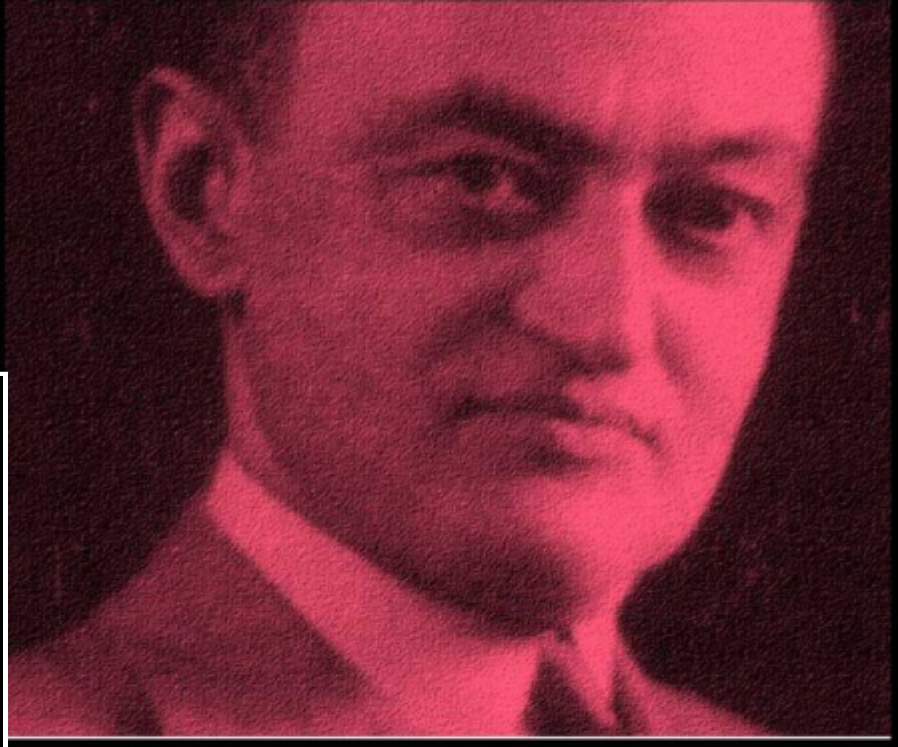

Unholy Trinity

Labor, capital, and land in the new economy

Duncan K. Foley

THE GRAZ SCHUMPETER LECTURES

Unholy Trinity

Labor, capital, and land in the new economy

Many of the central results of Classical and Marxian political economy are examples of the self-organization of the capitalist economy as a complex, adaptive system far from equilibrium.

Unholy Trinity explores the relations between contemporary complex systems theory and Classical political economy, and applies the methods it develops to the problems of induced technical change and income distribution in capitalist economies, the control of environmental externalities such as global warming, and the stabilization of world population.

The arguments and methods of this important book address central problems both of economic science and economic policy, and provide fresh paths for theoretical exploration.

Duncan K. Foley is Leo Model Professor of Economics at the Graduate Faculty of New School University, New York City.

The Graz Schumpeter Lectures

Unholy Trinity

Labor, capital, and land in the new economy

Duncan K. Foley

Routledge
Taylor & Francis Group
LONDON AND NEW YORK

First published 2003
by Routledge
11 New Fetter Lane, London EC4P 4EE

Simultaneously published in the USA and Canada
by Routledge
29 West 35th Street, New York, NY 10001

Routledge is an imprint of the Taylor & Francis Group

This edition published in the Taylor & Francis e-Library, 2004.

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
A catalog record for this book has been requested

ISBN 0-203-45647-5 Master e-book ISBN

ISBN 0-203-34080-9 (Adobe eReader Format)
ISBN 0–415–31079–2 (Print Edition)

For Helene and Nico

Contents

Foreword

The Graz Schumpeter Lectures

On 30 October 1911 Joseph Schumpeter (1883–1950) was appointed by Emperor Francis Joseph Professor of Political Economy in the University of Graz, in Schumpeter's words "the most agreeable university in Austria." He remained a faculty member until 1922. Schumpeter used to call the thirties in a scholar's life "the scared decade of fertility." True to his belief, the publication of the German original of the *Theory of Economic Development* coincided with Schumpeter's arrival in Graz. A string of well-known works such as *Economic Doctrine and Method, The Crisis of the Tax State* and *Zur Soziologie der Imperialismen* bear testimony to the extraordinary productivity of the period spent in Graz.

The Graz Schumpeter Society was founded in 1995. Generous financial support from the Government of Styria promoted the inauguration of the Graz Schumpeter Lectures in the same year. Meanwhile, the Lectures are firmly established in the pertinent intellectual community. A search committee appoints the Graz Schumpeter Lecturer for a particular year. Lecturers are chosen on the merits of their original contribution to scholarship. The Lectures aim at the frontiers of knowledge in areas of research distinguished by rapid innovation and potential applicability of their results in economic and political decision making. While the Lectures are named after Joseph Schumpeter, their concern is by no means confined to his life and work. In Schumpeter's spirit, lecturers are encouraged to transgress conventional disciplinary boundaries and to enquire into more inclusive views of the social world.

Stephan Boehm
Chairman, Graz Schumpeter Society

Acknowledgments

I would like to thank the Schumpeter Society for the invitation to deliver these lectures, and the University of Graz and its Department of Economics for the warm welcome I found in Graz. Heinz Kurz's friendship and support has been invaluable to me in completing this work. Sam Bowles, Gérard Duménil and Dominique Lévy, Tom Michl, Karaswamy Velupillai, and Sergio Parrinello have taken the trouble to give me helpful comments on various aspects of this book. Alexander J. Julius provided me with crucial bibliographic suggestions and a sustained critical dialogue on the issues discussed here. The book has also benefitted from comments and reactions at seminars at the Universities of Rome I and III, the University of Pisa, the University of Frankfurt, and the University of Siena. Much of Chapter 4 has been reprinted from my article, Stabilization of human population through economic increasing returns. *Economic Letters*, 68(3), pp. 309–17, 2000, with permission from Elsevier.

Duncan K. Foley

1 Complexity, self-organization, and political economy

Introduction

My theme in this book is the capacity of the methods of the Classical political economists, Adam Smith, Thomas Malthus, David Ricardo, and their critic, Karl Marx, to reveal the self-organizing character of the capitalist economy regarded as a complex, adaptive, non-equilibrium system.

From one point of view this is an exercise in anachronism, since the language of complex systems theory and its application to economic problems is only about forty years old, and it is implausible to claim that Smith or Ricardo or Marx thought about the problems of the economy using the conceptual tools of complexity science. On the other hand, I will argue that the language and vision of the Classical political economists incorporates many insights of contemporary complex systems theory. There are also indirect but important intellectual pathways that connect the Classical political economists of the eighteenth and nineteenth centuries to the twentieth century emergence of complexity science. I also will argue that complexity theory sheds some light on the extraordinary effectiveness of the Classical political economists' methods and the depth of their analytical results. I believe that contemporary economists still have much to learn from these methods and results about the capitalist economy and its evolution.

What is a complex system?

Complexity theory represents an ambitious effort to analyze the functioning of highly organized but decentralized systems composed of very large numbers of individual components. The basic processes of life, involving the chemical interaction of thousands of proteins, the living cell, which

localizes and organizes these processes, the human brain in which thousands of cells interact to maintain consciousness, ecological systems arising from the interaction of thousands of species, the process of biological evolution from which new species emerges, and the capitalist economy, which arises from the interaction of millions of human individuals, each of them already a complex entity, are leading examples. Some introductions to the concepts of complex systems theory are Cowan *et al*. (1994), Kauffman (1995), Albin and Foley (1998), Wolfram (2002). A good introduction to the mathematics of complexity theory is Casti (1992, ch. 9).

Complexity theory starts from the bold and controversial conjecture that these diverse systems have important features in common that transcend their apparent differences in scale, material components, and organizing laws of motion. What these systems share are a potential to configure their component parts in an astronomically large number of ways (they are *complex*), constant change in response to environmental stimulus and their own development (they are *adaptive*), a strong tendency to achieve recognizable, stable patterns in their configuration (they are *self-organizing*), and an avoidance of stable, self-reproducing states (they are *non-equilibrium systems*). The task complexity science sets itself is the exploration of the general properties of complex, adaptive, self-organizing, non-equilibrium systems.

The methods of complex systems theory are highly empirical and inductive. The complex systems scientist tends to study the properties of particular simplified and abstract models of complex systems. These models often involve the study of the interaction of large numbers of highly stylized and simplified components in computer simulations, with the aim of identifying generalizable properties of adaptability and self-organization common to a wide range of complex systems. A characteristic of these stylized complex systems is that their components and rules of interaction, though they are often very much simpler than real neurons or proteins or capitalist firms, are *non-linear*, that is, that they exhibit qualitative differences in their behavior in response to stimulus of different intensities and scales. The computer plays a critical role in this research, because it becomes impossible to say much directly about the dynamics of non-linear systems with a large number of degrees of freedom using classical mathematical analytical methods.

There are many potential pitfalls in this research project. Most of these arise from the difficulty of verifying the general character of the specific phenomena observed in particular models. A pattern of self-organization, for example, may turn out to reflect a particular symmetry of interaction implicit

in the model system, and thus not to appear in similar systems that lack this symmetry. Skeptics question the premise that complex systems share any general determinable properties. The record of complexity research has not put these doubts to rest. Its triumphs remain largely in the realm of brilliant insights connected to particular models, and a unified synthesis remains an elusive goal. Nonetheless, the methods of complex systems science have had a growing impact on research in a wide range of fields, not least in economics. The vision of explaining complex and adaptive order as emerging from the interaction of large numbers of relatively simple components according to relatively simple laws presents a compelling challenge to many researchers.

The Classical political economic vision

The great theme of the Classical political economists was that individual economic actions have unintended social consequences. Economic life in the large is thus organized and coherent in a way that no single economic actor envisions or controls.

Smith

The most powerful example of this effect is the Classical conception of competition, enunciated, if not originated, in Adam Smith's *Wealth of Nations* (1937). Smith observes that each owner of "stock" (capital) will seek to maximize its potential rate of growth, that is, its profit rate, by investing in the line of production he judges to be most promising. Capital, according to Smith's vision, will be disinvested from lines of production with relatively low profit rates, and moved to lines of production with relatively high profit rates. The intention of wealth-owners in reallocating capital in this way is to maximize their own rate of profit, but the effect of their actions is to *equalize* profit rates tendentially between different lines of production. This equalization of profit rates, which is of no particular interest to individual capitalists, is also the condition for maximizing the profit rate of the aggregate national capital, that is, the wealth of the nation.

Smith and the Classical political economists who followed him did not believe that this competitive process would lead to an actual equalization of realized or prospective profit rates at any moment in time. The movement of capital from one line of production to another would upset the conditions

of other lines of production, which, together with disturbances from outside the national economy, would always prevent the realization of a state of equalization of profit rates. They expected to see a ceaseless fluctuation of prices and profit rates as the outcome of the competitive process, rather than the achievement of a state of "equilibrium" in which prices settled down to levels ("natural prices") at which profit rates would be equalized. Nonetheless, the *concept* of this equilibrium state (which has come to be referred to as "long-period" equilibrium) plays a natural and important part in the analysis of the real economy. The competitive dynamic, even if it is not stable in the mathematical sense of pushing the system to an equilibrium of equal profit rates, will prevent prices and profit rates from wandering indefinitely far from their equilibrium values. This idea is expressed by arguing that observed market prices tend to *gravitate* around the natural prices at which profit rates would be equalized. The *abstract* concept of long-period equilibrium natural prices plays a crucial analytical role in understanding the *concrete* fluctuations of observable market prices.

This sophisticated method of reasoning contrasts sharply, and, in my opinion, favorably with the tendency of neoclassical economists to identify observed values of prices with their equilibrium levels in abstract models. The neoclassical vision requires an implausible degree of foresight and coordination of individual plans in its assertion of the attainment of equilibrium as a picture of the operation of the real economy. Furthermore, stable equilibrium systems cannot exhibit complex dynamic behavior, so the neoclassical vision remains blind to the evolutionary, path-dependent, and adaptive character of economic institutions. The Classical vision, on the other hand, is consistent with the complex systems view of the world. It does not insist that each and every component of the economy achieve its own equilibrium as part of a larger master equilibrium of the system as a whole. In fact, it is precisely from the *disequilibrium* behavior of individual households and firms that the Classical vision of competition sees the orderliness of gravitation of market prices around natural prices as arising. In the language of complex systems theory, Classical gravitation is a self-organized outcome of the competitive economic system. From the Classical point of view, competition need not be "perfect" in order to bring about the tendency to self-organization. The self-organization of complex systems is *robust* in the sense that it does not depend on any particular detail of the evolution of the system, and will reassert itself even when some of the mechanisms supporting it are frustrated.

Smith characterizes the capitalist restlessly seeking the highest profit rate on his capital as a "public benefactor" (1937, ch. III), and the coordinated (or, more precisely, self-organized) outcome for the economy as the result of the operation of an "Invisible Hand." But the force of Smith's argument here has often been misunderstood. There is no reason in general why one individual in capitalist society benefits from another individual's increase in wealth. The benefits from individual accumulation lie in the growth of the *national* wealth, which Smith saw as the foundation of its military and diplomatic power. Presumably this effect arises in part because the wealth of individual capitalists is the foundation of the state's taxing power.

But Smith has another, more important, reason for regarding the accumulating capitalist as a public benefactor. Smith argued that the driving force of economic development was the *division of labor* that arises as a result of the widening *extent of the market*. It is precisely the accumulation of capital, in Smith's view, that drives the extent of the market, both by increasing the wealth and income of the population, and increasing population itself. The individual accumulating capitalist enriches himself, which is his intention, but in increasing the market for other capitalists' products, he also indirectly and unintentionally fosters an increase in the division of labor. The ensuing increase in the productivity of labor does benefit the other capitalists and, potentially, workers. The accumulation of capital is thus part of a "virtuous cycle" in Smith's vision. Accumulation increases population, wealth, and income, thus increasing the size of the market, which in its turn fosters a wider and deeper division of labor, increasing labor productivity, profit rates, and accumulation. This self-reinforcing cycle is the basic metabolism of capitalist economic development, responsible both for its creative triumphs and its destructive paroxysms. Smith's endorsement of laissez-faire policies is at its root an affirmation that this process will in the end be good for humanity.

The neoclassical tradition interprets Smith's concepts in quite a different way. Neoclassical analysis identifies the Invisible Hand and laissez-faire policies with the tendency for unfettered competition to achieve an efficient allocation of resources, rather than with the tendency for unfettered capital accumulation to produce a widening division of labor. Smith's notion of a widening division of labor leading to increased labor productivity translates into neoclassical language as *increasing returns* to the application of labor and capital to land. But pervasive increasing returns is incompatible with the establishment of a neoclassical competitive equilibrium except under special analytical assumptions. Thus, the feature of economic life that Smith puts

at the center of his vision is a feature that is actually inconsistent with the neoclassical vision of achieving an efficient allocation of resources through competition.

But Smith's vision of the widening and self-reinforcing division of labor is remarkably consistent with the systems theory conception of a complex, self-organizing, non-equilibrium process. Growth and development as irreversible processes are characteristic of complex systems. While particular self-organizing aspects of complex systems may have strong homeostatic properties that lead them to seek recognizable organized states (e.g. like the individual cell in an animal), the systems themselves are open, adaptable, and indeterminate (like the life history of an animal), and not typically subject to simple equilibrium analysis. We know that the wolf, for example, must maintain nutritional balance with her environment to live, but this observation does not allow us to predict her life cycle, where she will migrate, mate, or, eventually, die. Smith's vision of capitalist economic development is analogous: he can explain the metabolic processes, accumulation and competition, that support the evolution of the capitalist economy, but not its history, the specific development of its technology, or its sociology.

Malthus and Ricardo

Smith's great immediate successors were Thomas Malthus and David Ricardo. Their characteristic discoveries were in fact in opposition to Smith's open-ended optimism about the prospects for capitalist economic development, but their methods grow out of Smith's arguments, and reflect the same preoccupation with unintended consequences of human actions.

Malthus (1985) argued that human societies tend to reach a *demographic equilibrium* in which high mortality from disease and malnutrition, especially infant mortality, balanced high fertility. His analysis of this problem centers on a stable feedback mechanism, in the language of modern systems theory. If mortality were to fall below the equilibrium level, the high rate of fertility would increase population. Malthus believed that an increasing population would encounter diminishing returns in the face of limited land and other natural resources, so that the standard of living would fall, increasing the incidence of mortality through malnutrition and disease. Malthus' theory has turned out to be spectacularly inappropriate to understanding the actual process of capitalist development over the succeeding three hundred years. But it is interesting to note that his method of reasoning depends on the

same notions of unintended consequences and self-organization as Smith's. Malthus' procreators have no way of knowing that the indirect consequence of their fertility decisions will be a demographic equilibrium. They themselves are not in any kind of "equilibrium" according to Malthus' argument. The limitations of land and natural resources impose themselves as a pervasive system-wide phenomenon which shapes the uncoordinated decisions of individuals into the demographic equilibrium.

Ricardo (1951) extended and elaborated Malthus' notion of demographic equilibrium to a picture of a *stationary state* in which the pressure of capital and labor resources on limited land would force the return to capital, the profit rate, close to zero, and choke off the process of Smithian accumulation. Ricardo's vision rests, like Malthus' on the implicit assumption of diminishing returns to population and capital in the face of limited land resources. But his account of the equalization of profit rates, which underlies the mechanisms that enforce the stationary state, is the same gravitational mechanism we find in Smith. The individual capitalist does not see the rise in rents and in money wages that squeeze his profit rate as connected to his own accumulation. The process of accumulation does not necessarily follow any predetermined path toward the stationary state. Ricardo's arguments are powerful because he shows how *any* path of accumulation will run itself into the stationary state, given only the general phenomenon of diminishing returns associated with limited land resources. In the stationary state itself some capitalists may be making profits and accumulating, while others are making losses and decumulating. Ricardo's stationary state is not a reflection of a microeconomic equilibrium in which each agent finds itself, but a self-organizing state of a complex system that continues to adapt and change, even as it reproduces the stationary state as a macroeconomic average.

Marx

Karl Marx took the Classical political economy of Smith, Malthus, and Ricardo as the basis of his critical reconstruction of the theory of the capitalist economy. Marx instinctively and unquestioningly adopted the mode of argument of the political economists, which sought to discover aggregate regularities in the capitalist economy that did not depend on the detailed behavior of individuals. The power of his methods of analysis, which has been the frequent subject of admiring comment, rests on this foundation. Marx can reach powerful, general, analytical conclusions about the course

and patterns of capitalist economic development without limiting himself to particular implausible and limited "models," and without claiming to predict the actual behavior of particular individuals.

Marx brought to political economy the language of "dialectics" that pervaded Continental philosophical thought, particularly through the writing of Hegel, in his youth. In my view, dialectics can be usefully understood as an attempt to find a precise language to discuss the phenomena of system complexity and self-organization.

From one point of view, complex systems are "determined" by the propensities and tendencies of their constituent parts (e.g. the chemical properties of proteins in the cell, or the behavioral tendencies of households and firms in a capitalist economy). But the aggregate behavior of complex systems is far from a simple reflection of these tendencies at the aggregate level. In fact, complex systems paradoxically tend to exhibit features that are in many respects the opposite of the tendencies of their components. The resolute pursuit of profit by individual capitalists, for example, may lead to a falling average rate of profit in the system as a whole. Dialectical language promotes this observation to the (contested) status of a "law."

Despite its features of self-organization, a complex, adaptive system is in a constant process of development and change. Self-organizing aspects of the system emerge because they are independent to a very considerable degree from the detailed function of any particular part of the system. Complex systems tend to be able to continue to function recognizably even when some of their constituent subsystems are disrupted. Randomly wired computers, for example, organize themselves in ways that cannot be destroyed by cutting a few links, while we know that even the smallest failure of a single component completely disables conventional computing machines. Thus the self-organization of a complex system appears to be "over-determined" in dialectical language, in that the destruction of one or even several pathways through which the feature reproduces itself may not succeed in altering the self-organization of the system as a whole.

While complex adaptive systems are "determinate" in the sense that it is in principle possible to trace the interactions among their myriad components that are responsible for their aggregate behavior, they are not "predetermined" in the sense that we can hope to figure out the exact path of their future evolution. Complex systems share this lack of predeterminacy and predictability with chaotic systems, since it arises from the extremely large number of degrees of freedom that characterize both systems. Chaotic

systems, however, are so unstable that they break down self-organizing structures very rapidly, while complex systems can sustain self-organizing structures over long periods. Curiously, the disorder of chaotic systems makes them statistically predictable, while complex systems create irregular statistical patterns that are impossible to extrapolate. Dialectics acknowledges this lack of predeterminacy in complex systems by insisting that the future is genuinely open, though constantly being shaped by the actions of constituent particles in the present. This is a key point of difference between the conceptual worlds of equilibrium and self-organizing complex systems. Equilibrium systems tend to return to predetermined states, while complex systems undergo open-ended evolution.

Marx frequently refers to Ricardo, and uses Ricardo's arguments as the basis of his own reformulations of the discoveries of Classical political economy. In part this is due to Marx's appreciation (shared by many other readers) of the analytical power and sharpness of Ricardo's mind. But in substance Marx is a Smithian much more than a Ricardian. The crucial point here is the role of diminishing returns to capital accumulation. Marx shared Smith's view that the essence of capitalism as a social form of organization is its ability to overcome diminishing returns through the widening social division of labor and the technical advances the division of labor makes possible. Marx, in fact, elaborated a powerful systematic account (Marx, 1981, ch. 13) (based on Ricardo's remarkable chapter on Machinery) of the way in which capitalism institutionalizes technical change through the struggles of particular firms to gain cost advantages from new technology. This line of thinking was fundamental to Joseph Schumpeter's work on the dynamics of capitalist economies. But, again, notice that this theory of Marx's is not a set of hypotheses about the specific course of technical change, nor about particular technologies. It is better seen as an account of a tendency of capitalist systems to organize themselves as engines of technical change, whatever the particular technical challenges they face might happen to be historically. Marx, like Smith, sees the essential character of capital accumulation as an ongoing, open-ended, evolutionary process.

Marx also believed that the capitalist system rested on a contradictory and morally unsustainable system of exploitation of labor. Smith is enough of a realist to acknowledge the class basis of capitalist society, but also enthusiastic enough about capitalist process to gloss over the problem of class divisions in the belief that workers will substantively share in the gains of productivity over time. On this point Smith, at least in the context of highly

developed capitalist economies, has proved to be right so far. Smith foresees no particular fate for capitalism, unlike Ricardo and Malthus, who forecast the stationary state as a kind of "heat-death" for capital accumulation. For Marx, on the other hand, capitalism as a system would eventually have to evolve to resolve its class contradictions. Complex systems theory suggests that it is very difficult to resolve these speculative historical questions, since there is no way to compress the analysis of a complex system into a model that is any less complex than the system itself.

Classical method

Complex systems pose major challenges to our "common-sense" notions about determinacy, predictability, and stability. It might seem at first that complex systems are inherently invulnerable to systematic analysis. In some respects this is true. We cannot hope to model the future path of a complex system in detail, because of the intractable multiplicity of its degrees of freedom and the paradoxes inherent in its capacity for self-reference and self-reflection. The phenomenon of self-organization, however, opens up a sphere of possible analysis. It is possible to understand the forces that make for the self-organization of a complex system in some dimensions, and to model these limited aspects of the system. Classical political economists' theories of competition, demographic equilibrium, and technical change are good examples of this method. Understanding the self-organizing aspects of complex systems is immensely valuable knowledge, but inevitably frustratingly incomplete. For example, we might be very confident in predicting that insofar as the economy continued to function on the basis of commodity exchange, it will organize itself into markets with prices, and that competitive forces will create weaker or stronger mechanisms of induced technical change. This is a vitally important thing to know about the capitalist economy. On the other hand, it tells us nothing about the details of what products will become leading commodities, where the specific centers and bottlenecks of technical change will emerge, or even how markets will be organized or over what spatial or temporal regions. These are the things we would like to know to make good decisions about education, speculative investments, and public policy.

The self-organization of complex systems thus presents the apparent paradox of promising analytical knowledge about open-ended, evolutionary processes which are inherently unpredictable. The triumph of Classical

political economy, in my view, was its uncanny power to discover this type of result. It thus points the way to a solution of a difficult philosophical dilemma. Those who remain committed to the idea of an analytically based social science without adopting the complex systems vision are forced to deny the open-ended, indeterminate character of human social life. These thinkers will force the complexity of social life into simpler forms for the sake of making them amenable to analysis. Those who remain committed to the vision of an open-ended, evolutionary account of human social life without recognizing the phenomenon of self-organization seem condemned to a kind of epistemological nihilism. For them the social world is complex and determinate, but it is impossible to say anything systematic about it. The recognition of self-organization as a pervasive tendency of complex, adaptive systems offers the possibility of discovering and analyzing substantive regularities of complex systems like the economy without hypostatizing them as realized equilibrium states.

Self-organization and equilibrium

In some cases it is possible to study the self-organizing tendency of the economy in terms of homeostatic feedback mechanisms that can be represented by differential equations. For example, it is not hard to represent Malthus' theory of demographic equilibrium in a two-dimensional system of equations involving population and the standard of living, linked by a fertility-mortality relationship on the one hand and a population-productivity relationship on the other. (I will develop this system in detail in Chapter 4.) Mathematicians call the rest point of a set of differential equations an "equilibrium," but I am insisting on a sharp distinction between the concepts of self-organization and equilibrium. This suggests that the term "equilibrium" has different meanings in different contexts, as indeed it does. Mathematicians, physicists, and economists use the term "equilibrium" in significantly different ways.

A very fruitful notion in science is the concept of a *dynamical system*. A list of quantities describing the relevant aspects of a dynamical system at any moment in time constitute its *state*. The collection of all possible states the system might be in constitute the *state space*. For example, we might represent Malthus' system by defining the state of the economy at any moment as its population, productivity, fertility, and mortality. The notion of a dynamical system is that the motion of the system through time is determined by its current state.