

Schumpeter and the Evolutionary Economics: Three Conceptual Issues

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Abstract

Schumpeter is usually considered as the leading figure of the evolutionary economics, despite his own reservations about applying principles of evolutionary biology into economics. In regard of the relationship between evolutionary economics and Schumpeter's own understanding, three important themes, or conceptual issues, seem to appear. The first question is whether the notion of evolution should be understood as a causal mechanism or merely a metaphor that can shed light on reality. The second question has to do with the appropriate "unit" of evolutionary economic analysis. That is to say, whether the economy itself, or the society/social institutions, or just technology are subject to evolution. The third question is whether the idea of evolution can be used as a "demarcation line" to distinguish among different economic methodologies.

The present paper argues that a proper classification of different strands of evolutionary economics can be made possible by finding appropriate answers to these questions, which are sometimes confused within the evolutionary economics literature. Also, with respect to the importance of Schumpeter's vision in the evolutionary economics, it is argued that the notion of evolution should be seen as a guiding principle to understand the reality as an ensemble of emergent entities and processes, dissipative structures, self-organizational states, punctuated equilibrium conception, uncertainty etc. Such an understanding of evolution as an ontological presupposition would be capable of opening up new possibilities for a pluralistic approach in economics, in conformity to the tradition of Schumpeter's understanding.

Introduction

Since Charles Darwin's *Origin of the Species*, published in 1859, the notion of evolution stands at the center of heated controversies, both in natural and social sciences, economics being no exception. This is quite natural because Darwinism suggests an overall evolutionary approach, a full-blown scientific paradigm, so important that it should not be limited to biology only (Hodgson 2006: 12). Moreover, the influence of the concept of evolution on economics gets further into the agenda as Darwin himself was influenced by Malthus's theory of population, as he mentions it in *The Origin of the Species* (Clark and Juma 1988:198). Since then, there have been different attempts to incorporate evolutionary thinking into economics. However, these attempts can be said to become even more intense in recent years, particularly after Nelson and Winter's celebrated work *An Evolutionary Theory Of Economic Change* (1982). After this book was published; economists such as Dosi (1988), Metcalfe (1991;1992), Witt (1992) and Dopfer (1997) have started showing an interest on economic evolution concept, and have pioneered the development of different approaches on evolution.

Nevertheless, different strands can be distinguished within the evolutionary economics itself, each of which takes the notion of evolution from a different vantage point. At present, it seems that the unifying position of these different "evolutionists" seems to be a growing contempt with the neoclassical economics, especially to its simplifying assumptions, which take inventions, innovations and dissemination of information as external variables. This poses an important theoretical problem since technology and, its indispensable part, innovation cannot be seen as merely external variables. Such downsizing approach by classical and neo-classical economics implies that society can be conceptualized only within the context of exchange. Evolutionary economics, by contrast, grasps the society as a whole, and handles the processes and social relations in a holistic social-theoretic framework (Sherman 2003: 75-83). Evolutionary economics is presented as an alternative to the Neo-classical school which is insufficient in explaining an important phenomenon which affects economies and institutions.

Yet, apart from a dislike towards neoclassical conception of economic reality, one can encounter important differences within different strands of the evolutionary economics, among which the definition of the notion of evolution takes a prominent place. The term "evolution", in its most general sense, used to explain the changes which occur in the course of time. The change process attributed in this concept illustrates a circumstance in which there are no interruptions and where there is a permanent progress. This is a self-developing change which is based on internal factors rather than a change based on external factors. For this reason, evolution is an endogenous theory of change (Dosi and Nelson 1994). Darwinism demonstrates

that progress is not towards a certain target or result, and it focuses on the causal explanation of sequential, step-by-step developments (Hodgson 2006: 22).

Beyond this point, however, important differences seem to emerge. Indeed, historically speaking, the phases that evolutionary economics itself has gone through since its emergence up until today illustrate that evolutionary economics has also undergone through an evolution in itself. Different approaches which came on the scene also reveal the differences in methods and concepts employed within evolutionary economics.

Therefore, the present paper is concerned with these different stages, or different strands, that can be distinguished within the evolutionary economics itself. Having this in mind, the paper takes the three significant problems of evolutionary economics as constituting as its central core, with the belief that the answers given to these problems are useful to identify the similarities and differences among these different approaches.

The paper is structured as follows. First; evolutionary economics will be categorized under three groups in terms of the phases that it went through: traditional evolutionary economics, the Neo-Schumpeterian evolutionary theory and new evolutionary economics. In this connection, with reference to Schumpeter's place in evolutionary economics, three important themes or conceptual issues seem to appear. The first question is whether the notion of evolution should be understood as a causal mechanism or merely a metaphor, or an ontological presupposition that can shed light on reality. The second question has to do with the appropriate "unit" of evolutionary economic analysis. That is to say, whether the economy itself, or the society/social institutions, or just technology is subject to evolution. The third question is whether the idea of evolution can be used as a "demarcation line" to distinguish among different economic methodologies. An effort will be made to find answers to these questions in the paper. To anticipate the conclusion, we can assert that the notion of evolution should be seen as a guiding principle to understand the reality as an ensemble of emergent entities and processes, dissipative structures, self-organizational states, punctuated equilibrium conception, irreversibility, and uncertainty. Such an understanding of evolution as an ontological presupposition, which also has its own epistemological implications, would be capable of opening up new possibilities for a pluralistic approach in economics, in conformity to the tradition of Schumpeter's understanding.

1-“Traditional” Evolutionary Theory

It would be fair to observe that, with the possible exception of Herbert Spencer, the first reflection of Darwin’s Theory of Evolution can be encountered in Marx’s theory of social change, as Engels asserted in Marx’s funeral. Even though Marxian ideas about class struggle and social evolution do not coincide with Darwinian explanations, Marx adopted an evolutionary conception both in his analyses of social change and technological transformation, for he consistently draws on evolutionary metaphors in these writings. In Marx, evolution takes place in social and economic environment, and there is an interaction between technology and environment. He uses biological analogies and states that evolution of technology can be represented by transitions from crude designs to more refined manufacturing systems (Clark and Juma 1988: 202).

In fact, not only Marx, but almost the entire classical school had provided significant contributions to the development of evolution concept, even long before the idea of evolution had become popular. In particular, Adam Smith’s indication that knowledge will spread together with specialization, and his technological innovation concepts, in his immortal discussion of the division of labor, reflect an evolutionary point of view. Adam Smith provided a noteworthy contribution to one of the ideas which holds an utmost importance in evolutionary economics (Hodgson 2007). Another eminent economist who realized the importance of the evolution concept in economics science is, of course, Alfred Marshall, the remarkable representative of neo-classical economics. According to Marshall, ‘Mecca of economics lies in economic biology rather than economic dynamics’. He adopted a conception of Darwinian gradualism, characterized by the dictum that “*natura non facit saltum*”. Marshall maintains that economic evolution is gradual and moves forward, and this move is never a sudden one (Clark and Juma 1988: 204). However, Marshall’s ideas, as far as evolution is concerned, remain closer to those of Herbert Spencer rather than to Darwinian understanding of evolution (Hodgson 2007).

Contrary to Spencer’s views, one can contend, the applicability of Darwinism into the socio-economic field depends on Darwin’s principle of causality, which sets the ontological basis of such an endeavor. Darwinism stands for a causal explanation, and the concept of cause is what is necessary to enable the transfer of material and energy. Divine, miraculous and causeless causes are exceptional. Causal explanations focus on processual algorithms. A key processual algorithm outlined by Darwin was natural selection. Darwinism is consisted of an overall theory which could be applied to all open, complex, and evolving systems (Hodgson 2002; 2004; 2006:22). In other words, the complex results that appear in the Darwinian conception are explained with the step by step accumulation of causal mechanism. The

significance of accumulation in selection is emphasized, and it is indicated that each step in which the nature will not make a leap has to have a causal explanation (Hodgson 2004a). such an understanding of evolution, with the principle of “cumulative causation” at its center, can be found, of course, in Thorstein Veblen’s writings. In that sense, Veblen can be seen as the most remarkable economist who defends the traditional evolutionary approach in a conscious way, and he emphasized the importance of Darwin’s principle of causality. Veblen maintains that a Darwinian evolution concept is necessary to understand especially the evolution of institutions, and economics should follow evolutionary guidelines, as he emphasized in his article ‘why is economics not an evolutionary science’, in which he develops the concept of “cumulative causality” while touching upon the importance and necessity of the principle of causality ‘An evolutionary science...is a close-knit body of theory. It is a theory of a process, of an unfolding sequence...of cumulative causation’ (Veblen 1898a: 373-397). For Veblen, Darwinism ‘cumulative causation’ in which there is no trend, no final term, no goal (Hodgson 2006: 22).

Veblen argues that, under Darwinian causality principle that humans, as agents, are subject of an evolutionary process and therefore, humans could not be perceived as a constant or data (Veblen 1898a). Veblen defines humans as an efficient being in nature, and describes their technical actions as the impulsive force for institutional and social changes. According to Veblen, only evolutionary thought is capable of explaining technological development process in capitalist economy (Hodgson 1994:20).

The issue of causality from a Darwinian point of view is the necessity to explain all results with an interconnected causality process. In social area, selection and conscious behavior are complementary mechanisms. The principle of determination in the sense that “every event has a cause” is an ontological supposition and it is a universal principle of causality (Hodgson 2004). The evolution of human tendencies and the development of such tendencies within each single human being should be explained within the context of natural selection and principle of causality. Each step of natural selection requires a casual explanation. In Darwin’s evolution theory unit of selection is the species and Darwin in his theory of evolution has not expressed that only species evolve but also has drawn attention to the casual mechanisms of evolution (Hodgson 2004a, 2004b).

Veblen, who has developed a socio-economic evolution theory, also states that the dominant factor which affects human behavior is ‘Habits of thought, points of view, mental attitudes and aptitudes’ (Veblen 1973:133). The origins of habits derive from instincts. According to Veblen, human nature is determined by infinite instincts and institutions are determined by human nature. In fact, it is observed that the word “instinct” has a very different

usage in Veblen. Instinct is a habit which has a very strong decisiveness (Sherman 2003).¹ Veblen's concept of thought habits is actually a concept that he makes use of in explaining institutions. In Veblen, the habits will inevitably change once the institutions change. Thus, instincts and human nature change and develop in the process of evolution. Veblen sees institutions together with individuals as an element of unit of selection (Veblen 1973: 135

Veblen points out that there is a similarity between the life of humans in society and the survival struggle of organisms in nature. According to him, the evolution of social structure has to do with natural selection of institutions. Actually, what Veblen wants to express is when compared to the institutions which adapt themselves to changing circumstances and respond to changes, institutions which adapt themselves less to changing circumstances will disappear due to the conditions of struggle for existence (Veblen 1973: 188).

Even though it is partially, Veblen's socio-economic evolution understanding follows a Lamarckian² scheme. Society's sequential generations, habits and institutions are carried over from one generation to another. In Lamarckism, environmental factors which affect the organism and "the inheritance of gained character" which establishes the evolution theory put an emphasis on the cumulative inheritance of evolution (Veblen 1909: 628). He indicates that cultural change is cumulative. By stating that "cultural development is a cumulative permutation of habits", he emphasizes partially Lamarckian side of his own socio-economic evolution. The clues leading to the fact that Veblen's socio-economic evolution is Lamarckian are more eminent in his ideas as far as technology is concerned. Veblen draws attention to "idle curiosity and instinctive propensity", and indicates that instinctive propensities lay the foundation of change and invention. 'Such an instinctive curiosity will break the fundamentals of information based on habits, thus the technological understanding will appear' (Veblen 1914: 87).

Veblen states that economic events will change depending on the nature of the society. The history and future of the society change depending on the environment rather than demonstrating a slow progress towards the ideal. In this context, Veblen's understanding of evolution does not accept the concepts of ideal situation, harmony and equilibrium. Veblen points out that the society will not proceed through the anticipated steps and path. The progress

¹ Of course, one should emphasize that the term "instinct in Veblen, rather than referring to purely biological traits, refer entirely social traits, in the sense that they are part of "human nature," thus making them human beings (Hunt 1992: also Hunt 1979).

² This thought put forward by Lamarck in the early 19th Century has been the first fundamental theory of the evolution theory. According to Lamarck, evolution is a process ; takes place in slow phases, provides the possibility of a brand new species after several generations, and occurs by little phases joining each other within the dimension of time . In Lamarck's approach to evolution, small changes happening in the environment brings up new needs for organisms. The movements and bodies of organisms change due to such needs, and then this change is transmitted to following generations. The main emphasis here is on transmitting, the gained changes while adapting to the environment, to next generations.

of each society will vary. In open words, development will be different for each scenario (Veblen 1909:589). By considering this point, it is possible to mention that an individual could be drifted neither to a hedonistic individualism nor to a socialist individual in Veblen. No matter what the outcome is, the individual proceeds in path dependence. Environmental factors, his evolutionist nature and habits stem from cumulative changes in Lamarckian sense, cultural inheritance and institutional dissemination. In Veblen, the evolution of individual happens in Darwinist evolution whereas evolution of society follows a Lamarckian line on the basis of gained trait inheritance (Sophus A. Reinert 2006).

In his socio-economic evolution theory, Veblen expresses the ideas which handle both Darwinist and Lamarckian evolution as follows (Veblen 1899:188) :

Like other animals, man is an agent that acts in response to stimuli afforded by the environment in which he lives. Like other species, he is a creature of habit and propensity. But in a higher degree than other species, man mentally digests the content of habits under whose guidance he acts, and appreciates the trend of these habits and propensities...by selective necessity. He is endowed with a proclivity for purposeful action...he acts under guidance of propensities which have been imposed upon him by the process of selection to which have been imposed upon him by the process of selection to which he owes his differentiation from other species.

Veblen applied Darwin's natural selection idea to the selection of reflection habits and social institutions as well. Moreover, he refers to the harmonization of habits as growth of institutions (Veblen 1899:213-214).

Classic evolutionary economics and Veblen, the most eminent representative of this approach, have perceived the notion of evolution as a causal mechanism. Veblen has also been the economist who referred the most to Darwinist thoughts in his analysis. However, perceiving evolution as a causal mechanism remained insufficient in explaining economic evolution. The economic evolution theories which were developed subsequently perceived evolution not as a causal mechanism but at metaphor level.

Even though Veblen was almost the first economist who explicitly called for an evolutionary mechanism for economic thought, he seems to forget the fact that just because evolution is a credible form of explanation in biology does not necessarily entail that it would provide credible explanations for social sciences in general and for economics in particular. That is to say, Veblen's own understanding seems to draw upon evolutionary analogies rather

than *causal mechanism*. This is actually a more general problem from a methodological point of view. The presupposition that evolution, a category that applies to biological nature, is also applicable to human behavior and to the development of society may require too big a leap of faith. That is to say, it ignores the discontinuity that exists between nature and society. In general, it would be a mistake to assume uncritically that a causal mechanism in the natural sphere necessarily exists or is operational in another sphere, unless a kind of reductionism, such as that of Spencer, that denies such discontinuity between nature and society is assumed.

One methodological problem in this respect is the extensive use of functionalist explanations in the evolutionary literature in general. Functionalism, to use Giddens' definition, is the 'doctrine which holds, first, that societies or social systems have 'needs' and second, that identifying the ways in which they meet these needs constitutes an explanation of why particular, given social processes are as they are' (Giddens 1981: 16). More generally, Little (1991: 91) defines functionalism as follows: '*Functional explanations* seek to explain a feature of society in terms of the beneficial consequences it has for the larger system.' The real problem with functionalism is that to say that such an institution/practice fulfil some function does not answer the question of why this practice emerges in the first place, unless one is willing to admit that it was designed by some intelligent being; in other words, functionalism cannot offer a causal explanation in the proper sense of the term.³ As different writers (e.g., Little (1991: 93) and Hollis (1994: 97-98) emphasize, functional explanations are quite useful for artificial systems created by deliberate design which seeks to achieve certain ends by the selected characteristics. But when one asserts that the institution in question emerges spontaneously, then such a functional argument loses its strength.

Another methodological problem in this respect is that it could be dangerous to use biological or evolutionary analogies or metaphors as causal mechanisms in the social sphere. As metaphors, those ideas may contribute the clarification of the issue in question. One can, for example, use the evolutionary metaphors to explain the development of social institutions, or of technology. However, unless one states explicitly causal mechanisms behind this development, such a metaphor cannot carry the burden of causality by itself. For example, how can we apply the notion of "natural selection" as a causal mechanism to the development of social institutions. What is actually being "selected" here? Another problem in the human sphere is the existence of intentionality. How can one reconcile the notion of , say, "natural selection" with that of human intentionality or agency, the power of making a difference in the state of affairs? These issues are difficult ones to solve, unless one confines the analysis with evolutionary

³ For a critique of functionalist thought in the social theory, see Giddens (1984, 293-97).

analogies and tries to avoid using them as causal explanations.⁴ In this regard, one can contend that Veblen, and his contemporary followers, seem to try to use these metaphors or analogies as causal mechanisms which cannot be employed for such purposes. Perhaps for this reason, Schumpeter is so critical about applying evolutionary ideas to economics, even if his whole outlook presupposes an evolutionary ontology.

Schumpeter, who can be said to be influenced by the dynamic structure that Marx laid out in his studies, has questioned the static equilibrium conception of the neo-classical school, and has evaluated the capitalist development for a long period within the framework of the evolution concept; he has drawn his capitalist evolution idea which enables technological competition between companies from Marx (Fagerberg 2003). Schumpeter has deployed fundamental analytical concepts, used at present by many evolutionary economists, against neo-classical economics in building up his own development theory. This can be seen most clearly by Schumpeter's (2005) own understanding of "development" as '*transition from one norm of the economic system to another norm in such a way that this transition cannot be decomposed into infinitesimal steps*' (Schumpeter 2005: 115). The notion of development implies that the idea of adaptation does not apply in cases of changes in the norms themselves: 'When starting from the old form, the new one must *not* be reachable by adaptation in small steps' (Schumpeter 2005: 113). That is to say, development should be seen as 'an emergent process with an unknown outcome' (Foster 2000: 323). So defined, this notion refers to dynamic change or evolutionary change in the system, the end result of which cannot be known *a priori*. In this regard, Schumpeter's approach seems to have three basic distinctive characteristics when compared to neo-classical economics (Dosi 1990):

- 1.) when analyzing capitalism, its starting point is the notion of "development" or "transformation" rather than "equilibrium";
- 2.) when analyzing the emergence, development, and disappearance of social institutions it is concerned with historical time rather than logical time;

⁴ Another problem in this regard is the understanding of the notion of causality in a Humean sense as "constant conjunction" between atomistic, brute events. However, as one can see from the discussion that follows in the third section, such an understanding of mechanical causality presupposes a specific ontology in which a "corpuscularian" vision (Harré 1984: ch. 5) and a "classical paradigm of action" (Bhaskar 1975: 79) is assumed. This paradigm adopts a *corpuscularian* or atomistic view of matter and a *mechanical* view of causality in which all causes are regarded as efficient and external to the thing in which change occurs. Also, the entities, or "atoms" are assumed not have any complex internal structure, and the existence of a pre-formation or material continuity is denied (Bhaskar 1975: 83). As should be clear from what follows, such a vision is entirely contradictory to an evolutionary outlook. Of course, we do not wish to argue that Veblen endorses such an ontology and causality, especially if one considers his notion of "cumulative causation," but one should consider the prevalence of the 19th century understanding of causality as informed by the Newtonian paradigm. In other words, the uses of biological and evolutionary metaphors need not necessarily entail an evolutionary mechanism and ontology.

3.) it is suspicious of the idea that the economic agent seeks optimization in a rational way.

Although Schumpeter, as is well known, is critical about “evolutionism” in the social thought (Schumpeter 1954: 435-446), he uses the term in the sense of evolution of the economic system. Schumpeter states that evolution

can be defined in a wider and a narrower sense. In the wider sense it comprises all the phenomena that make an economic process non-stationary. In the narrow sense it comprises these phenomena minus those that may be described in terms of continuous of rates within un changing framework of institutions, technological horizons, and will be included in the concept of growth’ (Schumpeter 1954: 287).

In this regard, one should remember the fact that Schumpeter, when he defines “evolutionary process” as a ‘succession of static models’ (Schumpeter 1954: 964), he warns the reader that “the conceptual devices sketched have nothing to do with any similar ones that may be in use in the physical sciences” (ibid, 965). So conceived, evolution refers to ‘changes in the economic process brought about by innovation, together with all their effects and the responses to them by the economic system (Schumpeter 1939: 86). Economic evolution is marked by the discontinuity of economic phenomena. In other words, it can be explained by breaking away from steady state framework (Alcauffle and Khun 2004).

We believe that this approach put forward by Schumpeter should be the starting point of the discussions whether or not Schumpeter is an evolutionary economist. This definition illustrates that Schumpeter’s evolutionary choice does not derive from a Darwinian or a Lamarckian process (Kelm 1997). Unlike Schumpeter, Neo-Schumpeterians have attached a greater importance to the Darwinist natural selection mechanism (Foster 2000). For example, Metcalfe (1994) emphasizes on the impact of biological metaphors on economics, and indicates that the Darwinist concepts of selection, variation and mutation have their equivalents in economics as competition, imitation and innovation, and underlines the significance of using these analogies. Emerging new approaches in evolutionary economics render the appearance of new methods and concepts in shaping theoretical frame possible. The most important factor in the formation of diversity, for which the starting point was Darwin’s theory of evolution, originates from the reservations in using biological analogies. Nelson and Winter (1982), while mentioning biological analogies in the book that they published, were hesitant to use Darwinian evolution. They perceived evolution as a metaphor rather than a causal mechanism (Hogdson 2004).

2-Neo-Schumpeterian Evolutionary Economics

Neo-Schumpeterian evolutionary economics is the second heading of our classification of evolutionary economics. The starting point of this approach has been Nelson and Winter's book *An Evolutionary Theory of Economic Change* (1982). Nelson and Winter tried to model technological evolution by using biological metaphors openly and by making use of concepts borrowed from evolutionary biology i.e. natural selection and coincidental genetic mutations. Economists such as G. Dosi, C.Freeman, J. Silverberg and L.Soete are amongst the advocates of this approach led by Nelson and Winter.

The evolution notion of this approach consists of the deployment of biological analogies (Mokyr 1990). Darwinian principles of variety, inheritance and selection are used as analogies. Three key theoretical elements in Darwin's evolutionary theory are the existence and replenishment of variety, the inheritance of information and the selection of the relatively fitter units. These three key elements set the core of Nelson and Winter's (1982) innovative work (Hodgson 2003). In addition, Nelson and Winter (1982: 9) referred to the deployment of evolution concept as "above all signal that we have borrowed ideas from biology". Routine becomes the determining concept of Neo-Schumpeterian evolutionary economics. Nelson and Winter (1982:14) defined routine '...all regular and predictable behavioral patterns of firms is routines...' 'in our evolutionary theory, these routines play the role that genes play in biological evolutionary theory' 'they are heritable in the sense that tomorrows organism generated from today's have many of the same characteristics, and they are selectable in the sense that organism with certain routines may do better than others, and if so, their relative importance in the population (industry) is augmented over time'. Although Nelson and Winter's above mentioned explanations on routine clearly reflect Darwinian inheritance and selection, Nelson and Winter have stated that their socio-economic evolution theories are Lamarckian⁵.

The concept of routine in this approach could actually be correlated to habit in traditional evolutionary economics. Routines concerning organization are similar to habits concerning individuals, and therefore; like habits, routines are propensities rather than behaviors. Routines are structured in the organizational complex, which involves both organizational structures and the habits of individual members of the organization (Hodgson 2006). Routines as the organizational analogue of habits, they have behavioral capacities and these capacities involve

⁵Self-organized systems of information that are transmitted from generation to generation. Biological information is transmitted through parental genes, and acquired characteristics are not passed on. In all socio-economic evolution, including technology, information is transmitted laterally and diagonally as well as vertically (Mokyr 1990; 350).

knowledge and memory. Just as Habits replicate from individual to individual, routines replicate from organizations to organizations (Hodgson 2006).

Leading economists of this approach; Freeman (1982), Rosenberg (1982), Mokyr (1990), Nelson and Winter (1982) and Dosi (1988) indicate that unit of selection meaning the unit which evolves is technology (Dosi and Nelson 1994). The evolution of technology has to do with the innovation activities of the companies. Neo-Schumpeterian evolutionary economics' works on innovation are to a large extent in correlation with J. Schumpeter's technology and his entrepreneurial theory that undertakes innovative works in connection with technology. Schumpeter's Entrepreneurs are identified as the internal carries of the mechanism of change in capitalist economies (Ebner 2000). He pays special attention the emergence of novelty, that is ascertained when innovations materialize in the economy (Alcauffleand Khun 2004).

The economic development theory developed by Schumpeter carries a dynamic characteristic. As Marx did, Schumpeter also established an evolutionary model of technological change, and the crucial role in this change falls on the entrepreneur as an innovative agent. He defines innovation as 'The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumer's goods, the new methods of production or transportation, the new market, the new forms of industrial organization that capital enterprise creates' (Schumpeter 1950:68).

Following a successful innovation swarming illustrates that the sector or the industry in which the innovation took place will grow. Besides, an important innovation carries the propensity of stimulating other innovations (Schumpeter 1939: 131). Due to such interdependency, innovations have the propensity either to intensify themselves in and around some certain sectors or cluster (Schumpeter 1939: 100-101). The intensification of technologies in and around some sectors in Schumpeter, transforms into technological paradigm concept in Neo-Schumpeterian evolutionary economics. This concept stands for a cluster of interrelated technical, organizational and managerial innovations (Freeman 1988: 10).

The appearance of a new technology will render the harmonization of existing routines required for innovation. Particularly, as a radical innovation⁶ will have an impact not only in one sector of the economy but on the society as a whole, it will thus ensure the dramatic change of the routines. Schumpeter refers to a process determined by routines as a stagnant process, and indicates that such routines will start taking roots in ourselves. In case routines extend their effects for a long period of time, their benefits will be reduced as they do not require renovation or reproduction (Schumpeter 1939:35). For this particular reason, it is possible to state that

⁶ The economic history of Technology displays a similiar dynamic pattern of long periods of stagnation or very slow change punctuated by sudden outburst like the industrial revolution. (Mokyr 1990; 352).

Schumpeter's innovation concept actually provides the evolution of routines. In Schumpeter unit of selection is the routines. While defining the gradual direction of economic development in their own theories, Nelson and Winter do not deny that radical changes (Nature's leap) could possibly take place (Nelson-Winter 1982:10).

On one hand, change in technological paradigms refers to a change in line with the gradual change in Neo-Schumpeterian evolutionary economics and also in line with the change stressed in Darwinist causality principle, while on the other hand, it is pointed out that, dramatic changes, though seldom, could possibly take place in Schumpeter's radical innovation concept. Moyr (1991:143) puts it as 'saltational evolution is the best called transmutation because the production of new species or new types is discontinuous, owing to the sudden creation of a new essence'. Moreover, Moyr gives a definition of gradual evolution, and indicates why it is the contrary of saltationism. 'As soon as possible one adapts the concept that species evolve as populations and are transformed. Owing to the differential reproductive success of unique individuals over generations-and this is what Darwin increasingly believed-because of this, the evolution must be gradual' (Mokyr 1991:146).

It is observed that in Neo-Schumpeterian evolutionary economics, the notion of evolution is still perceived at a metaphorical level. Leading economists, as far as this approach is concerned, do not perceive the notion of evolution as a causality mechanism. Instead, they included biological analogies into their theories and perceived the issue was on metaphor level. However, it remains to be asked whether it would be appropriate to call such an approach as "evolutionary" in its biological sense. Then, one needs to adopt another methodological position in order one to subscribe an evolutionary ontology.

3-The "New" Evolutionary Economics

The economists who considered the explanation of socio-economic evolution by Darwinist and Lamarckian evolution theories to be insufficient have initiated a debate on the compatibility of biological analogies in economics sciences. John Foster expresses the insufficiency of biological analogies as follows:

the basic insufficiency of biological analogies is that they are untimely – no matter they are Darwinist or Lamarckian. They do not illustrate the history- except for the fictitious use of Newtonian comparative analysis. As stressed by various evolutionary economists, time irreversibility, lacking equilibrium, structural

instability and uncertainty are the characteristics of historical process, however, none of them exist in biological analogies. (Foster 1997: 448-449).

Ulrich Witt (1999, 2001) is another economist who has a skeptical approach towards biological analogies. Witt's starting point is based on Darwinian causality principle as well. While mentioning the importance of human intentions particularly in the selection of routines and technologies, he indicates that the causality principle excludes the importance of human intentions (Witt 1999: 24). The statement "taking 'natural selection' as a reference in economics science means nothing but metaphor" puts an emphasis on the necessity of keeping natural selection at metaphor level. The criticism Witt and Foster brought on biological analogies have enabled laying the foundations of new evolutionary economics.

Such criticisms, in fact, presupposes a new evolutionary approach, that takes ontology at its center. on this conception, economic structures illustrate complex, open and self-organization characteristics (Dopfer, Potts 2004:3; Foster, Metcalfe 2001:1). Such economic systems include both endogenous and adaptive capacities.

Schumpeter focused his works on issues which had laid the foundations of his work to a large extent i.e. non-equilibrium, uncertainty, sudden changes which emerge in chaotic situations (radical innovation- change) and within the latter context punctuated equilibrium concept (discrete equilibrium). These are the grassroots issues of this approach.

Scientific progress is in parallel with social transformations which progress as a result of political and technological revolutions. Technical inventions such as the invention of steam machines have triggered economic growth and led a unique structural change in human history (Dopfer 2005: 7). This structural transformation has continued throughout the 18th century.

A new paradigm in natural sciences started to escalate in the 20th Century. The second law on thermo-dynamics developed by Ilya Prigogine explains the structural and evolutionary change. This new paradigm explains non-linear, chaotic or complex systems together with the uncertainty situation (Dopfer 2005:12; Kiel 1991:431). Such a paradigm shift can be said to fit well to Schumpeter's own understanding of change and "development" as an ontological outlook defining the capitalist reality.

In respect of Schumpeter's own understanding of evolution (i.e., "development"), Foster (2000) argues that the conception of evolution itself has undergone an important transformation in biology, and this should be reflected in economics itself. underlying such a transition is an ontological transformation within the scientific understanding itself. Foster distinguishes between a "Darwinian/Malthusian" understanding of evolution, that had been prevalent in the 1930s within the evolutionary biology literature, and, what may be called a "Schumpeterian"

conception of evolution, whose scientific basis has been laid by the developments in thermodynamics, chaos and complexity theory. Such a transition can be summarized in Table 1 below.

TABLE 1: TWO FORMS OF EVOLUTION

	<i>DARWINIAN/ MALTHUSIAN</i>	<i>SCHUMPETERIAN</i>
<i>CHANGE</i>	“Causal,” quantitative: Functional, Linear, and Reversible: (Many-to-one-mapping)	“Development,” novelty Adaptive, Non-linear, and Irreversible (One-to-many-mapping / Bifurcations)
<i>EQUILIBRIUM</i>	Newtonian: Balance of forces (<i>Disequilibrium</i>)	Thermodynamic: Absence of structural change (<i>Nonequilibrium</i>)
<i>ORDER</i>	Spontaneous Stable (Optimization)	Self-Organized Unstable/Dissipative (Routines: “Business as usual”)
<i>EVOLUTIONARY PROCESS</i>	Natural Selection (uncovering “tacit knowledge”) (Definite, determined, and efficient outcomes) <i>“Invisible Hand”</i>	Random Mutation (Innovation) (Emergent, indeterminate, and unknown outcomes) <i>“Evolutionary Hand”</i>

Source: Foster (2000), and Schumpeter (2005).

Such a development is relatively new, as described in Ilya Prigogine and Isabella Stenger's (1984: 60) important work, in which complex systems are defined in terms of self-organizing⁷ "dissipative structures" The non-linear systems⁸ that are emerged by the second law of thermodynamics display the relation between variables. Small changes in non-linear systems can reproduce positive feedback (any kind of change triggering a further change) (Jenner 1994: 126). This type of a mechanism implies possible sudden leaps.⁹ The evolution process that emerges in this approach diverges in two ways from the Darwinist evolution theory.

a.) The basis of Darwin's causality principle "nature does not leap" is not a true approach.

b.) Natural selection remains insufficient in explaining the complex situations in nature.

Therefore, it is emphasized that the new evolutionary approach could be more enlightening in explaining the evolution of economic systems which are more complex than biological systems. The self-organization process in the transition of biological systems from irregularity to regularity, and from simple formations to complex formations is more explicative when compared to natural selection approach. Natural selection is not an inefficient process in evolution; however, it remains as an insufficient approach in explaining the existing complexity. Although it is unable to explain complexity, it is a secondary element affecting the selection of different structures.

Such dissipative structures defined by Ilya Prigogine and Stengers (1984:60) establish a type of the sub-systems affecting each other in a non linear style. Non linear systems which take into consideration the relations between variables are not stable systems. All small changes emerging in this context affect the whole system. In fact, irregular structures are constantly under the influence of random fluctuations (Dopfer 2005 :14).

The most important characteristic of the 2nd law of thermo-dynamics is time irreversibility and that it implies the possibility of the creation of regular and complex structures in non-equilibrium and irregular environments (Kiel 1991:434; Prigogine 2005:64; Dopfer 2005:15).

⁷ Self-organization suggests that simple molecules will organize themselves and establish complex systems. Dissipative structure: These structures realized in open system import a large amount of energy from their surroundings. The entropy (the measure of irregularity level) created in use of energy diffuses to outer environment. (Kiel 1991: 433). Indeed, these systems are reaction systems which create long-term structures and change structure while conducting mass and energy exchange.

⁸ For the importance of non-linearity,

⁹ In terms of economic analysis, the "linear" models can be said to have two properties (West 1985: 5): *proportionality*; the response of the action of each separate factor is proportional to its value (that is, the output of any operation is directly proportional to the inputs); and *independence*; total response to an action is equal to the sum of the results of the values of the separate factors. Thus adopting evolution as an ontological presupposition also amounts to adopting a non-linear framework.

The complex systems structure approach developed in 1950s and 1960s have started to be tested in 1990s in economic and social fields. The possibility of its adaptation into economics science was enabled with the entering of complex system debates into the agenda, and with the help of John Foster and Ulrich Witt's (1997) works. Such an approach states that:

All ordered systems resemble one another, but each complex system is complex in its own way. The economy is a complex system.....the complexity of the economic system is due to its modularity, openness and hierarchic depth. The economic system is modular in the sense of being made up of a large number of functionally specific parts. It is open in the sense that these parts interact with degrees of freedom. And it is deep in the sense that each module is itself a complex system: every part is whole and every whole is a part. The economic system is modular, open and deep, and because there are many ways for a system to be like this, complexity is inherently emergent. Each complex component of the economic system tends to be complex in its own way' (Dopfer and Potts 2004:3).

The approach which defines economy as complex adaptive system is defined in economic literature as the new evolutionary economy (Foster and Metcalfe 2001: 2-3).

The evolutionary world displays the progresses which are constantly changing and opens up to new forms whereby this process is peculiar to history. Such a history characteristic brings up the path dependence concept (Dopfer 2005: 30). Path dependency in evolutionary economics implies that the change takes place within the course of time, and change is in close relation with the developments that happened in the process of history. Rather than a determined equilibrium concept, small historical events determine the direction of next developments. In path dependency, what happens today is formed in the accumulation of the past. That's to say, each event has a past, present and a future (David 2002:2).

In a system, chaos is seen when the components which are attached to each other separate or when the components which make the whole separate from one another, the structure of their relation, and when an unpredictable situation emerges at any time. As a result, a change in institutional terms happens (Jenner 1994:129). If there is positive feedback within the system, even the smallest changes cause large scale outbursts, discontinuity, and create unpredictable changes. In that level of instability the system can attain a critical point. This point is referred to as single movement or bifurcation point¹⁰ (Prigogine and Stengers

¹⁰ The peculiarity of this point is that it is impossible to predict the direction of the change. Hereby, the system will make a new leap in chaos (Prigogine and Stenger 1984; XV).

1984:160). It is impossible to predict the direction of the change in a system which reached that point. Such intermittent and discontinuous leaps lead to radical changes-innovations¹¹. Radical changes are explained with the concept of punctuated equilibrium. This concept was put forward by Eldredge and Gould (1972 and 1997)¹² (Lach 1999: 161). While the evolution of species continues within stable and long periods, sudden changes take place when new species are seen (Fialho, Hasenclever and Alberto 2003: 311). When we associate this concept with the appearance of innovation it stands for long term stability whereas sudden appearance of innovation stands for a radical change while displaying incremental changes.

The new evolutionary approach has sufficient accumulation for explaining the evolution of economic systems when taken together with the Darwinist evolution theory for explaining the evolution of economic systems which is more complex than biological systems.

When compared to the natural selection approach, even though the self-organization approach seems to be more explicative in transition of biological systems from irregularity to regularity, and from simple formations to complex formations, it does not give a full evolutionary definition (Hodgson 2002:259-281). Natural selection remains to be insufficient in explaining the existing complexity whereas self-organization theories illustrate how complex organizations will appear. However, the selection of these structures depends on natural selection. Some of these structures will survive for a longer period of time and will also be more effective than the others. The appearance of this situation is possible with natural selection. Conscious selections, competition pressures, market powers, environmental factors in selection of technology, institutions, regions, and even the economy as a whole embrace self-organized structures (Hodgson 2002). The selection of these structures is also influenced by natural selection.

Economic systems are information based systems which have a larger capacity of energy deployment when compared to biological systems. For that reason, the economic system needs to be analyzed as an adaptable complex system (Foster 1997, Witt 1997, Foster 2006). An adaptable complex system is a system which internalizes the information in its surrounding, and creates the knowledge reserve that will facilitate a reaction (Foster 2006). Complex environments provide an environment towards new and dynamic structures. In such irregular structures, new ideas and combinations appear and thus carry the existing structure further

¹¹ Evolutionary systems driven by the interaction of radical innovation and smaller innovations, and diffused by natural selection do not necessarily advance in a smooth and gradual way. Self organized information systems tend to be non-linear. (Mokyr 1990; 352).

¹² Punctuated equilibrium approach; based on this theory, the number of species do not encounter a lot of change throughout long time periods. However, this equilibrium is interrupted from time to time with the sudden formation of new species. A lot of new species appear suddenly during such outbursts.

(Jenner 1994 :131). The more the technological development level increases, the more complexity will be seen in the system.

The evolution of the economic system is a result of the joint evolution of energy recycling methods and knowledge. Socio-economic systems are structures which gather, recycle, and use information in order to solve the efficient recycling problem of energy that they face, in other words, they gather, recycle, and use information in order to raise the technological sufficiency level (Foster 2006)

The emergence of new ideas and the realization process of these ideas appear to be the first step of information dissemination. Information accumulation, information producer and information user enable an open path for division of labor between sub-systems, and by doing so, provide the economic system with the possibility to get more complex and have an increased ability in complying with changing environment conditions. The success of the system depends on; the creation of information, storing and using information in the production of new information, and thus, on the development and growth of the economic system. A company, discovering information and creating innovation will make use of this. The process continues with others complying themselves with the innovation and making the imitation mechanism function, the mechanism. Consequently, structures will be formed; various sub-systems are attached to each other and information production possibilities constantly increase (Malerba 1999). Based on this point, it could be said that the new evolutionary economics is basically about the change in the original information and the unit of selection is information.

Many leading economists remarkably accept the complex structures and endogenous choices in economy. Kenneth Arrow (1995: 1618 quoted Hodgson 2007) expresses that “the notion which establishes the economics theory has to change, and biology science is a more appropriate paradigm for economics than equilibrium models that have mechanic analogies”. Kenneth Arrow puts an emphasis on the transformation in neo-classical economics with the latter expression. This slide in neo-classical economics creates a significant opportunity for the evolutionary economics which emphasizes dynamic, uncertainty and limited rationality. Market, the basis in neo-classical economics, is indeed an institution and is comprised of complex rules. Markets include information networks which have to explain social norms, traditions and institutionalized relations. (Hodgson 2007).

Economics system is an accumulation of rules, a structure of rules and a process of rules. This ontological basis indicates that society is not only composed of individuals' accumulations. At the same time, it embraces a system of rules that enable communication and interaction of individuals (Hodgson 2007).

TABLE 2: CLASSIFICATION OF EVOLUTIONARY ECONOMICS

<i>Classification of Evolutionary Economics</i>	<i>The Notion Of Evolution</i>	<i>Social or Cultural Evolution (Literally or metaphorically)</i>	<i>Unit Of Selection</i>	<i>Process of Evolution</i>	<i>Pioneer Economists</i>
Traditional Evolutionary Economics	Causal Mechanism	Either Darwinian or Lamarckian	Society/social Institutions	Gradual (incremental change)	T.Veblen
Neo-Schumpeterian Evolutionary economics	Metaphor	Lamarckian	Technology	Either Gradual (incremental change) or Radical change (natural's leap)	S.Metcalf, R.Nelson, S.Winter, J. Mokyr, G.Dosi, Freeman, Soete
New Evolutionary economics	Metaphor	Neither Darwinian Nor Lamarckian	Economy/knowledge	Radical change (natural's leap)/ Punctuated Equilibrium	K. Dopher, U.Witt, J.Foster,

Conclusion

All stages, through which the economy has gone so far, reflect the evolutionary concept's own evolution process, which is summarized in Table 2. New concepts and methods that emerged in this evolution process and certainly the economists who developed them render the possibility of classifying evolutionary economics under different headings. This paper made a classification under three headings in terms of their evolutionary economics methods, the concepts that they deployed, their periods, and the economists who pioneered the development of different approaches. Although the classification made as traditional evolutionary economics, Neo-Schumpeterian evolutionary economics and new evolutionary economics does not display a clear cut distinction, it states the path covered by evolutionary economics throughout the history.

It is not possible to state that there is a very clear cut distinction between these approaches which emerged through the natural course of evolutionary economics and that they are developed completely in a disconnected manner. Although the concepts deployed in each approach, their perception of evolution and their units of selection are different, evolutionary economics is at their center when taken as a whole.

The first tangle that draws the attention, as far as the distinction in between is concerned, is their perception of evolution and the evolution theory that they deployed in their models. The classification made in this paper, excluding the one for classic evolutionary economics, perceives the evolution together with its natural extension, which is the natural selection, at the level of metaphor. This situation is clearly observed in Neo-Schumpeterian evolutionary economics models whereas the perception of natural selection at metaphor level is implicitly observed in the new evolutionary economics which does not perceive evolution in terms of Lamarckian and Darwinist concepts and which applies the second law of thermodynamic. However, the creation of information, the use of information by companies, and the existence of imitating companies illustrate that they do not exclude new evolutionary economics too much.

These approaches have basically the same answer for the question of which evolutionary theory. Veblen, the most eminent representative of traditional evolutionary economics, indicates that the evolution of the individual is Darwinian whereas the socio-economic evolution has to follow a Lamarckian evolution due to the mechanism of habit transfers from one generation to another. The evolution of institutions or the evolution of societies remains closer to Lamarckian evolution. However, Veblen has never denied the importance of inheritance, variation and selection which belong to Darwinist evolution. Similarly, Nelson and Winter, leading economists of Neo-Schumpeterian evolution have indicated that socio-economic evolution has to be Lamarckian, but also adopted Darwinist three fundamental concepts into their works (Hodgson 1997), and opted for technology as their unit of selection.

So far, in our evolutionary economics classification it remains to be an uncertain issue into which category does the most important evolutionary economist Schumpeter exactly fall. Schumpeter's preference to use the word evolution only as change or development illustrates that Schumpeter excludes "Darwinist process in evolution" (Hodgson 1997: 140). Besides, it is also noticed that Schumpeter does not believe that it would be beneficial to use too much biological metaphors (Foster 1997). However, Schumpeter's deployment of biological metaphors in his development and entrepreneurial theories is undeniable (Kelm 1997).

It is true that Schumpeter's evolution theory is out of Lamarckian or Darwinian evolution concepts (Kelm 1997). Schumpeter used evolution to demonstrate the contrary of static, and his definition for evolution, as defined above, is not comprised of natural selection, however, none of them shows that Schumpeter is not an evolutionary economist.

The concepts that Schumpeter used have been a source of inspiration for Neo-Schumpeterian and new evolutionary economics. His indication that evolution is an endogenous

change process, his equilibrium propensity, and his non-equilibrium concepts, his emphasis on uncertainty, and his indication that the nature of economics evolution is imbalanced actually demonstrate that Schumpeter could be categorized both in Neo-Schumpeterian and new evolutionary economics categories.

As a conclusion, we consider that, both within the framework of Schumpeter's ideas concerning evolution, and the ideas laid out by evolutionary economics, perceiving evolution at metaphor level would be beneficial for the development of evolutionary economics, and would also overcome the bottleneck created by the hesitations which derive from the ideas existing at theoretical level. In this context, evolutionary economics could go beyond without being an alternative to mainstream economy as laid out in the heading of article Hodgson 2007 'evolutionary and institutional economics as the new mainstream'.

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