmann entrepreneurship is an element of disruption, bringing endogenous novelty through innovation like in a process of Schumpeterian creative-destruction. Both perspectives are not necessarily incompatible, as the existence of selection mechanisms in markets allows for the existence of both creative and adaptive activity without chaotic disorder or simple adaptation to change. Markets are both adaptive in a Kirznerian sense and creative in a Lachmannian sense, and the evolutionary interaction between variation and adaptation leads to the attainment of order.

At first, we start with Hayek’s (1937) definition of equilibrium as mutual plan-coordination (in the form of mutual beliefs about the environment and coordinated expectations about each other’s expectations). From that starting point, investigating the entrepreneurial dynamics of the market

economy entailed answering Hayek's challenge: how in an economic system where knowledge is dispersed, and hence, imperfect, could endogenous tendencies for the adjustment of plans towards equilibrium be present if agents' beliefs are not previously coordinated and knowledge is strongly related to circumstances of time and place? In other words, starting from a scenario of disequilibrium could economic theory postulate the existence of endogenous mechanisms that would lead towards equilibrium?

As Kirzner (1997, p.61) put it, our conviction in the market process is a consequence of (a) our critiques of models that postulate every market phenomena as a manifestation of equilibrium and its consequence being (b) methodologically legitimate for us to ask for a market theory that realistically explains how from any initial state of disequilibrium market dynamics would work in the opposite direction. The main proposition underlying such a theory is that a state of disequilibrium is not the source of chaos and disorder and, due to behavioral characteristics possessed by agents, such disequilibria are noticed and consequently corrected.

Kirzner finds in the Misesian concept of purposeful action the foundation for his belief in the adaptive capacity of markets in disequilibrium. The purposeful search for want-satisfaction means that agents possess the characteristic of being alert to possibilities for improving their situations in the environment they inhabit. As a consequence, agents possess an inherent tendency towards discovering opportunities for satisfying their wants and, in a market context, obtaining profit by noticing and correcting the gaps created by disequilibria.

As Kirzner (2018, p.217) explains it, the economic system has its underlying variables (now, UVs) defined by preferences, available resources and technological possibilities and its induced variables (now IVs) defined by prices, production methods and quantities and qualities produced in markets under the impact of the UVs. Going beyond the presupposition of the system being in equilibrium (where $UV = IV$), market process theory aims at showcasing how IVs have some degree of independence from the UVs and how endogenous market forces take the IVs towards equality with UVs. That movement towards that equality is seen as a process of "equilibration".

If we observe the market process as a process of knowledge-acquisition¹⁵ through discovery, equilibration is (a) a systematic process of knowledge-improvement as a consequence of learning more about the UVs of supply and demand and (b) this process of learning is a consequence of entrepreneurial discovery. The entrepreneurial function defined in terms of knowledge-acquisition provides the market process with the characteristic of containing a mechanism for the systematic reduction of agent's mutual ignorance through learning, leading as a consequence to price and quantity vectors being ever-more consistent with the UVs.

A greater understanding of the equilibration process comes from seeing how discrepancies between variables work as a profit-incentive for entrepreneurs. The most basic example (ibid, p.222) is arbitrage: a price-discrepancy of one commodity being sold at two prices in two different markets.

¹⁵ A crucial point emphasized by the author is how that initial state of ignorance is, in fact, genuine ignorance. It is not presupposed, as in the economics of information, that agents suffer from asymmetries of information but *know* that they do. Genuine ignorance is defined as one that agents *don't know that they have* in such a way that its removal happens as a consequence of its *discovery along the market process*.

The discovery of said discrepancy is an opportunity for *pure profit*¹⁶, creating a situation where entrepreneurs will compete for residual profits until price-equality is verified for said commodity in both markets. Every unperceived opportunity is (ibid, p.224-5) (a) a disequilibrium characteristic of markets and (b) an unexploited profit opportunity waiting to be discovered. These profit opportunities are outcomes of: (a) pure arbitrage; (b) intertemporal arbitrage (buying a good in time T1 and selling it at a greater price on T2); (c) a creative act of production, buying factors at a lower price than the price of the final consumer goods sold. If entrepreneurship is a profit-seeking activity that consists in the discovery of discrepancies between variables, the tendency for the equality between IVs and UVs is attested. As Kirzner summarizes:

The market process view focuses on the incentives offered by disequilibrium market conditions for those discoveries that add up to systematic equilibrative tendencies. It sees these incentives as continually attracting the attention of potentially new competitors; it recognizes that the attention of such new competitors must take the form of entrepreneurial perception of exploitable profit opportunities (ibid, p.224).

On a more critical note, even though Kirzner's perspective is virtuous in showing how from discrepancies between variables comes endogenous adaptation, it is difficult to conceive his theory as turning the economic system truly open-ended. Explaining how entrepreneurs will react to disequilibrium is not the same as explaining the origins of disequilibrium (or how it is endogenously generated, even in a *welfare-enhancing* form). For market process theory to go truly beyond equilibrium, entrepreneurship needs to be more than related to equilibration and disequilibrating tendencies will need to be endogenously explained, as Kirzner's account is found wanting when dealing with changes in UVs.

That, of course, is no surprise. Following Kirzner, the entrepreneurial role is strictly an equilibrating role, discovering pre-existent profit opportunities towards the equality between UVs and IVs. As the author would have it (Kirzner, 2018, p.52), if equilibrium is a state of perfectly coordinated knowledge among market participants, the market-process as one of knowledge-acquisition turns entrepreneurship into a systematic equilibrative role. That is, in our perspective, an excessive reduction of the scope of what can be defined as an entrepreneurial role. As pointed out by Klein (2015, p.153) the entrepreneur plays an instrumental role in Kirzner's work, discovering exogenously determined arbitrage opportunities to explain how from disequilibrium comes equilibrium. The market process is continuous only in the sense that as entrepreneurs discover profit opportunities disturbing changes impede equilibrium from being reached. By conceiving entrepreneurs as reacting to change but not creating change we risk, even though unintentionally, returning to the closed system we wanted to get out from.

A second problem can be identified on entrepreneurship being an act of opportunity-discovery. In such a scheme opportunities are exogenously created and entrepreneurs are seen to just have to be alert to objective external pure-profit to emerge. That inserts another problem, as noted by Klein (ibid, p.157): if opportunities are by definition profit opportunities just having to be discovered, how does loss ever happen? If entrepreneurs are discovering objective profit-opportunities there is no way that they will ever achieve loss. At the maximum they will fail at discovering such opportunities.

¹⁶ Pure profit is defined as revenues over and above the production costs of a good (that being, what is earned after wages, rents and interest has been paid to the owners of the factors of production).

That issue, we argue, is not present in conceptions of the market process where entrepreneurship is also explicitly responsible for creating change.

The crucial point is elaborated by High (1986, p.115): the same mental processes responsible for adapting to change after it has occurred are responsible for originating change. Observed changes in cost and revenue curves do not simply happen but are instead outcomes of the same purposeful acts of consumers and producers that want to improve their situation. In the same way that Kirzner is unsatisfied by how the postulate of given means-ends structures neglects their change, we should be unsatisfied on claims that changes in preferences, technology and resource availability are given. That should not mean abandoning the role of equilibration in the market process but recognizing its analytic role instead of it being an empirical claim.

Our effort, then, is one of investigating the disequilibrium dynamics of the market process so it can be truly out-of-equilibrium as in complexity theory. As exposed by Lachmann (1977c), if we reject with Mises the notion of general equilibrium without denying the existence of equilibrating tendencies in and in between markets, we naturally would need to take into account the creative forces of change that impede equilibrium from being reached. Such an effort involves what Boettke et al (1986) conceive as going beyond equilibrium by recognizing how essential characteristics of the market process *depend* on the existence of disequilibrium. The mechanical metaphor of equilibration risks underscoring how dynamic change and the emergence of order happens along the market process. For the authors, that means recognizing the evolutionary and complex nature of market process theory:

It is an evolutionary ordering process. It is a scientific alternative that works without reference to any equilibrium construct. An evolutionary process is open-ended, in that the process does not tend toward any end-state (...) Similarly, the evolutionary process in economics does not refer to an end-state, but instead explains how creativity leads to complexity, while retaining a sufficient degree of coordination to make the complexity beneficial (ibid, p.66).

For Lachmann, the recognition of the dynamic nature of markets entails the progressive application of subjectivism to economic theory. An example is on the previously elaborated notion of subjective time: time and knowledge belong together and as time passes so does an agent's stock of knowledge change (Lachmann, 1977b, p.36)¹⁷. As a consequence, the Kirznerian learning process finds a counteracting force in the form of a changing stock of knowledge and the simultaneous obsolescence of previous knowledge about market conditions.

Another application of subjectivism for Lachmann is recognizing the role of expectations in the market process. Any change on underlying variables is not going to be equally assimilated by every agent and as a consequence heterogeneous expectations are formed. That is not saying that they will be wildly different as they are directed towards points of orientation given by the institutional setting of the market economy. Still, the very possibility of different interpretations of the same phenomena creates plan discoordination and maintains disequilibrium. An example is the incidence of loss for an entrepreneur. We can say that the incurrence of losses means disappointed expectations and the need

¹⁷ "The market is a process of continuous change, not a state of rest. It's also clear that what keeps this process in continuous motion is the occurrence of unexpected change as well as the inconsistency of human plans" (Lachmann, 1977a).

for plan revisions for the future of his business ventures. We can even conjecture types of changes that he will engage with: new products, different qualities, different factors of production, organizational changes, etc. What we *cannot say* is exactly *how* he is going to react until after the fact. His changing business strategy is, in a sense, an insertion of unexpected novelty into the system.

What is essential for Lachmann is rejecting conceptions of the market economy as a closed equilibrium system with inherent tendencies to such a final state (Lachmann, 1977a, p.152). Without divergent expectations we can only claim that the market is a continuous process if we insert random shocks into the system. The alternative is recognizing how action takes place in an uncertain world and that entails the need for interpreting the past and conjecturing about the future. In that conception, expectations take prominence and what agents are adjusting their behavior to is not only observable phenomena but also their interpretations about such phenomena and their expectations about future events (Lachmann, 1986, p.4). Market process theory, by taking account of the forces of change that result from undetermined action will naturally have to deal with entrepreneurial creative-destruction.

Each stage in the market process reflects a continuous process of appraisal of future conditions of underlying and induced variables as agents reformulate their means-ends relationships due to the continuous need for changing their behavior in face of a changing environment. The competitive process consists not only in correcting disequilibria, but also in it being created by disappointed expectations after loss has been incurred as a consequence of entrepreneurial rivalry. Returning to the discussion about what opportunities are, Lachmann's alternative will follow what Alvarez & Barney (2007) identify as the opportunity-creation perspective: instead of being exogenous shocks to an industry or market, they are endogenously created by entrepreneurs exploring new ways of supplying goods and services in the future taking into account past market outcomes¹⁸. Such a perspective is closely related to the evolutionary approach, as entrepreneurs will act and then observe how their competitors and consumers reacted to an adopted strategy or innovation. In the creation point of view, entrepreneurship is defined as the act of exercising one's creative capacity to achieve profit in the uncertain but still imaginable (through an act of understanding) future.

As a consequence, we need to study entrepreneurial innovation. For Lachmann, the creator of an innovation transmits crucial information to his competitors. If he fails, his competitors know what not to do as he is withdrawn from the market. If he succeeds, his temporary monopoly position confers to him pure profits that stimulate competition. His competitors will subsequently erode cost-price discrepancies by creating close substitutes in the direction of equilibrium. That, on the other hand, creates pressures in the opposite direction of equilibrium: the competitive pressure, by eroding profit margins, creates incentives for product differentiation. Such derivative products bring with themselves further pressures in the form of further substitutes. Entrepreneurial innovation is thus

¹⁸ Still, the only feasible way of using the opportunity metaphor is as an *ex post* evaluation of how a past entrepreneurial decision achieved profit in the present, and as such we can say that an opportunity has been created or discovered. Klein (2015, p.155) suggests that references to opportunity-language be suppressed, emphasizing that in a realistic and subjectivist perspective entrepreneurs are *imagining* future states of affairs. As such, entrepreneurial profit and loss are entirely possible as outcomes of present business decisions will only manifest in the future. Meanwhile, the opportunity metaphor may incorrectly lead to an objectivist bias that sees opportunities as given or created and, as a consequence, entrepreneurial failure cannot be satisfactorily explained.

a continuous fountain of endogenous novelty through a process of creation, imitation, differentiation, etc.

For Lachmann (ibid, p.16) that means seeing the market process as consisting of two alternating tendencies: an increase and a reduction in products offered in markets. The innovation of creative entrepreneurs is followed by competition by alert entrepreneurs to that newly created profit opportunity, being thus followed by subsidiary innovations by creative entrepreneurs aiming at further achieving profit. Such a process does not stop as action aiming at creating new products, organizations and methods of production are inherent to the dynamics of the market economy. For the author entrepreneurial innovation, being seen as a process of creating and disseminating knowledge about profit opportunities, means that there is no strictly equilibrating tendency in the market process as competition is by its nature defined by the “clash” of equilibrating and disequilibrating tendencies.

VI. Institutions, Calculation and the Emergence of Order.

We can observe that entrepreneurship is manifest as both a creative and adaptive activity as correcting disequilibria and creating innovation are two activities responsible for generating profit. Still, entrepreneurship does not happen in a vacuum: selection mechanisms are present to make sure that their activity is welfare-enhancing by assuring that profit is gained through satisfying consumer demand, instead of scarce resources being continuously wasted. If such selection mechanisms are not present entrepreneurs will neither be able to recognize profit-opportunities or innovate as any conjectures about the future will be, quite literally, a shot in the dark.

As a rule, entrepreneurs are making present decisions whose outcomes will only manifest in the future. Between now and then entrepreneurs might make choices that are *ex post* seen as mistakes, while a present available business venture will only be considered a mistake *ex ante* if there are mechanisms available for entrepreneurs to conjecture future expected revenues of present investments. Be it an act of innovation or exploiting arbitrage opportunities, entrepreneurs will have to take notice of an institutionally-embedded selection mechanism that provides the needed feedback.

We turn, then, to institutional theory. Following North (1993) institutions act effectively as “rules of the game” where exchange takes place, structuring the incentives surrounding individual choices. As such they end up acting as a mechanism that standardizes social interactions through the informational mechanism delineated in rules. Also in Lachmann (1971, p.49-50) institutions serve as points of orientation that coordinate agent’s heterogeneous plans. Individual plans of different agents take as their cue the common institutional environment where their interactions take place and as such institutions allow for large-scale social cooperation by enabling agents to make largely correct expectations about the acts of each other without the need to amass all the needed knowledge about their own individual plans.

As a consequence, institutions can be summarized as having an epistemic role¹⁹ as they are intersubjective knowledge incorporated in rules that serve as points of orientation to agent’s heterogeneous plans. As agent’s expectations showcase a great potential of being divergent due to the mind’s creative nature, they will on the contrary converge when they are formed taking into account similar interpretations of similar events and, due to the rules established by institutions, lead to

¹⁹ Or, in Boettke’s (2014) definition: epistemic institutionalism, focusing on the role of institutions in disseminating and generating the knowledge needed for social cooperation to take place.

similar actions. By following socially sanctioned behavior system-wide uncertainty is reduced and the possibility of order is verified.

Entrepreneurship is then happening into a specific institutional context. If certain rules of the game are present institutions will influence the interaction between disequilibrating and equilibrating tendencies in a such a way that an agent's creative capacity will lead to positive outcomes (innovation leading to technological improvement and economic development) rather than negative outcomes (leading to ever-greater discoordination²⁰). The epistemic mechanism used for entrepreneurial appraisal of future revenues of present investment is, of course, profit and loss as shown in economic calculation. Its epistemic role is shown on how for any competitive act an entrepreneur has engaged with there will be a monetary counterpart that showcases if such act was compatible with consumer preferences and technological possibilities. Profit and loss work to stimulate both alertness to correcting disequilibria and creative acts of consumer-oriented innovation to take place.

Both elements work as adaptation and variation and lead to markets showcasing typical and unique elements due to their institutional embeddedness. As in O'Driscoll & Rizzo (1996, ch.5) typical elements are taken to be what is assumed constant and repeatable between different interactions while unique elements are interactions dependent on conditions of time and place happening in a typified environment. Institutions are seen to be functional when individual actions are *ex ante* coordinated on their typical elements even if what is unique is not. Beyond that, another function exercised by institutions is working as feedback mechanisms, allowing for the outcomes of unique interactions to be interpreted in a typical way²¹.

In greater detail, economic calculation is specifically needed in complex-problem situations such as production decisions due to the substitute, interchangeable, relatively specific and combinable nature of production goods. As purely technological considerations are not sufficient to decide *how* to produce a certain good (as it's not only deciding the most efficient way of producing the good but also taking into account the relative demand for factors of production in different production processes), its necessary for entrepreneurs to have a cardinal mechanism for the common comparison of different production possibilities. As such, economic calculation arises as the mechanism that allows for economic planning on the part of entrepreneurs²² as the exchange relationships between money and various goods and services established in the market in the past and expected to be established in the future are the mental tools of entrepreneurial decision-making.

²⁰ An example would be the effect of credit expansion on entrepreneurship as in business cycle theory. As interest rates are used as a tool for the appraisal of how profitable future revenues of present business investment is, interference with its coordinating role will lead to intertemporal discoordination and general misallocation of resources in the capital structure as unprofitable investment will *seem to be* profitable.

²¹ The institutional embeddedness of economic calculation is emphasized by Mises: "The system of economic calculation in monetary terms is conditioned by certain social institutions. It can operate only in an institutional setting of the division of labor and private ownership of the means of production in which goods and services of all orders are bought and sold against a generally used medium of exchange, i.e, money" (Mises, [1949] 1998, p.230).

²² The existence of economic calculation is not by any means an assurance that entrepreneurial error will not happen. As in Mises ([1949] 1998, p.215): "It is not the task of economic calculation to expand man's information about future conditions. Its task is to adjust his actions as well as possible to his present opinion concerning want-satisfaction in the future. For this purpose, an acting man needs a method of computation, and computation requires a common denominator to which all items entered are to be referable. The common denominator of economic calculation is money".

As entrepreneurial action takes place in time there is a distance between present investment and future revenues. As such their decisions are taken by appraising the expected difference between present factor prices and future prices for consumer goods produced. The difference between present and future prices showcases the inherently speculative and uncertain nature of entrepreneurship by making it possible for the future prices of a present investment decision to be higher (lower) and for the entrepreneur to incur in profit (loss). The character of success or failure of any entrepreneurial decision becomes meaningful through profit and loss accounting since any act of “discovery” or “creation” is established as right or wrong by revenues lost or acquired.

For Mises ([1949] 1998, p.230) economic calculation then acts as the guiding-star of the market system. The entrepreneur calculates so he can distinguish between profitable and unprofitable production possibilities and chooses the business venture that promises to better satisfy consumer wants. These choices are always made under the scrutiny of cost accounting and revenues acquired by selling (or failing to sell) goods work as a corrective feedback by signaling to entrepreneurs how his expectations of future consumer demand aligned with realized consumer demand.

This monetary calculus of profit and loss is what allows for entrepreneurial action to manifest itself in an out-of-equilibrium system as a corrective and dynamic driving force of the system itself. Instead of being a pure grope in the dark, the comparison between past data and expected future data of the market orients entrepreneurial activity as it turns profit and loss, success and failure, into meaningful concepts by their relationship to consumer-wants and, in a way, ensure adaptiveness to the underlying realities surrounding business activity. Entrepreneurs constantly face the market test, exploring new combinations of factors of production and reallocating them between lines of production on the basis of their expectations about future revenues. In that sense, references to equilibrium are unnecessary to our understanding of market dynamics as the creative and alert nature of entrepreneurial action does not make reference to final equilibrium prices but instead to market prices as established day in and day out in the real markets²³.

In conjunction the interaction between adaptation and variation submitted to the profit and loss selection mechanism allows for markets to possess the characteristic of being a complex order. Following Hayek’s (1972, p.160) definition of order as largely correct expectations about future decisions of other market participants, the market process as an evolutionary process permits relatively coordinated interactions between individuals while stimulating change. The central ordering *locus* of such a system is economic calculation with its informational feedback directing creative innovation and stimulating discovery.

In such a framework entrepreneurial action gains predictability by showcasing patterns which have positive unintentional consequences. Achieving profit is the main objective of the entrepreneur, but to do just that he needs to satisfy consumer wants and he does it by attending to their preferences utilizing scarce resources in the most economically viable manner. Successful entrepreneurs are those

²³ It is also needed to emphasize that the impossibility of final equilibrium prices being achieved *is not* an objection against the possibility of supply meeting demand. As in Mises, final equilibrium prices subsist in the actionless world of the evenly rotating economy. Market-clearing prices, on the other hand, constantly manifest themselves in day-to-day transactions if no barriers to entry and the use of monetary calculation of profit and loss prevails. The efficiency properties of the market are showcased independently of the need to achieve equilibrium states with perfect knowledge, zero transaction costs and perfect future markets as the constant giggling of the market ensures consumer-satisfaction through entrepreneurial initiative.

that efficiently adapted to the restrictions established by (1) the strategies adopted by their competitors; (2) the technologically feasible production possibilities and (3) met unsatisfied consumer demand. These restrictions are translated by economic calculation into selection mechanisms, turning the market into a complex adaptive system driven by entrepreneurs.

Conclusions.

Two things should now be clear. On the one hand, the role that the equilibrium debate played in the history of the Austrian school as a foundation for the connection between that theoretical tradition and the complexity approach. On the other hand, the still neglected dynamic and evolutionary contribution to market process theory developed by Mises due to its focus on uncertainty and economic calculation as a coordination mechanism.

At first, Kirzner's focus on the alertness inherent in entrepreneurial activity allows the appreciation of the capacity that markets have of adapting to unpredictable change, even if imperfect knowledge (and hence, ignorance) prevails. In a similar manner, the creative and imaginative nature of choice in Lachmann and the disruptive role of innovative entrepreneurial activity throws light into how novelty emerges through competitive variation in markets. In conjunction, both contributions provide a disruptive character to Austrian economic thought. As a consequence, many crucial defining characteristics of the complexity approach, such as disequilibrium, the emergence of novelty and constant adaptation to change under uncertainty are essential parts of the Austrian understanding of competition.

In the end, the connection between economic calculation in Mises and the role of selection mechanisms that institutions perform also allows for a reconsideration of the author's contributions. When seen through the lenses of the inherent uncertainty that surrounds entrepreneurial activity – in conjunction as it being an epistemic mechanism of negative and positive feedback to market performance – economic calculation becomes the connection between individual creative initiative and the impersonal market selection mechanism that results from entrepreneurial rivalry. In that perspective, economic calculation is the necessary tool for ordered results of social coordination. Even if there is unpredictable change and disequilibria generated by the creative-destruction of innovative entrepreneurs, Mises manages to substantiate in calculation the needed rationality for social cooperation to be achieved without references having to be made to the attainment of optimal states that are far different from a world where man has to act and thus cope with the forces of time and ignorance.

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