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ARTICLE

Redefining Evolutionary Economics

Makoto NISHIBE

Graduate School of Economics, Hokkaido University, Kita 9, Nishi 7, Kita-ku, Sapporo, 060–0809, Japan. E-mail: nishibe@econ.hokudai.ac.jp

Abstract

The aim of this paper is to redefine evolutionary economics in view of its negative and positive identities. The negative identity is formed as a counterargument to neoclassical economics with the hypotheses of optimizing agents and equilibrium, and this functions as a 'vision' that leads to the positive identity. According to the vision, the market is not a universally designed or constructed system, but an autopoietic system or a spontaneous order. In order to specify the positive identity, we examine the ontological/epistemological double meanings of evolutionary economics that entail a recursive relation between economy and economics. Evolutionary economics is redefined as the economics of a large-scale, complex and uncertain economy that exists as a loosely connected system with a micro-macro loop structure, facilitated by such social institutions as rules or conventions, multi-layered buffers and routines. It also means the 'analogical-evolutionary pluralist' approach within economics as well as meta-economics in terms of the relationship between economics and history of economics or other disciplines of science.

Keywords: the negative and positive identity, bidirectional causal relation, analogical-evolutionary pluralism, meta-economics, large-scale and complex system, multi-layered adjustment, buffer, micro-macro loop.

Introduction: The Negative and Positive Identities of Evolutionary Economics

Evolutionary economics is still in the early days of institutionalization and its systematic formulation has not been firmly established. That is all the more reason for evolutionary economics to be strongly motivated to question its definitions, objects, domains, concepts and methods as in 'what is it, and what and how does it study?' Indeed, to answer is not an easy task, but I believe it is worthwhile to try.

I do not mean by the title 'Redefining Evolutionary Economics' that clear definitions are already given and we have only to reassess their validity. On the contrary, I want to express that there are no conclusive answers yet so we should keep on inquiring about them. Moreover, the very nature of evolutionary economics might suggest that we cannot

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help but remain in an endless process of research without any final answer. In short, the prefix "re" means 'again and again' in the evolutionary trial and error process of defining it in a positive sense.

The questions raised above instantly take us to another adjunct but most fundamental one, 'what is evolution, in particular, in socioeconomy?' To give a convincing solution to the question is the goal of this article and it can, as a result, establish a truly original theoretical position of evolutionary economics. But this is apparently another hard question because, to define it properly, we need to use concepts such as selection, heterogeneity, variation, diversity, complexity, and uncertainty, and venture into ontological and epistemological investigations. So we may well go on a roundabout path for the time being, and will later on come back to the issues when considering the positive identity of evolutionary economics.

1. The Negative Identity of Evolutionary Economics as a Guide to 'Vision'

A new theory is advocated in the course of criticism and objection to an old theory in order to overcome its demerits and defects, in most cases, without any clear-cut definitions of itself. Evolutionary economics is no exception. So it is much easier to recognize what kinds of criticism and objection have been raised when it first emerged. In order to do so, we had better ask 'what is *not* evolutionary economics?' replacing the original question of 'what is evolution economics?' Obviously, evolutionary economics was formed through criticizing the neoclassical economics that was the orthodox doctrine at the time and is even more so at present. Thus an initial identity of evolutionary economics was negative in the sense that it is 'not to be' neoclassical. Truly, negative identity is not sufficient to systematically establish a certain discipline of science. But it well explains the driving forces deep underneath to initiate and develop a new project. And it is also, as we shall see below, crucial to understand the double meaning of the term 'evolutionary' in evolutionary economics. The term 'negative identity' seemingly has negative connotations, but it surely has positive theoretical implications as in 'negative freedom.'

This is true of the two founders of evolutionary economics, Marshall and Veblen. In particular, it is easily seen that, when Veblen wrote his precursory article 'Why is Economics Not an Evolutionary Science?' (Veblen, 1898), his criticism to the 'realism' of neoclassical economics was based on his dissatisfaction and antipathy towards its hedonistic view of human nature, as well as its Newtonian mechanistic view of the market, although he reversely raised the same question of 'what is *not* evolutionary

economics?', not from the side of 'evolutionary economics' that did not yet exist, but from that of generic 'economics' actually meaning orthodox neoclassical economics. But Veblen not only criticised the economics of those days but also showed an alternative direction for evolutionary economics.

'The economic life history of the individual is a cumulative process of adaptation of means to ends that cumulatively change as the process goes on, both the agent and his environment being at any point the outcome of the last process. His methods of life today are enforced upon him by his habits of life carried over from yesterday and by the circumstances left as the mechanical residue of the life of yesterday' (Veblen, 1898).

On reading this passage, we find that rudimentary ideas were expressed to be further elaborated as a cumulative process and even a bidirectional causal relation between agents and the environment (a micro-macro loop). This case seems to indicate that negative identity functions as a guide to produce a stage of positive identity of evolutionary economics. The negative identity is in this sense 'vision' as a 'preanalytic cognitive act' (Schumpeter, 1954, p. 41) prior to the firm establishment of a positive identity.

2. The Negative Identity as Counterargument to Neoclassical Economics: Static Views of the Market and Efficiencies with Rational Agents and Equilibrium

The modern neoclassical economics that originated from the Lausanne school successfully formed the mainstream in the 20th century. Its central tenet is constituted by two major hypotheses: 'rational choice (optimization)' on the decision-making of economic agents, and 'equilibrium' on overall economic coordination. Adam Smith explained in his *Wealth of Nations* (Smith, 1981) that, in a society where division of labour is extensively observed, every individual pursuing his own interest as *homo economicus*, led by an 'invisible hand', frequently promotes the public interest of the society more effectively than he really intends to. Many modern (in particular neoclassical) economists have considered the relation between the father of economics of the 18th century and neoclassical economics in the following way. Neoclassical economics has developed Smith's two profound metaphors of *homo economicus* and the 'invisible hand' in his account on mechanisms of the market economy into the more sophisticated concepts of 'optimizing agents' and 'equilibrium', and given rigorous demonstration of the essential problem of 'how rationality of the market economy is attained', so that neoclassical economics may well occupy mainstream status for its

distinguished contribution. However, there are certain problems in this plausible argument.

Let us take notice of the following point. Smith had comprehended the unintended desirable result generated by the 'invisible hand' as development of productivity, in more elaborated words, the development of labour productivity caused by improvement in 'the skill, dexterity, and judgment with which its labour is generally applied' (Smith, 1981, Introduction and Plan). But, neoclassical economics bypassed the crucial point and simply exchanged it to optimal allocation of scarce resources (called 'Pareto efficiency' at present). The point is that, whilst it was the dynamic nature of labour productivity for Smith that the market and division of labour should attain, it has been replaced with static efficiency by neoclassical economics. This difference, though it is frequently overlooked, has great implications. Both sides advocate rationality of the market but their arguments are based on completely different grounds.

For example, even if one attributes the collapse of the socialist planned economy to the predominance of the market economy, the theoretical implications are quite distinct, depending on which ground underpins such an argument. Static efficiency is not always conducive to dynamic efficiency and *vice versa*. Whilst a capitalist market economy induces severe economic fluctuations and produces unemployment and superfluous capital, it has brought rapid economic growth and various new technologies and products not only to advanced countries but also to developing countries. This is the fundamental fact that we have lived through the 20th century. From this commonsense experience, it would be reasonable to presume that the market economy promotes development in productivity through innovation and technical progress more than optimal allocation of resources as given, namely, dynamic efficiency more than static efficiency.

However neoclassical theory has never been refuted or falsified by such basic stylized facts. Rather, the free market is admired only for its advantage in static efficiency and incentive compatibility ignoring its deficiencies, and this assertion is reflected in libertarian policy ideals called *laisser-faire* and cheap governments. We thus admit that neoclassical hardcore hypotheses—'optimizing agent' and 'equilibrium'—which exclusively focus on static efficiency are not only unnecessary but also prime obstacles for recognizing the issue on Smith's (and the classical school's) dynamic efficiency. Many approaches in evolutionary economics raise concerns about the contents and implications of the central propositions of neoclassical economics, but this is not all. In fact, they criticize the axiomatic hypotheses of 'optimizing agent' and 'equilibrium' for drawing such propositions as unrealistic simplification.

General equilibrium has been thought of as the most formally refined analytical framework of neoclassical economics. It not only presupposes *homo economicus*, who merely considers his own interest based on utilitarian motives, but also adds stronger conditions that firms maximize profit and consumers maximize utility, viz., economic agents optimize their objective function. It is assumed in general equilibrium that economic agents regard prices fixed in the market as signals on which they cannot have any effect, and decide production or consumption plans by calculating the solutions of optimization problems with some constraint conditions. However, the rational agents can stay at optimal states all the time only under many implicit assumptions on human ability in terms of data collection, cognition, computation, and execution. Such assumptions correspond to perfect information (zero information gathering cost), infinite computational capacity (zero calculation cost), and unlimited execution capability (zero management cost). They are not only unrealistic but also untenable because they enable the general equilibrium theory to exclude the viewpoints of evolution and complexity.

The problem of rational agents casts a shadow over not only the construction of market theory but also its application. For, in the economic calculation debate from the 1920s to the 1930s, whilst Mises and Hayek of the Austrian school criticized a centralized planning economy as unfeasible because of the impossibility of economic calculations, Lange and others claim that, assuming producers and consumers to be rational agents, the model of feasible market socialism can be constructed as an application of the general equilibrium theory, and that it is more efficient than that of the market economy. However, the very concept of static efficiency is in itself drawn from assuming the unlimited capacities and unbounded rationality of agents. On the contrary, evolutionary economics endeavors to recognize the peculiar nature of human rationality and capacities. To have bounded rationality and limited capacities as theoretical presuppositions is one of major characteristics common to evolutionary economics.

The general equilibrium theory further presumes that the market economy is understandable only in terms of equilibrium. Here the market is identified merely as a price mechanism, and all transactions presumably take place only with the market clearing prices formed at equilibria of equating overall demand and supply. In other words, the market for neoclassical economics is nothing more than a natural analogue computer, which is more wasteful and inefficient than an artificial digital computer for Lange, to calculate equilibrium prices so as to attain an optimal allocation of scarce resources.

Evolutionary economics does not restrict itself to such a narrow functional view of the

market. Rather, it tries to approach the market from fundamentally different angles to clarify the following points.

(i) Individual transactions take place here and there, today and tomorrow, in a decentralized manner, not at equilibrium prices that match the overall demand and supply of all commodities, but at different *non-equilibrium* prices that *satisfice* both buyers and sellers.

(ii) The market is not a simple tool for calculation to show the price signals necessary to attain static efficiency, but a *complex and dynamic social institution* to make economic behaviors meaningful and spontaneously produce socioeconomic order by embodying various levels of rules, and the market exists only as a loosely and dispersively connected network of individual buying and selling initiated by money owners.

(iii) The market is also a sort of *sociopolitical* field where the mutually colliding aims and interests of different individuals are reconciled *peacefully* in the form of economic transactions.

I believe that these are the ontologically basic descriptions of the market for evolutionary economics in contrast to those of neoclassical economics. Naturally, each approach of evolutionary economics would put an emphasis on different aspects. But, common to evolutionary economics is to conceive the market not as a universally designed or constructed system, but an autopoietic system or a spontaneous order, self-generating and self-organizing, in which its unique history (hysteresis) matters.

3. Three Fundamental Questions for Positive Identity: Basic Concepts and Objects, Methods and Pluralism and, Descriptive and Normative Explanation

The aim of evolutionary economics is not only to become a new branch of economics but also to form transboundary integration of various branches of heterodox economics by proactively building upon their academic outcomes irrespective of the existing borders between them. Moreover, it endeavors to open the door to not only such social sciences as economics, sociology, linguistics and philosophy, but also such natural sciences as physics, biology, geo-science, cosmic science and engineering. Evolutionary economics thus seeks to form an association with a great diversity of disciplines beyond the borders inside and outside of economics. We may say it has a huge potential to create a new transdisciplinary social science by integrating the humanities and science. To define evolutionary economics in such a broad sense might be adventurous. However, in Japan this is not just an empty wish, but a real ongoing process. A wide range of research

collaborations between evolutionary economics and other sciences has been realized in the past decade.[1)] In order to make evolutionary economics as coherent and unique as possible in such a situation, we need to give certain answers to the following basic questions.

(1) What exactly do the central concepts “evolution” and “genes” used in evolutionary economics mean?

(2) What objects and by what methods does evolutionary economics perform the transdisciplinary study of socioeconomy?

(3) How does evolutionary economics not only explain the reality of socioeconomy at present but also describe it normatively or show a policy agenda for the future?

These questions stem from the most crucial question as to what evolutionary economics is/ought to be. This signifies the positive identity of evolutionary economics and represents its own unique characteristics not seen in other types of economics. The first two questions inquire about the methodology of evolutionary economics, particularly with regard to prime concepts and objects of study. Question (1) concerns the different connotations of the same terms ‘evolution’ and ‘genes’ used in biology and economics, or, peculiar properties in economic evolution in contrast with biological evolution. Question (2) focuses on various fundamental aspects of methodology in evolutionary economics: ontology/epistemology as a domain of study, deduction/induction/retroduction as methods of scientific discourse and discovery and its relation to other fields of economics, history of economics and other disciplines of social and natural sciences. Question (3) takes up the issue of its uniqueness, distinct from other fields of

[1)] Shiozawa (2004) has already reported that the U-mart project features a virtual futures market by using computer simulation techniques. This is one example of transdisciplinary collaboration of human and natural sciences in which natural scientists participate. Nishibe (2004), which is a collection of articles on such various topics as the framework of study, money, local currencies, market, cognition of agents and complex patterns of world trade and life expectancy of firms, is another example of collaborative research project by young researchers from both natural and social sciences. It is also widely observed, as Shiozawa pointed out, that articles and presentations with multi-agent simulations models whose authors include natural scientists on complex systems propagated in the Japan Association for Evolutionary Economics (JAFEE). Agent-based simulation is a necessary method of study to deal with complex systems with non-linearity and chaos because it is impossible to study a complex system exclusively depending on mathematical analysis. The articles of Hashimoto and Tominomori published in this issue are thought of as the products of transdisciplinary research collaboration, both of which were first presented at the autumn conference with the main theme of ‘Redefining Evolutionary Economics’ held in Sapporo on September 10, 2005, where six guest speakers from the natural and social sciences approached the main theme from different angles.

economics, of evolutionary economics as factual study as well as normative or polity-making study.[2)]

4. The Double Meanings of 'Evolutionary' as a Metaphor: The Recursive Definition of Evolutionary Economics

Evolutionary economics is, most simply defined, such an approach as to study economy and economics from an evolutionary perspective.

It is, on the one hand, a new way of the cooperative creation of theoretical networks in a pluralist framework in which many approaches, using the multisense term 'evolution' as a key metaphor, endeavor to form a loosely coupled system of 'division of knowledge' in order to ontologically identify and explain such economic objects of study as money, market, exchange, finance and so on. We call this aspect of evolutionary economics 'analogical-evolutionary pluralism.'[3)] On the other, it comprises a new way of understanding the recursive relation between economy and economics, which systematically recognizes and explains both economy and economics as evolving as complex systems.

It is comparatively well recognized that various economic doctrines of major economists, say, Smith, Ricardo, Marx, Keynes and Hayek affected, and, on occasion, transformed on a large scale mechanisms, structures, systems and tendencies of socioeconomy as objects of study through change of policies of governments, or change of value, cognition and behaviors of individuals and groups of individuals. But, on the the other hand, economics has always been affected not only by such internal factors as the development and situations of theories, methodology and analytical methods, but also by such external factors as change of economic environments, social situations and its related scientific interests. In other words, economics try to study economy as its external object, but, as economics and economists actually belong to an economy and do not transcend it, they are in reality internal observers. The relation between economy and economics is self-referential and makes a recursive loop. It is not a fully recognized process, but rather an unconscious one. How evolutionary economics differs from conventional economics is that the former tries to be fully aware of the bidirectional causal relation between economy (object) and economics (theory) from an evolutionary perspective, and to appreciate the significance of variances and diversities for the

[2)] Let us say in advance that question (3) is completely untouched in this article because of constraints of space. Nishibe (2005) provides comprehensive answers to these three questions.

[3)] The reason why this is called as such will be explained later on.

evolutionary process more seriously, and situates them in its own methodology.[4)]

To use the phrase 'Names and natures often agree', the name 'evolutionary economics' symbolizes its unique natures arising from the fact that the adjective 'evolutionary' attached to 'economics' expresses a double meaning. We can express such characteristics in the two following cases:

(α) The case *without* a self-referential or recursive relation between economy and economics:

'*Evolutionary economics that explains economy as an evolving system is in itself evolving*.'

(β) The case *with* a self-referential or recursive relation between economy and economics (Different types of brackets in a sentence signify economy's subsumption of (evolutionary) economics in different ranks of reference.):

'*Evolutionary economics that explains economy as an evolving system (evolutionary economics that explains economy as an evolving system [evolutionary economics that explains economy as an evolving system <evolutionary economics that explains economy as an evolving system is in itself evolving> is in itself evolving] is in itself evolving) is in itself evolving.*'

Definition (β) continues to extend itself indefinitely and cannot stop by itself because it embraces infinite recursive loops within it. So we understand that it defines not a definite description of state, a sequential procedure or process in order to make economics evolutionary in the double sense. To put it differently, it expresses 'knowing how' (practical knowledge), not the 'knowing that' (propositional/theoretical knowledge) (Ryle, 1949), of the positive identity of evolutionary economics.

In this vein, evolutionary economics as thus defined is characterized as follows.

(1) Researchers from different perspectives, by different approaches, endeavor to understand and explain the generation, preservation, development, and extinction of socioeconomic institutions, networks, knowledge and techniques while they share such key concepts as institution, evolution and complexity for undertaking analogy, abduction or retroduction (hypothetical inference) for the ontological identification of mechanism,

[4)] Herrmann-Pillath (2001), in his extensive study on the ontological foundations of evolutionary economics, assumes a bimodal ontology of a subject world of mind and an object world without it. He contends that this is essential for establishing the reality of evolutionary economics (pp. 98–100). We admit that there is a substantive similarity in terms of such ontological premise and its theoretical and epistemological implications (say, for pluralism) between his approach and ours when we argue on 'economy (object) and economics (theory) from an evolutionary perspective.'

structure, powers and tendencies in social domains.

(2) Creation of a moderate academic association with diversity is encouraged in order that novelty may emerge from the coevolution of different approaches with mutual competition and cooperation, with a self-referential or recursive relation between economy and economics. A great deal of diversity is necessary particularly in such a case where the economy as the object of economics evolves very rapidly in abrupt change, and conventional frameworks or theories of economics become obsolete at high speed.

Here, the description (1) characterizes evolutionary economics as explaining 'economy as an evolving system' in terms of objects and methods of study, as expressed in the first part of the definition (α) as in '*Evolutionary economics (...) explains economy as an evolving system*', and the characterization (2) presents as its other aspect, as a practical solution in the situation with a recursive loop formed by economy and economics as given, the pluralist position for the discovery of novelty as well as reproduction and development of academic disciplines, as expressed in the other part of the definition (α) as in '*Evolutionary economics (...) is in itself evolving*'.

Evolutionary economics is thus, from the above definition of evolutionary economics, the economics of an evolving economy as well as the theory of an evolving economics. We refer to the latter side of evolutionary economics as 'meta-economics' as this corresponds to transcendental inquiry into economics.

5. The Viewpoint of Meta-economics in the Relation between Economics and History of Economics

Before exploring the implications of the pluralism of evolutionary economics mentioned above in the next section, we shall consider the relation between economics and the history of economics from the perspective of 'emeta-economics' in this section.

First, let us turn to the problem of the bidirectional causal relation between economics and the history of economics. The history of economics can provide building blocks for constructing, and new inspirations for developing, modern economics since it studies the generation, development and extinction of a variety of schools and theories from past to present. If innovation of doctrines is conceivable as inventing new combinations, with partial modifications, of building blocks consisting of old doctrines, then the history of economics will be indispensable in order to understand the genealogy and constellation of various doctrines and schools, and to generate a new theory that has never existed. Evolutionary economics, being aware of this, advocates the 'meta-economics' approach

to integrate economics and the history of economic theory form the evolutionary and self-referential viewpoint.

In fact, this approach has already been initiated *virtually*. The best example of the 'meta-economics' approach in evolutionary economics is Hodgson's *Economics and Evolution* (1993). In the book he presents his own taxonomy, making free use of metaphors and abduction/retroduction, in order to classify a multitude of meanings of 'economic evolution' into systematized categories and, by using retroductive abstraction, to arrange such major economists as Smith, Malthus, Marx, Marshall, Menger, Walras, Schumpeter, Veblen, and Hayek in the taxonomy so that a whole picture of economics is given in view of evolutionary ideas. The case indicates that meta-economics is a concrete form of substantiation of the ideas of the aforementioned pluralism, analogical-evolutionary pluralism.

The task of the history of economics from the perspective of this approach is not to justify the present state of economics by tracing back a lineal historical path, from past to present, of economic doctrines, but rather to enable us to recognize that the collateral diversity of economic schools and doctrines has continued to exist over time, and that this fact suggests not only that there are also many potentially parallel states of affairs which are not actually realized but might have been possible, and will be possible, but also that a diversity of states of economy and economics in the future will be generated through hybridizing them in a new form. This is what the 'meta-economics approach' of evolutionary economics can add to conventional interpretation on the history of economics.

Such a history of economics in a meta-economics approach does not just diachronically describe the generation, development, and completion of a specific school and doctrine. It rather seeks an integration of theory and history in order to study different schools and doctrines synchronically as in a comparative history of economics, or to scrutinize the difference and significance of specific theories and doctrines as in the history of economic theories, so that it might bridge the gap between theories and their genealogy to search for a new combination of theories. Evolutionary economics, then, has a double meaning. It is economics to study socioeconomy in view of evolution, and, at the same time, 'meta-economics' to understand economics also in view of evolution so that it enables us to understand the diverse doctrines of economics in the past as a sort of bundle of possibilities open to the future, just like gene pools for potential use in the future presently scattered through the various species of biological organisms.

Put differently, it is necessary for economists, in order for economics to become a

systematic academic discipline, to observe actual phenomena in socioeconomic worlds and ontologically identify real entities as the object of study by performing abduction/retroduction (hypothetical inference). Suppose that economists' eyes to observe them metaphorically represent the ontology and/or epistemology adopted by different approaches. The eyes can be directed to all aspects of the object from various angles, and, symbolically, even from the surface to the deep layers and structures. Accordingly, they have various directions and distances, occasionally crossing each other. The role of evolutionary economics as meta-economics is to make us be keenly aware of the diversity of those eyes and to integrate images of two-dimensional planes cut off by different approaches into a three-dimensional solid of reality. The method of study of meta-economics is thus different from the diachronically descriptive method in the conventional history of economics, even if both study various schools and doctrines from past to present.

A conventional history of economics tries to restage the genealogy of schools in economics from past to present as faithfully as possible, but it is inclined to describe its history as a process where economics gradually develops towards perfection as new doctrines complement deficiencies and overcome the defects of old ones. As a result, such a history is supposed to be constituted so as to describe a single path predetermined on a time path, from past to present, developing towards the ideal end state, as if the hand scroll of history, whose contents had already been written but unknown to us at the starting point, gradually becomes visible to our eyes as it is unrolled. Such a mono-linear historic view has been dominant in the conventional history of economics, and the multi-linear historic view describing divergence processes with coexistence relations of various schools or doctrines has been mostly neglected. Consequently, the history of economics often functions as legitimating the present configuration of various schools and the consequent power relation among them, rather than providing building blocks for creating a new theory or doctrine in modern economics. In this vein, it is not difficult to admit that neoclassical economics is legitimated because of its present dominance since it is, in a presumed mono-linear historic view, regarded as being most scientific and effective after its survival as the fittest among other schools. The conventional history of economics, because of the intrinsic nature of its own method, even unconsciously tends to function as justifying the present situation.

In contrast, evolutionary economics as meta-economics sees diversity positively from a future-oriented perspective. The role of economics is not only to objectively/mind-independently observe socioeconomy from outside it and explain its structure and

mechanism from an evolutionary perspective but also to become self-aware of its own 'social' status and power as *social practice* within socioeconomy. Statements or discourses of economics in themselves function as such internal effect factors as to constitute part of reality by way of their influence on the behaviors and beliefs of human agents, and, as a result, have the power to change the mechanism of an economic system and effectiveness of economic policies. In other words, economists are not external observers to an economic system but internal observers/practitioners who belong within socioeconomy and commit themselves to its constitution and evolution. Such self-referential characteristics cannot be fully described in definition (α), '*Evolutionary economics that explains economy as an evolving system is in itself evolving*,' so that recursive loops between economy and economics should be introduced in definition (β). In fact, the evolution of economics has affected the course of the evolution of the economic systems which economics tries to describe and explain. Evolutionary economics' self-awareness of this fact, expressed as a self-referential or recursive loop, properly clarifies the practical meanings of economics to the socioeconomic domain. The lack of this self-awareness of an epistemological recursive loop might be termed an *objectivist fallacy*.

For instance, in conventional historical materialism in which economic base or substructure determines ideological and idealistic superstructure, we may say that the one-way causal relation of real economy to economics is only pointed out. But, evolutionary economics in the absence of the *objectivist fallacy* recognizes the existence of the opposite causal relation of economics to economy. It conceives not of a unidirectional but of a bidirectional relation between economy and economics. It contends that, even though the effect of the first causal relation is stronger than that of the second one ordinarily in human history, particularly in a capitalistic market economy, the latter is not negligible, and is even stronger than the former occasionally.

As stated before, novelty emerges not from nothing, but phylogenetically from a new combination, with certain necessary amendments and different implications, of modules or parts of old beings. Evolutionary economics therefore needs to become more aware of its self-referential property, endeavor to create a new theory by integrating building blocks or modules used in various old theories, and form a better influential relation to the real economy. Evolutionary economics seeks not conventional approaches for the history of economics that diachronically describe the 'objective' history of individual schools, but meta-economics approaches attaching a higher value to awareness of where it could lead economics in the future. Then, for that purpose, researchers in evolutionary

economics are asked to carve specific aspects out of the history of economics and reconstitute them from their proper visions on those issues inherent in the time and place they inhabit, and, from such viewpoints, try to make cross-cutting comparisons of various schools so as to reach a comprehensive understanding of economy and economics.

6. The Implications of Analogical-Evolutionary Pluralism

Here we extensively examine the implication of the pluralism for evolutionary economics discussed in section 4, referred to as 'analogical-evolutionary pluralism'.

Methodological pluralism (Caldwell, 1982) describes the situation where many schools or research programs with definitely different sets of concepts, methods of study, or proper domains compete and coexist. Its main problem can be explained as follows. The diversity of different schools or research programs is just described as a given situation of a certain discipline and justified for novelty or productive dialog among members of alternative research programs, but there is no explanation of how such diversity is created in the first place, and why novelty and productive dialog are generated without plunging into a state of incomprehension and mutual distrust.

Analogical-evolutionary pluralism can answer such questions. It is the kind of pluralism where the common use, by different approaches and angles, of analogical concepts and analytical methods can activate multi-dimensional complex networks of diverse approaches to spontaneously and dynamically develop. Accordingly, the networks thus formed mediated by analogical concepts can enhance the collective capability of associations for evolutionary economics to identify proper (but overlapping) domains and ontology for study. Besides, as, *with* built-in self-referential or recursive relations between economy and economics, both of them dynamically fluctuate in a relatively independent way with such occasional upheavals or cataclysms as revolutions or the collapse of systems, then a vast disparity between economy and economics is eventually created, so that the diversity of different schools or research programs should become much larger than otherwise. This shuffling movement explains why the initial diversity is created in the first place.

Pluralism in economics has recently been discussed extensively, and it is sustained in many arguments. Bouwel (2005) identifies five distinct motivations for pluralism in economics: a) ontological motivation, b) cognitive limitations as a reason for plurality, c) historical and geographical situatedness as source of pluralism. d) pragmatic motivation, e) strategic motivation. For example, one of the arguments for b) is as follows.

'Since no theory can consider all relevant factors in any particular economic context, there is a strong *prima facie* case for theoretical pluralism. Different theories will often be complementary rather than alternative, so that 'to seek dominance for one theory over all the others with the possible result that all the rival theories are extinguished amounts to advocating scientific regress' (King, 2004).

This can be interpreted as a reference to 'meta-economics'. The complexity of economic reality necessitates the complementarity, rather than substitution, of different theories, and rivalry among them encourages an intentional better result of scientific progress through an evolutionary process.

The motivations for 'analogical-evolutionary pluralism' may be summarized as 'ontologically and epistemologically evolutionary', and in fact correspond to the combination of a) through e). Each position is interpreted appropriately in evolutionary terms: a) as ontological complexity and openness of evolutionary systems for objects of our study, b) as ontological limitation or locality of cognition and calculation of evolutionary agents for objects of our study, c) as ontological spatio-temporal diversity of evolutionary systems for objects of our study, d) as epistemological partiality and fallibility of different approaches in evolutionary economics, and e) as a strategic move in the meta-economic game of trying to dominate as a majority in a discipline based on the ontological character of economics as a social science. Analogical-evolutionary pluralism means not only a disciplinary framework of description and explanation, but also the attitude and ethics of study in academia. Accordingly, the position for evolutionary economics with the double meanings of 'evolutionary' can give us the most plausible and comprehensive accounts of motivation for pluralism in economics.

7. On the Relation of Evolutionary Economics to Other Disciplines

Let us move on to the next issue on the relation of evolutionary economics to other social and natural sciences.

Evolution is conceivable in various stratified domains such as the spacesphere, geosphere biosphere and humansphere, even in natural sciences. To directly import the conception of evolution in biology, in particular the neo-Darwinism presently dominant in the field, into economics is rather more misleading than insufficient. In such a case, the peculiar characteristics in the social domain are easily lost. But we must also admit that there might be unknown deep connections between different domains so that, for example, the revelation of the evolution of the universe, the galaxy, the solar system and the earth unraveled in the domains of spacesphere and geosphere must affect our

understanding of evolution in the biosphere and humansphere of the future. The principle of emergence, where new properties or entities emerge in the upper domain of the real world that are not seen as nor reducible to those in the lower levels, also acts on the conception of evolution. Hence we must understand that the single universal concept of evolution is not applicable to all the spheres, and that concepts of evolution are not only multiple but are themselves evolving as emergent properties peculiar to the stratified domains of our universe.[5] It is indispensable for evolutionary economics to conduct a *meta-evolutionary* approach by which we identify the appropriate concept of evolution for the socioeconomic domain, with reference to various types of concepts of evolution in the natural sciences. This is one of the reasons why evolutionary economics must seek to integrate the humanities and sciences.

From the 18 th century to the 19 th century, economics had a substantial influence on biology. The thoughts on evolution in the economics of Mandeville, Smith and Malthus contributed to the birth of the Darwin's theory of evolution ('descent with modification'). At the end of 19 th century, Veblen and Marshall made attempts to create evolutionary economics or biological economics, though they only left the grand concept of a framework rather than its concrete contents. Nevertheless, economics in the 20th century has developed by importing the concept or technique of such old physics in the past as classical mechanics and thermodynamics. It is probably because, on the one hand, studies in theory of evolution had not fully ripened into maturity in those days and had not yet come to have a big impact on economics, and, on the other hand, it was hard to recognize the evolutionary viewpoint accompanied with complexity and pluralism in the 20th century that was swayed by the simple dichotomy of market vs. planning, or, capitalism vs. socialism.

But the situation is changing now. Such various related fields in natural science as computing, cognition, artificial intelligence, artificial life, chaos, complexity, self-organization, and autopoiesis have greatly developed, and have had great influence on economics. Moreover, cases where natural scientists participate in research into evolutionary economics are increasing in number because the theory of evolution and complex system science has come to target not only nature but also society. On the other hand, original deployment of evolutionary economics in evolutionary game theory, experiment and simulation analysis has affected natural science. Besides, since the defects in a state socialist planned economy as well as in a laissez-faire capitalist market

[5] For the evolution of evolution, see the discussion in the next section.

economy had become quite clear by the end of the 20 th century, the 21st century will be the time when polymorphic systems of socioeconomy are sought. Under such circumstances, evolutionary economics is now expected to be a discipline that understands diversity as a bundle of possibilities open to the future.

Here let us examine Lawson's assessment of evolutionary economics from our viewpoints of meta-economics and analogical-evolutionary pluralism. Lawson (1997, 2003) argues that ontology should be more appreciated since modern economics continuously neglects explicit ontological analysis because of its epistemic fallacy. Particularly on evolutionary economics, Lawson (2003, ch. 5) further maintains that this is also shown in the manner that evolutionary economics directly borrows evolutionary concepts from biology to social theory. According to him, this easy transfer of a method or framework from one realm to another takes places in the form of a universal approach with natural selection models, irrespective of the different nature of the object of study. He identifies five essential features of a general evolutionary model: population of individuals (P), variety generation (V), reproduction (R), selection mechanism (S) and the degree of independence between V and S. Then he presents three kinds of PVRS models, i.e., the neo-Darwinian PVRS model with V-S strictly independent, the Lamarckian feed-backward PVRS model, and a feed-forward PVRS model. Although Lawson admits all of these can actually exist in the biological realm, he insists that the neo-Darwinian PVRS model representing the natural selection mechanism is nothing but the one that evolutionary economists borrow from biology, and asks whether the PVRS model can do anything more than the transformational model of social activity (TMSA) that can already explain the nature of a social system as open and dynamic. His answer to the question is no. He thus concludes that borrowing evolutionary concepts or models of natural selection from biology into economics is of some use, but not more useful than TMSA.

This whole argument seems to be developed to explain that such an endeavor eventuates in an *abductionist fallacy* as epistemology is more appreciated than ontology. I agree with his general diagnosis of the case of ontology and epistemology in economics, but not with his criticism of the alleged borrowing from evolutionary biology. He tends to describe evolutionary economics in a narrow range so that he can criticize it as a straw man. Evolutionary economics, as least in large part, neither commits an abductionist fallacy, or, direct application of the neo-Darwinian type of natural selection without recognizing ontological differences between the biological and the social realm, nor asserts validity of such a universal framework of analysis, denying

pluralism in economics. I rather suggest that evolutionary economics should, without importing evolutionary concepts and ideas directly from biology, identify replicators and interactors unique to socioeconomic domains. It is crucial, in so doing, that we use metaphorical or retroductive abstractions of what we can learn from the recent development of DNA studies, particularly after the complete determination of the human genome sequence, reconsidering the transformation of the rigid view of gene reductionism based on 'nature vs. nurture' into a more flexible idea of a Genome Organizing Device (GOD) based on 'nature via nurture' (Ridley, 2003). In short, evolutionary economics is, and can be, much more widely defined than it is by Lawson.

8. The Concept of Evolution and Genes in the Socioeconomic Domain

We explained in section 4 that evolutionary economics has a double meaning, in which the term 'evolutionary' modifies both 'economy' and 'economics', and described its self-referential character in the sense that evolutionary economics is a description both of economy as an evolving social practice system on the object level, and of economics as an evolving social discourse system on the meta level. We examined the latter aspect of evolutionary economics as meta-economics in section 5. We now turn to the former aspect thereof.

The connotation of the term 'evolution' presently used is different not only from reversible move or change, but also from irreversible growth or progress and development or unfoldment. While growth or progress means increase or incremental change in quantity or quality desirable for people, as in GDP growth or technological progress, development or unfoldment is interpreted as the gradual manifestation over time of a predetermined future or end state. Evolution, even if it is an irreversible process, does not assume a single pathway in development, nor teleology in development. Before proceeding further to identify the meaning of social evolution, let us first take a look at the recent development of biological evolution.

The human genome project was completed in 2003 and determined the sequences of the 3 billion chemical base pairs that make up human DNA. It was found that the human genome contains only 30,000 genes that code protein formation,[6] occupying only 2% of human DNA; the remaining 98% are related to the control of genes. However, the genome of Escherichia coli (E. coli) is mostly used for coding genes; its number is 4,000. The difference seems to suggest that the central domain of biological evolution

[6] The number of genes has been corrected from 30,000 to 22,000 genes thereafter.

has historically moved from that of genetic codes to determine the structure of protein, to that of control of genes to determine when and where to use genetic codes in response to ontogenetic growth of individual organisms or change of external environment, and further to that of adaptive ability to widen the diversity of the control of genes to increase the tolerance level to the overall change of environments. Even though, as the gene-centric view contends, genetic mutation and natural selection are the central mechanisms of evolution for a simple organism such as E. coli, in the case of a highly complex animal like the human, multi-feedback networks formed by genes and proteins for control mechanism, sustaining a diversity of genes and adapting to various environmental changes, are central in the driving forces of evolution (Kaneko and Kodama, 2004). Now we must take account of the implication of the evolution of biological phylogenetic evolution and, by using such meta-evolutionary abduction, try to recognize the even more complex nature of socioeconomic evolution.

A modern economic system that evolutionary economics has as its object of study is characterized as large-scale, complex and uncertain. While 'large-scale' denotes a large number of agents in the system such as individuals and organizations, 'complex' implies a wide variety and number of, whether linear or non-linear, interrelations and interactions among many agents, mostly forming multi-layered networks of interdependencies. Here 'uncertain' means not only the undetermined character of stochastic future events in prediction and expectation of agents, or in statistical laws, but indeterminacy endogenously generated from mutual ignorance and the diversity of interpretations and recognitions that individual agents have with different cognitive frameworks as to events or affairs from past to present under the condition of ignorance of agents.[7)]

Methodological individualism has so far regarded an economic system as being in the harmonious state where optimal behaviors of individual agents are mutually coordinated. But, as economic agents are faced with a limited capability for information collection, information processing and execution in a large-scale economic system with complexity and uncertainty, they draw upon routinized behaviors, conventions or social rules of conduct in order to decrease the heavy loads imposed by continuous decision-making and execution. Such situated rational agents with limited ability must have sufficient hardwired cognitive and responsive frameworks built-in from the outset, but more complex frameworks are *a posteriori* obtained and revised through learning or imitation

[7)] See the next note for the meaning of 'endogenous indeterminacy' as mentioned here.

of behavioral rules and social institutions through actual interactions with other agents.

At all events, it would be observed that the whole pattern of decision-making and the actions of each agent form multi-layered nested structures of feedback and/or feedforward mechanisms with different frequencies over time, for instance, from short-term reflex actions to long-term deliberation or forecast. In this vein, it is important to understand that a large-scale and complex system is feasible only as a loosely connected system with multi-layered buffers. Such buffers that consist of inventories (physical buffers) and money stocks (financial buffers) function as decoupling and informational mechanisms on the multi-layered adjustment behaviors in terms of stocks of goods or money, capacities of production or credit, investments or depreciation in fixed capital, and R&D and innovations with different time horizons (temporary, short-run, medium-run, long-run and super long-run).[8)] Economic systems are apt to be regarded as independent of other social, political and cultural factors, but, as the multi-layered nested structures of decision-makings and the actions of each agent are complexly intertwined with such factors, the economic system cannot be separated from other systems. This inseparable whole system is termed a 'socioeconomic system' that exists as an evolving ecosystem where various systems, institutions and social rules coexist in complementary and/or substitutive relations. The principle of socioeconomic evolution is different from that of biological evolution.

First, replication or heredity does not hold in socioeconomic systems in the strict sense that genes as real entities exist in biological evolution. Rules, institutions and organizations, routines or customs are regarded as quasi-genes that can endure and reproduce themselves for a fairly long time and are replicable, though without precision,

[8)] Kichiji and Nishibe (2004), concretizing the general ideas of Nishibe (1996, 1998), Shiozawa (1990, 2004) by using agent-based simulation models, study the endogenous dynamics of the market system formed as a dispersive network of transactions among agents, where 1) firms have the same structures of 'if-then' rules of routinized behaviors for multi-layered adjustment in which firms increase (or decrease) the production level if inventory vanishes (or exceed the threshold value), and increase (or decrease) the price of products if the cumulative number of change in production in the same direction exceeds the predetermined tolerance values, 2) they have the same values for all parameters except for different threshold/values for inventories of finished goods, and 3) they are mutually ignorant of other agents' inner parameters. The combinations of different threshold/tolerance values signify the different cognitive/responsive frameworks. So once all the initial parameters are set, agents show different patterns of adjustments in terms of inventory/production as well as price formation over time, which endogenously create the macro dynamic fluctuations of the system. This can be depicted as a model for the market of a loosely connected system formed by interactions of agents with the decoupling mechanisms of inventories and frequencies of price change that be explained here.

but those equivalent to biological genes in socioeconomic domains are not materially identifiable. They are not physical or chemical materials, but social things or relations that can only exist on such platform institutions or communication media as language or money. Social quasi-genes, compared with biological genes, are much more abundantly various and exist on every level of social domains. But even in biological evolution there is still controversy over whether or not there is group selection, or, more generally, multilevel selection contrary to the gene-centric view of evolution.

Secondly, variation of such quasi-genes does not arise in mutation or crossing but more prompt drift as aberration from the norm or innovation occurring to such purposeful behaviors as imitation and learning using language/sign or money as communication media. This case corresponds to the Lamarckian inheritance of acquired characteristics in social domains. But knowledge is communicated more rapidly than inheritance between generation through learning and imitation among individuals and groups in markets, organization and communities. Thus Lamarckian evolution is further extended in social evolution.

Hence, it is now clear that evolutionary economics need not adopt evolutionary concepts in biology. In order for evolutionary economics to explain the emergence and dynamic movement of a system from behaviors of micro-level constituents or agents, it should first search for a Darwinian, non-consummatory, phylogenetic approach without embracing Dawkins's gene reductionist position. Thus, evolutionary economics must, unlike the neoclassical economics that confines replicators to the rational behavior of selfish agents such as individuals and firms, 1) permit a wide range of stratified entities of such quasi-genes as customs, routines, conventions, social rules, institutions and economic systems, 2) theoretically constitute multiple bidirectional causal relations between the micro level of behaviors of agents and the macro level of the emergence of rules, institutions and economic outcomes (a micro-macro loop), incorporating such Lamarckian evolutionary factors as improvement/innovation though imitation/learning, and differentiation/diversification by division of labour/knowledge, and 3) depict the process where the social actions, positions and attributes of economic agents (individuals, firms and other groups and organizations) as interactors are selected through interaction with the environment including those of other agents. Social macro systems exist as multipolar and multi-layered structures (a multi-lattice structure) where each constituent interacts horizontally with other constituents on the same level and is affiliated with multiple constituents on the upper levels. Social evolution with these properties can be called 'Lamarckian-Darwinian', based on stratified realism as

ontological understanding.[9)]

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[9)] The concept of stratified ontologies (Lawson, 1997, ch. 6) is extremely important for evolutionary economics since it allows multilevel bidirectional causality and emergence of novelty.

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