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METHODS

Empiricism in ecological economics: a perspective from complex systems theory

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Abstract

Economies are open complex adaptive systems far from thermodynamic equilibrium, and neo-classical environmental economics seems not to be the best way to describe the behaviour of such systems. Standard econometric analysis (i.e. time series) takes a deterministic and predictive approach, which encourages the search for predictive policy to 'correct' environmental problems. Rather, it seems that, because of the characteristics of economic systems, an ex-post analysis is more appropriate, which describes the emergence of such systems' properties, and which sees policy as a social steering mechanism. With this background, some of the recent empirical work published in the field of ecological economics that follows the approach defended here is presented. Finally, the conclusion is reached that a predictive use of econometrics (i.e. time series analysis) in ecological economics should be limited to cases in which uncertainty decreases, which is not the normal situation when analysing the evolution of economic systems. However, that does not mean we should not use empirical analysis. On the contrary, this is to be encouraged, but from a structural and ex-post point of view.

Keywords: Ecological economics; Neo-classical environmental economics; Empiricism; Predictive analysis; Complexity; Post-normal science; Policy

1. Introduction

Ecological economics deals with, and is related to, policy generation and, in order to do this needs numerical data about both human and natural systems. It is the goal of this paper to analyse the role of empiricism in the framework of neo-classical environmental economics and ecological economics. After doing that, the paper defends a phenomenological and ex-post analysis to deal with the complexity of modern economies, by giving some examples of empirical work already done under this view.

The concepts underlying ecological economics and neo-classical environmental economics will be outlined, to emphasise that the latter makes some strong implicit assumptions about the working of systems under its analysis (i.e. economic systems).

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These assumptions are compatible neither with the main characteristics of present complex environmental systems nor with the nature of economies. This is why ecological economics deals with both the problems and the systems in an alternative way.

The structure of the rest of the paper is as follows: Section 2 focuses on the conceptual structures in ecological economics and in neo-classical environmental economics from an evolutionary perspective based on the concept of time. Section 3 presents the debate about the role of policy for sustainability purposes. Section 4 presents the position of these two schools of economic thought on empirical analysis, focusing on time and evolution. With this background, Section 5 mentions some of the latest developments in empirical analysis that have been published in the field of ecological economics, and that are an example of what could be empirical analysis when dealing with complexity in ecological economics. Finally, Section 6 reaches the conclusion that a predictive use of econometrics in ecological economics should be limited to cases in which uncertainty decreases. This leads to presenting the way ahead regarding empirical analysis in ecological economics, and its relationship to policy formulation.

2. Conceptual structures in ecological economics and in neo-classical environmental economics

2.1. Neo-classical economics

Neo-classical economics focuses on the exchange of goods and services among the economic agents, such as consumers and producers, emphasising the role of consumer preferences and resources endowments, to guarantee the economy's equilibrium. As pointed out by Ruth (1993) the main characteristics of this approach are a concentration on market mechanisms, a focus on microeconomics instead of macroeconomics, static analysis (neglecting then the history of processes), linearity, and a consideration of the environment only as a given boundary. This means that the methodology developed by neo-classical economics, general equilibrium theory, guarantees the achievement of a solution in the allocation of scarce resources (Faber et al., 1996).

To understand better neo-classical economics we might think that it follows classical mechanics in its description of the economic process. That is, production, consumption, or distribution are seen as single processes that can be analysed separately to achieve not only understanding of them, but also to make possible forecasting. In the words of Georgescu-Roegen (1971) (p. 319), it "is a mechanical analogue". As in mechanics, economists are seeking "universal laws" that can be applied everywhere and regardless time. Once laws are defined and basic principles or axioms are accepted, then this economics must be a theoretical science, deductive, and deterministic, capable of finding unique optimal solutions.

Since neo-classical economics follows mechanics, where all processes are reversible, its equations and models are also 'time symmetric', where time is just a cardinal magnitude, which can, therefore, be added or subtracted (Beard and Lozada, 1999). At this point it is worth mentioning Georgescu-Roegen's distinction between 'time' and 'Time'. Using his own words (1971, p. 135), "T represents Time, conceived as the stream of consciousness or, if you wish, as a continuous succession of "moments", but t represents the measure of an interval (T', T'') by a mechanical clock" (emphasis in the original). Neo-classical economics claims the theory to be valid in all societies, that is, to be a-historic, because they are considering mechanical time, instead of historical Time. This distinction is relevant since it is related to Prigogine's (Nicolis and Prigogine, 1977; Prigogine and Stengers, 1984) Second Arrow of Time, which in words of Proops (1983) (357), is "the tendency of certain systems to become more complex and more structured".

Neo-classical natural resource and environmental economics, deals with the environment by analysing the threats of scarcity and pollution using the ideas described above. The methods developed have been: (i) optimisation in the case of managing natural resources (either renewable or exhaustible), and (ii) assigning property rights on pollution (or more generally externalities) in order