Modelling of Complex Economic Systems: Toward Conceptual Platform

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ABSTRACT

This paper discusses various modelling platforms that can be applied to describe complex systems embedded in economics, as well as the role of modelling in the context of three main functions of scientific research: description, explanation and prediction. Qualitative modelling (non-quantitative) is characterized as an initial stage of any modelling approaches, including the one represented by econometrics. The requirement to begin the modelling process from a non-quantitative perspective represents the vital precondition to satisfy the “isomorphism” function of modelling in relation to real live systems being modelled. Qualitative as well as quantitative description models create the foundation for explanatory model development. These, in turn, can be used for prediction purposes satisfying the third main scientific function of research.

Keywords: business models; conceptual design; descriptive modelling; economics; modelling process; qualitative research; systems approach; systems design

INTRODUCTION

The word “model” is used in an equivocal manner and may be interpreted in different ways. Because of that, classifications or typologies of models are also developed from different perspectives. This gives the impression that a certain option exists by adding some adjective to the word “model” (such as “descriptive”, “mathematical”, “abstract”, or “semantic”).

On the other hand, a trend is observed in economic sciences to interpret the word “model” narrowly or econometrically. A model of economic phenomenon is thus most often understood as a formalized one with linear, less often nonlinear, description.

This paper discusses the role of modelling in describing complex economic systems and argues the important role of not only formal, but also soft (descriptive or qualitative) modelling in economics. Descriptive modelling is characterized as a preliminary stage of modelling. This qualitative stage is, in our opinion,
an indispensable condition in the process of fulfillment for the model’s isomorphism function towards projected reality. A descriptive model, combined with a formalized one, represents the foundation for development of an explanatory model, which in turn can be used for prediction purposes, satisfying the main function of scientific research.

The main theme of this paper evolves around the opinion that economists, in order to test their theories, should start with the thorough description of reality through a descriptive model assuring that theoretical structure depicts a real-life system under consideration. In this way, the Popper’s (1974) verisimilitudinity theory, as the main purpose of science, will be assured.

RESEARCH IN ECONOMICS: SYSTEM’S PERSPECTIVE

Depending on the scientific school, the object of research in economics is understood either widely or narrowly. Institutionalists focus on economics embedded in social realities and try to include all possible conditions and parameters — this is a wide approach. Monetarists narrow their areas of investigation to selected factors and economic relations only. The former assumes that human behaviour is hardly foreseeable, the latter assumes that we act in a rational manner. In this paper, it is postulated that the higher the level of abstraction used in specifying the object of economic analysis, the farther we can be from economic realities. But, on the other hand, we have to remember at all times that a deep and thorough, real-life description does not validate a theory automatically (Blaug, 1973, 1982).

A modelling process is very often looked at from a system’s perspective. One can find quite a number of different meanings of the word “system” in the literature. The most often accepted definition of a system is one in which we say that a system is a group of different elements mutually related and influencing each other, being a whole in some way (Lubański, 1982). The word “whole” suggests that “system” is an organized and integrated construction, which structure generates some qualities not attributed to any element alone.

Gasperksi suggests that the system’s approach consists of the following steps (Cackowski, Kmita, Szaniawski, & Smoczyński, 1987):

1. Deciding if we are interested in the internal structure of the considered object of study (if yes, the object is a system; if not, this object is a basic element of a larger system);
2. Decomposing the subjected object into parts;
3. Deciding if the internal structure of the first subdivided part interests us under the performed study (if not, we consider the researched part as elementary; if yes, we treat this part as the lower level system, a subsystem);
4. Decomposing of subsystem into parts;
5. Repeating steps 3 and 4 as many times as there are parts in the system, including its subsystems, until all parts are elementary;
6. Considering if the structure of the world outside our system is of interest to us (if not, we have recognized the “rest of the world” as an environment; if yes, we recognize it as a suprasystem); and
7. Decomposing the suprasystem according to steps 1 through 5.

By relating the matter of economic research to the procedure mentioned in these steps, it is easy to notice that both economics as a whole, and individual markets are systems.

The three-step model of complex systems indicates, as illustrated in Figure 1, that systems should be analyzed by Szczerbicki (1993, 1993a):

1. Decomposition into components,
2. Description of these components, and
3. Integration of described components into a solution.

Particularly, such a procedure is applicable to systems with complex flows of information (Szczerbicki, 2001; Szczerbicki &
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