CHAPTER 1

NONLINEAR ECONOMIC DYNAMICS

1 DYNAMICS VERSUS EQUILIBRIUM ANALYSIS

Dynamic analysis in economics is as old as economics itself. A glance at the subject index in Schumpeter (1954) is sufficient to convince you about this. Even dynamic mathematical models are fairly old. The cobweb model of price adjustments for instance dates back to 1887.

Throughout the history of economics there has been a competition between the dynamic and the equilibrium outlooks. As an alternative to a truly causal or recursive dynamics there is the concept of an equilibrium balance of forces.

In general the equilibrated forces are results of optimizing behaviour, and therefore the epistemological polarity - causal versus teleological - is involved. (Moreover, expectations of the actions of others as well as the optimality of one's own belong to the concept of equilibrium.)

Certain controversies in the history of economics reflect this polarity of different philosophical outlooks. One example is provided by those who objected the Marshallian concept of market equilibrium on the grounds that price could not be determined both by cost and utility at once. These objections need not be ascribed to mathematical ignorance. Another example is the more recent discussion on recursive versus interdependent systems in econometrics.

On the whole equilibrium analysis has been dominant during the history of economics, especially in various classical periods. Maybe it is natural that a classical period of scientific consolidation emphasizes the harmony in a balance of forces, whereas more turbulent periods of renewal favour the genuinely dynamic outlook.
A basic theme in Schumpeter (1954) is the alternation between periods of renewal and what he names "classical situations". Implicit is that we tend to overestimate the consolidation periods and underestimate those of scientific renewal. The term "classical situation" roughly corresponds to what Kuhn (1962) called "normal science". Schumpeter identifies thee classical periods in the history of economics, and describes them in those somewhat ironic words: "... there is a large expanse of common ground ... and a feeling of repose, both of which create an expression of finality - the finality of a Greek temple the spreads its perfect lines against a cloudless sky".

Schumpeter would certainly have agreed that today we have a fourth classical situation with a complete dominance of general equilibrium theory. The concept of a commodity not only represents all physically different brands, it also specifies availability at different moments and in different locations. When an intertemporal equilibrium, based on "rational" expectations is established, economic evolution merely becomes a cinema performance of a film produced beforehand, and a dynamic process over time just represents a very specific sequence of coordinate values of the equilibrium point. How different this outlook is from that represented in Samuelson (1947) where equilibrium analysis is regarded as the simplified study of stationary processes alone. The claim to higher generality is a sign of dominance as good as any.

2 LINEAR VERSUS NONLINEAR MODELLING

When the flourishing field of economic growth theory finally collapsed under the attacks from "The Club of Rome" and the "Limits to Growth" movement this was the end to the latest outburst of economic dynamics. Although several economists managed to deliver convincing counter-attacks on the ad hoc character of the computer simulated models on which the doomsday scenarios were based, economic dynamics never recovered.

The basic reason for this must have been the inherent limitations of linear dynamics then in use. A linear dynamic model can either produce explosive or damped movement. The latter option was used in the study of stability in dynamized market equilibrium models, the former became the basis of growth theory.

We may, however, ask whether a model is at all dynamic if it can only explain the progressive decay of any exogenously introduced deviation from eternal equilibrium.

In the explosive case we have to consider the following problem: In general we assume that functions among variables are nonlinear but smooth. Therefore they can in certain intervals be approximated by linear relations. But then we must be sure that the approximation is not used in a model producing change so large that the bounds of the approximation interval are violated. When Hook's law, representing the restoring force of a spring as proportionate to its elongation, was used in models of mechanical vibrations, it was granted that the variables were kept in the interval for which the approximation