

“Institutions and the Viability of Macroeconomics: Some Perspectives on the Transformation Process in Post-Communist Economies”

by Geoffrey M. Hodgson

The Judge Institute of Management Studies, University of Cambridge, Trumpington St, Cambridge CB2 1AG.

Email: gmh1001@cam.ac.uk

ABSTRACT

The building of a modern, market economy requires the establishment of undirected systems of coordination and order. Yet, for three hundred years, social theorists have grappled with the project of explaining the basis of socio-economic order. The more recent attempt of mainstream economics to base macroeconomics on ‘sound microeconomic foundations’ is a modern version of this project. All these efforts have been motivated by a specific form of reductionism, based on the use of the individual as the given and fundamental use of analysis. Both mathematically and philosophically, this project has now run into the sand. Mathematical attempts to derive aggregate macro relationships from microeconomic assumptions have reached insurmountable difficulties. More generally, philosophical objections have been developed against reductionism. Some of the latter employ the concept of emergence, which is explored here. In addition, suggestions are made here as to how institutional economics can develop a quite different articulation and understanding of micro-macro relationships. The implications for policy-makers in the economies in transition are briefly discussed.

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1. Introduction

The transition process in the post-Communist countries after 1989 has been prolonged, traumatic and problematic for those involved. However, many of the Western economists who advised the new governments in the countries of the former Soviet Bloc assumed that the process of transition would proceed rapidly once privatisation and private property rights were in place. Markets and individual incentives would power the transformation to a capitalist economy, once the ‘dead hand of state bureaucracy’ had been removed and the microeconomic essentials were in place.

However, these optimistic expectations were not fulfilled. For example, data in Zecchini (1997) show that by 1996, none of the former Soviet Bloc economies in Europe had yet recovered to its GDP level of 1989. Inflation has been endemic, particularly in the early 1990s, and unemployment remains high. In 1998, Russia itself entered a severe recession brought on by a financial collapse. Overall, the process of transition has proved more difficult and prolonged than the eminent economic advisors had tended to suggest.

Accordingly, the post-1989 experience has provided a challenge to economic theory as well as to economic policy. Some of the more perceptive economists recognise this. The example of Douglass North comes readily to mind.² However, the challenge to mainstream economic theory, including the ‘new’ institutionalism of Ronald Coase, Oliver Williamson, Richard Posner, Svetozar Pejovitch, Eirik Furubotn and others, goes very deep.³ And it is difficult for many to theorists, having made a reputation in the old way of theorising, to discard much of the intellectual capital and reputation that they have accumulated over the years.

It is the purpose of this essay to sketch out some of the fundamental issues involved. Largely by references to preceding work, I shall try to corroborate the following points:

- The theoretical foundation for an adequate policy of economic transition must address the problem of the formation and sustenance of socio-economic order.
- The theoretical programme, within mainstream economics, aiming to show how order emerges from given, microeconomic units has failed. We have no theoretical basis to

¹. The author is very grateful to Janez Šušteršič and other participants at the September 1998 conference on ‘Institutions in Transition’ in Bled, Slovenia, for helpful comments on an earlier version of this essay.

². On the basis of extended personal conversations with the author.

³. For an extensive and insightful textbook on the ‘new’ institutional economics see Furubotn and Richter (1997).

assume that real-world market systems can arise or maintain themselves through the interactions of atomistic individuals.

- The parallel theoretical programme, within mainstream economics, aiming to reduce macroeconomics to microeconomics has also failed.
- Viable socio-economic order requires more than individual incentives and property rights; it requires an encompassing framework of conducive macroeconomic institutions and macroeconomic policies.
- The theoretical foundation for the former must be established on the basis of a new rationale for a macroeconomics that has a degree of autonomy from, although it is propositionally consistent with, microeconomic theory.
- The philosophical basis of the former move must make use of the concept of emergence. It can gain insight from the 'old' institutional economics of Wesley Mitchell and others and the writings of the preceding German historical school.

It is not possible here to establish all these points rigorously. However, there is a substantial amount of literature in support of these points. Section 2 considers the problem of socio-economic order. Sections 3, 4 and 5 consider the philosophical and theoretical problems in the reductionist attempts to build models of economic order upon the assumption of given, utility-maximising individuals. Sections 6, 7 and 8 introduce the concept of emergence and explain its relevance to macroeconomic and institutional analysis. Section 9 concludes the essay.

2. The Problem of Socio-Economic Order

The problem the development and stability of socio-economic order was clearly formulated over three hundred years ago by Thomas Hobbes. He argued that a society composed of self-seeking individuals could not hold together without the imposition of a strong sovereign. However, Hobbes's solution is internally inconsistent in that his model of human nature does not extend to the sovereign himself. The supreme ruler must be benevolent and just, unlike his self-interested subjects. Nevertheless, a clear feature of Hobbes's argument is that order cannot be established through the interactions of ordinary people without the intervention of a more powerful authority.

In contrast, Bernard Mandeville, in his *Fable of the Bees* (1714) argued that social order and coherence were possible, even on the basis of the private greed of autonomous individuals. To some degree these ideas were taken up by Adam Smith in his *Wealth of Nations* (1776). However, it should be noted that Smith maintained that a structure of trust and reciprocity, and even a degree of state intervention, were necessary to help markets function. Nevertheless, Smith was closer to Mandeville than to Hobbes. Both Smith and Mandeville attempted to show that socio-economic order would be established on the basis of trading individuals, and without the intervention of a sovereign. Much of economic theory ever since has been devoted to an attempt to sustain the proposition that social order and economic allocation can function purely on the basis of such self-interested individuals.

What Hobbes, Mandeville and Smith all had in common, however, was the view of self-interested individuals, seeking out possessions and wealth. The individual entered the socio-economic realm with such aspirations - they were seen as natural or essential to human nature. Their common view was the 'possessive individualism' subsequently analysed by Crawford B. Macpherson (1962) and others. This view of the given individual set the tone for much of subsequent Anglo-American social science.

Hence, when neoclassical economics emerged in the 1870s, one of its enduring projects was to show how economic order could arise from the interactions of utility-maximising individuals. In this sense they continued the endeavours of Mandeville and Smith. The term ‘neoclassical economics’ can be defined loosely as an approach based on the assumption of globally rational and optimising behaviour by economic agents, in which the predisposition is to examine the attainment and characteristics of economic equilibria. This approach still dominates the economics textbooks, despite the recent ascendancy of game theory and other novelties.

Fundamentally, the modern neoclassical analysis of markets is based on the type of general equilibrium analysis pioneered by Léon Walras in the 1870s, and formalised during the postwar period by theorists such as Kenneth Arrow, Gerard Debreu, and Frank Hahn, two of whom won Nobel Prizes for their efforts.⁴ At its foundation, neoclassical economics has no established and rigorous alternative to this Walrasian theory.

This kind of analysis assumes that tastes and preferences, along with technology, are given. One reason for this assumption is the influence of classic liberal ideology in economics, sustaining a tendency to take individuals as inviolable units of analysis. Another reason is to aid the mathematical tractability of the Walrasian model.⁵ In this model, and with the aid of an entirely fictitious auctioneer, the economy ‘gropes’ towards an equilibrium position in all markets and towards the determination of a complete final vector of prices. Nevertheless, and despite a number of simplifying assumptions, it took a long time for the formalisation of this model to progress.

3. Reductionism: Explaining the Macro in terms of the Micro

From the 1870s to the 1930s, mainstream economics in the English-speaking world was almost entirely microeconomics. Accordingly, the attempt continued to explain all economic phenomena in terms of given individuals. The emergence of macroeconomics in the 1930s represented an alternative approach, based on the aggregate phenomena.

Despite earlier, nineteenth-century developments in macroeconomic theory - by Friedrich List, Karl Marx and others - macroeconomics proper did not really get off the ground until after the publication in 1936 of the *General Theory* by John Maynard Keynes. In fact, the word ‘macroeconomics’ itself did not come into use until 1939.⁶ From the 1940s to the 1960s there was an uneasy synthesis in the mainstream economics textbooks - exemplified in Paul Samuelson’s bestselling *Economics* - between a neoclassical microeconomics and a bowdlerised and sanitised version of Keynesian macro-theory.

However, the life of a relatively autonomous macroeconomic theory was short. There was increasing unease with even the limited version of ‘Keynesianism’ that had made its way into the mainstream. Consequently, the neoclassical fundamentalists mounted a counter-attack. Emanating from Chicago and elsewhere, this assault was well under way by the 1970s. ‘Keynesianism’ was attacked on both methodological and policy grounds. In policy terms, the

⁴. Arrow and Hahn (1971), Debreu (1959), Walras (1954).

⁵. Indeed, as orthodox economics progressively transforms itself into a branch of mathematics, the latter reason has assumed greater and greater relative significance.

⁶. According to Samuelson (1997, p. 157) the word ‘macroeconomics’ was first used by Lindahl (1939).

limited justification of state intervention in the textbook ‘Keynesian’ system was rejected. In methodological terms, theories based on supposed aggregate behaviour were regarded as scientifically unsound and *ad hoc*. The reductionist idea of explaining wholes in terms of individual parts had for long been seen by many as the *sine qua non* of all science. Confidence in the necessity of reductionism in science reached the point that the Nobel Laureate James Tobin (1986, p. 350) wrote that:

This [microfoundations] counter-revolution has swept the profession until now it is scarcely an exaggeration to say that no paper that does not employ the ‘microfoundations’ methodology can get published in a major professional journal, that no research proposal that is suspect of violating its precepts can survive peer review, that no newly minted Ph.D. who can’t show that his hypothesized behavioral relations are properly derived can get a good academic job.

‘Scientific’ credentials were claimed for the microfoundations enterprise. Jon Elster (1983, pp. 20-4) expressed and endorsed a very widespread view when he wrote:

The basic building block in the social sciences, the elementary unit of explanation, is the individual action guided by some intention. ... Generally speaking, the scientific practice is to seek an explanation at a lower level than the explanandum. ... The *search for micro-foundations*, to use a fashionable term from recent controversies in economics, is in reality a pervasive and omnipresent feature of science.

Applying such notions to economics, Nobel Laureate Robert Lucas (1987, p. 108) wrote:

The most interesting recent developments in macroeconomic theory seem to me describable as the reincorporation of aggregative problems such as inflation and the business cycle within the general framework of ‘microeconomic’ theory. If these developments succeed, the term ‘macroeconomic’ will simply disappear from use and the modifier ‘micro’ will become superfluous. We will simply speak, as did Smith, Ricardo, Marshall and Walras, of *economic* theory.

Mainstream economics took the veracity of its reductionist research programme for granted. It attempted to build up a composite picture of the economic system from atomistic, individual units, just as the particle forms the elemental unit in Newtonian mechanics. The attempt was to explain the whole through its analytical reduction to its presumed microfoundations and component parts.

Yet we may note in passing a strange dissimilarity between the reductionist project in other sciences and that in economics. Reductionists in the physical sciences try to explain all phenomena in terms of their fundamental units or components. Strictly, this procedure should carry on until we reach the most fundamental sub-atomic particle: the basic constituent of all matter, whatever it may be. By contrast, reductionists in the social sciences seem content to stop with human individuals. This approach is widely described as ‘methodological individualism’. But if reductionism is a worthy and worthwhile project, why stop with the individual? If we can reduce explanations to individual terms, why not further reduce them to the biological genes, and then on to the sub-atomic particles of physics?

In fact, both the microfoundations project in economics and methodological individualism carry reductionist flags but always involve a *partial* analytical reduction only. They thus fail to completely succeed in reductionist terms. For the reductionist to settle on the individual involves an inconsistency. A true reductionist would go on further. If we can reduce

explanations to individual terms why not further reduce them to the terms of genes? Or molecules? To avoid this 'double standard' one must either accept multiple levels of analysis, each with their own partial autonomy, or attempt to reduce everything to the lowest possible level. One cannot be a thoroughgoing reductionist and a methodological individualist at the same time.

A reductionism that suggests that wholes must be explained in terms of parts must take the parts as given. To take a contrary view would suggest an infinite regress, in which each part has to be explained in terms of its relations with other parts, and so on, without end. The reductionist injunction assumes that which must eventually reach the basic, unperturbable and irreducible parts or individuals where the analysis can come to a stop (Hodgson, 1988, 1993a, 1998a).

The reasons why the most zealous of reductionists in the social sciences are incomplete in the application of their own reductionist canon are too complex to concern us here. In part they involve the rift in the early twentieth-century between the social and the biological sciences (Degler, 1991; Hodgson, 1999). This legitimised an (untenable) explanatory barrier between the natural and the social world: allegedly a barrier that no theorist need, or should try, to cross. The reasons for an incomplete and individual-centred reductionism also relate to the tenacious influence of an individualistic political ideology in the social sciences.

What does concern us here is the reason why reductionism in general, and the microfoundations project, in particular, have failed. Furthermore, we are concerned to examine the rudiments of an alternative approach. We first go on to consider the reasons for its failure.

4. The Failure of the Microfoundations Project and the Crisis of Mainstream Theory

As we have noted, mainstream theory has been engaged in a long-lasting attempt to place economics on secure and individualistic microfoundations. However, it was eventually realised that assumptions of diversity among individuals threatened the feasibility of this project. Many types of interaction between the individuals have to be ignored to make the analysis tractable. Indeed, it was not easy to develop a composite picture from the assumption of a diversity of types of individual agent.

Even with the standard assumptions of rational behaviour, and its drastic psychological and epistemological limitations, severe difficulties are faced. As Nobel Laureate Kenneth Arrow (1986, p. S388) has been led to declare: 'In the aggregate, the hypothesis of rational behaviour has in general no implications.' Consequently, in a desperate attempt to deduce something in the macro-sphere from the micro-tenet of individual rationality, it is widely assumed that all individuals have an *identical* utility function. Apart from ignoring obvious differences in individual tastes, this denies the possibility of 'gains from trade arising from individual differences' (p. S390).

Typically, the textbook macroeconomics that is spun out of neoclassical microeconomic theory goes well beyond the confinement and rigour of general equilibrium theory, to make bold and general claims concerning the relationship between wages and unemployment, and inflation and the money supply. Only the more honest and careful neoclassical theorists have questioned such bold macroeconomic derivations from microeconomic assumptions. For instance, Arrow (1986, p. S386) stated that he knows 'of no serious derivation of the demand for money from a rational optimization'.

However, let us leave aside the more incautious textbook statements and concentrate on the more considered propositions of the theoretical pioneers. The fact is that, several years ago, the microfoundations project reached insurmountable difficulties and it essentially collapsed due to the weight of its own internal problems. This truth is not widely broadcast. Nevertheless, starting from the assumption of individual utility maximisation, Hugo Sonnenschein (1972, 1973a, 1973b), Rolf Mantel (1974) and (Nobel Laureate) Gerard Debreu (1974) showed that the excess demand functions in an exchange economy can take almost any form. There is thus no basis for the assumption that they are downward sloping. This problem is essentially one of aggregation when individual demand functions are combined. As Alan Kirman (1989) has reiterated, the consequences for neoclassical general equilibrium theory are devastating. As S. Abu Turab Rizvi (1994a, p. 363) put it, the work of Sonnenschein, Mantel and Debreu is quite general and is not restricted to counter-examples:

Its chief implication ... is that the hypothesis of individual rationality, and other assumptions made at the micro level, gives no guidance to an analysis of macro-level phenomena: the assumption of rationality or utility maximisation is not enough to talk about social regularities. This is a significant conclusion and brings the microfoundations project in [general equilibrium theory] to an end.

In general, research into the problems of the uniqueness and stability of general equilibria have shown that they may be indeterminate and unstable unless very strong assumptions are made, such as the supposition that society as a whole behaves as if it were a single individual. Again, this demolishes the entire microfoundations project (Lavoie, 1992, pp. 36-41; Screpanti and Zamagni, 1993, pp. 344-53). Facing such profound problems, Kirman (1992, p. 118) wrote: 'there is no plausible formal justification for the assumption that the aggregate of individuals, even maximizers, acts itself like an individual maximizer.' He concluded: 'If we are to progress further we may well be forced to theorize in terms of groups who have collectively coherent behaviour. ... The idea that we should start at the level of the isolated individual is one which we may well have to abandon' (Kirman 1989, p. 138).

The theoretical implications of these uniqueness and stability results for general equilibrium theory are devastating. A fundamental consequence is the breakdown of the types of analysis based on individualistic or atomistic ontologies. The indeterminacy and instability results produced by contemporary theory lead to the conclusion that an economy made up of atomistic agents has not structure enough to survive, as its equilibria may be evanescent states from which the system tends to depart (Ingrao and Israel, 1990; Kirman, 1989).

Fabrizio Coricelli and Giovanni Dosi (1988, p. 126) argued that 'the project of building dynamic models with economic content and descriptive power by relying solely on the basic principles of rationality and perfect competition through the market process has generally failed.' Attempts to base macroeconomics on neoclassical microfoundations involve faith in the 'invisible hand' and in the substantive capabilities of individuals to calculate endlessly and make supremely rational choices. Yet the results of this theoretical endeavour show no more than a very crippled hand, incapable of orderly systemic coordination even in relatively simple models:

Moreover, note that these results are obtained despite an increasing attribution of rational competence and information processing power to individual agents. Certainly ... the attempt to 'explain' macroeconomics solely on the basis of some kind of 'hyper-rationality' of the agents ... and the (pre-analytical) fundamentals of the economy (i.e. given technology and tastes) has failed. (Coricelli and Dosi, 1988, p. 136)

Hence it is no exaggeration to say that the microfoundations enterprise has effectively disintegrated, and for reasons well known to and understood by the leading theorists of the genre.

As Rizvi (1994b) pointed out, it was this partially-hushed-up-crisis in general equilibrium theory in the 1970s that led to the adoption of game theory in the 1980s. Today, game theory has largely replaced the general equilibrium approach that was found to be unviable in the 1970s. However, Rizvi (1994b, pp. 23-24) argued that game theory does not save mainstream economics from its core problems:

Game theory does not solve the arbitrariness problem which led to the halting of the general equilibrium research programme and its replacement by game theory methods. Instead, the fact that such arbitrariness appears so significantly in both the general equilibrium and the game theory settings is strong evidence that the approach of making (even strong) rationality assumptions on individual agents considered individually and then expecting system-wide outcomes to be orderly or usefully arrayed is badly flawed. Moving from one micro-rational system to another does not seem to improve matters at all.

In a related vein, Roy Radner (1996) argued that the game-theoretic analysis of institutions is thwarted by problems of uncertainty about the logical implications of given knowledge, and by the existence of multiple equilibria. Cristina Bicchieri (1994, p. 127) notes that what is missing in most game theoretic models is 'a description of the players' reasoning processes and capacities as well as a specification of their knowledge of the game situation'. This amounts to the observation that the processes of cognition and learning are absent from much of game theory.

Far from leading the mainstream to salvation, theoretical work in game theory has raised questions about the very meaning of 'hard core' notions such as rationality. Yanis Varoufakis (1990) surveyed some of the recent results concerning the problems of rational decision making in the circumstances where a limited number of other actors are believed to be capable of 'irrational' acts. Such 'irrationality' need not stem from stupidity; it is sufficient to consider the possibilities that rational actors may have incomplete information, limited computational capacities, slight misperceptions of reality, or doubts concerning the attributes of their adversaries. Agents do not have to be substantially irrational for irrationality to matter. Irrational behaviour may emerge simply where some people are uncertain that everybody else is rational.

Mainstream economic theory is in fact in a profound crisis. Its attempts to explain real economic phenomena in terms of given individuals by using reductionist methods have failed. The gravity of this crisis is not widely appreciated, however. The means by which this crisis has been concealed has been to turn economics into a branch of applied mathematics, where the aim is not to explain real processes and outcomes in the economic world, but to explore problems of mathematical technique for their own sake. By this method, the failure of mainstream economics to provide a coherent theoretical apparatus to explain real phenomena is obscured. Seemingly, explanation no longer is the goal, and reality is no longer the object of reference. Economics thus is becoming a mathematical game to be played in its own terms, with arbitrary rules chosen by the players themselves, unconstrained by questions of descriptive adequacy or references to reality.

However, those who are concerned to save economics from this plight have an opportunity. Not only has the microfoundations project in economics failed, but also the reductionist approach in science as a whole is increasingly being questioned by philosophers of science. These philosophical developments provide an opportunity for those that may be dissatisfied with mainstream theory. It is to these philosophical issues that we now turn.

5. The Nature and Limits of Reductionism

Reductionism sometimes involves the notion that wholes must be explained entirely in terms of their elemental, constituent parts. More generally, reductionism can be defined as the idea that all aspects of a complex phenomenon must be completely explained in terms of one level, or type of unit. According to this view there are no autonomous levels of analysis other than this elemental foundation, and no such thing as emergent properties (see below) upon which different levels of analysis can be based.

In social science in the 1870-1920 period, reductionism was prominent and typically took a biological form. Accordingly, attempts were made to explain the behaviour of individuals and groups in terms of their alleged biological characteristics. By the 1920s biological reductionism was largely abandoned in Anglo-American social science, although it has reappeared in the 1970s in the controversial form of sociobiology (Wilson, 1975).

Reductionism is still conspicuous in social science today and typically appears in the special form of methodological individualism. This is defined as 'the doctrine that all social phenomena (their structure and their change) are in principle explicable only in terms of individuals - their properties, goals, and beliefs' (Elster, 1982, p. 453). It is thus alleged that explanations of socio-economic phenomena must be reduced to properties of constituent individuals and relations between them. Allied to this is the attempt discussed above to found macroeconomics on 'sound microfoundations'. There are other versions of reductionism however, including versions of 'holism' that suggest that parts should be explained in terms of wholes.

It should be pointed out at the outset that the general idea of a reduction to parts is not being overturned here. Some degree of reduction to elemental units is inevitable. Even measurement is an act of reduction. Science cannot proceed without some dissection and some analysis of parts.

However, although some reduction is inevitable and desirable, a complete analytical reduction is both impossible and a philosophically dogmatic diversion. What is important to stress is that the process of analysis cannot be extended to the most elementary sub-atomic particles presently known to science, or even to individuals in economics or genes in biology. A complete reduction would be hopeless and interminable. As Sir Karl Popper has declared: 'I do not think that there are any examples of a successful reduction' to elemental units in science (Popper and Eccles, 1977, p. 18). Reduction is necessary to some extent, but it can never be complete.

In the social sciences, methodological individualism carries similar problems of intractability. Indeed it has never been fully carried out in practice. Lars Udéhn (1987) has argued convincingly that not only is methodological individualism flawed but because of the problems of analytical intractability involved it is inoperable as a methodological approach. The reductionist explanation of all complex socio-economic phenomena in terms of individuals is over-ambitious, and has never succeeded. In practice, aggregation and simplification are always necessary.

Reductionism is countered by the notion that complex systems display emergent properties at different levels that cannot be completely reduced to or explained wholly in terms of another level. Anti-reductionists often emphasise emergent properties at higher levels of analysis that cannot be reduced to constituent elements. It is to the concept of emergence that we now turn.

6. The Concept of Emergence

The idea of emergence has an established history in biology and other disciplines and has made rare appearances in economics. Emergence refers to the idea that novel properties may 'emerge' in a complex system that are not reducible to constituent micro-elements at a 'lower level'. The concept of emergent properties is typically prominent in critiques of reductionism. In particular, concepts like consciousness and purposeful behaviour may be regarded as an emergent property of the complex human nervous system (Sperry, 1991).

The philosopher of science Paul Feyerabend (1965, p. 223) has provided a useful example. Consider the relationship between the movements of molecules, at one level, and the concept of temperature, on another. Feyerabend asserts that although the concept of temperature can be associated with statistical mechanics and the movements of molecules, the kinetic theory cannot 'give us such a concept' as temperature, which relates to an interactive level above and beyond the combined movements of molecules.

Earlier examples are found in the *Rules of Sociological Method* (1982, pp. 39-40) written in the late nineteenth century by Emile Durkheim (although he himself did not use the word emergence):

The hardness of bronze lies neither in the copper, nor the tin, nor in the lead which have been used to form it, which are all soft or malleable bodies. The hardness arises from the mixing of them. The liquidity of water, its sustaining and other properties, are not in the two gases of which it is composed, but in the complex substance which they form by coming together. Let us apply this principle to sociology. If, as is granted to us, this synthesis *sui generis*, which constitutes every society, gives rise to new phenomena, different from those which occur in consciousness in isolation, one is forced to admit that these specific facts reside in the society itself that produces them and not in its parts - namely its members.

There are other examples. The meteorologist Lewis Fry Richardson (1922) wrote a famous paper showing that the wind has no specific velocity or direction. The wind is a turbulent flow of tiny eddies: the atoms move in all different directions and at different speeds. Wind speed and direction are thus emergent properties of a much more complex system.

Jack Cohen and Ian Stewart (1994, p. 232) ask: Are carbon atoms black, or sulphur atoms yellow? No.

The colors are not present, not even in a cryptic or rudimentary form, in the atoms from which the chemical is made. ... The collective structure of bulk matter reflects light at certain preferred wavelengths; those determine the color. Color is an emergent phenomenon; it only makes sense for bulk matter.

The concept of self-organisation in complex systems is also related to the concept of emergence. Ilya Prigogine and Isabelle Stengers (1984) developed the idea of order emerging from chaos some time ago. They showed that order and structure can develop through the interaction of elements such as cells or molecules. This idea has been developed by Stuart Kauffman (1993, 1995) and his co-workers at the Santa Fe Institute in the United States.

In general, as Tony Lawson (1997, p. 176) explained: ‘an entity or aspect is said to be *emergent* if there is a sense in which it has arisen out of some “lower” level, being conditioned by and dependent upon, but not predictable from, the properties found at the lower level.’ Furthermore, as Margaret Archer (1995, p. 9) elucidated: ‘What justifies the differentiation of strata and thus use of the terms “micro” and “macro” to characterize their relationship is the existence of *emergent properties* pertaining to the latter but not to the former, even if they were elaborated from it.’

7. The Emergence of Emergence

The idea of emergence is perhaps foreshadowed in the ‘dialectic’ of Georg Hegel, with the idea of the transformation of quantity into quality. The philosopher Auguste Comte (1853, vol. 2, p. 181) wrote of irreducible properties: ‘Society is no more decomposable into individuals than a geometrical surface is into lines, or a line into points’. The idea of emergence was also hinted at by John Stuart Mill (1843, bk. 3, ch. 6, para. 2) with his idea of ‘heteropathic’ causation. The word ‘emergent’ in this context was first suggested by the philosopher George Lewes (1875, ch. 3, p. 412). The British philosopher of biology C. Lloyd Morgan began to develop the idea in the 1890s and subsequently wrote extensively on the topic (Morgan, 1927, 1932, 1933). Following Mill and Lewes, Morgan (1927, pp. 3-4) defined emergent properties as ‘unpredictable’ and ‘non-additive’ results of complex processes. In more detail, Morgan (1932, p. 253) explained:

the hypothesis is that when certain items of ‘stuff’, say $o p q$, enter into some relational organization R in unity of ‘substance,’ the whole $R(o p q)$ has some ‘properties’ which could not be deduced from prior knowledge of the properties of o , p , and q taken severally.

Morgan saw such properties as crucial to evolution in its most meaningful and creative sense, where ‘the emphasis is not on the unfolding of something already in being but on the outspringing of something that has hitherto not been in being. It is in this sense only that the noun may carry the adjective “emergent”’ (Morgan, 1927, p. 112). For Morgan, evolution creates a hierarchy of increasing richness and complexity in integral systems ‘as new kinds of relatedness’ successively emerge (Morgan, 1927, p. 203). Also for Morgan, the ‘non-additive’ character of complex systems must involve a shift from mechanistic to organic metaphors: ‘precedence should now be given to organism rather than to mechanism - to organization rather than aggregation’ (Morgan, 1933, p. 58).

Morgan visited Chicago in 1896 and the institutional economist Thorstein Veblen was crucially influenced by his ideas (Dorfman, 1934; Hodgson, 1998b; Tilman, 1996). However, although Veblen arguably incorporated the concept of emergence into his thinking, he did not dwell upon or further refine the idea. One of the few economists to take note of the concept of emergence in the interwar period was the institutional economist John A. Hobson. In his book on *Veblen*, Hobson (1936, pp. 216) wrote in one short passage: ‘Emergent evolution brings unpredictable novelties into the processes of history, and disorder, hazard, chance, are brought into the play of energetic action.’

Despite Morgan and Hobson, the idea of emergence was largely submerged in the positivistic and reductionist phase of Anglo-American science in the interwar period (Ross, 1991). The idea of emergent properties was rediscovered by Sir Karl Popper and others some time after the Second World War. As Popper (1974, p. 281) remarked: ‘We live in a universe

of emergent novelty'; a novelty which is as a rule 'not completely reducible to any of its preceding stages' (Popper, 1982, p. 162).

The existence of emergent properties at each level means that explanations at that tier cannot be reduced entirely to phenomena at lower levels. Philosophers Roy Bhaskar, Arthur Koestler, Alfred Whitehead and others proposed that reality consists of multi-levelled hierarchies. The existence of emergent properties at each level means that explanations at that tier cannot be reduced entirely to phenomena at lower levels. As the biologist Ernst Mayr (1985, p. 58) put it:

Systems at each hierarchical level have two characteristics. They act as wholes (as if they were a homogeneous entity), and their characteristics cannot (not even in theory) be deduced from the most complete knowledge of the components, taken separately or in other partial combinations. In other words, when such systems are assembled from their components, new characteristics of the new whole emerge that could not have been predicted from a knowledge of the components. ... Perhaps the two most interesting characteristics of new wholes are that they can in turn become parts of still higher-level systems, and that they can affect properties of components at lower levels (downward causation) ... Recognition of the importance of emergence demonstrates, of course, the invalidity of extreme reductionism. By the time we have dissected an organism down to atoms and elementary particles we have lost everything that is characteristic of a living system.

As James Murphy (1994, p. 555) developed a similar argument:

The theory of emergence ... is a nonreductionist account of complex phenomena. ... The notion that from complexity emerges new phenomena that cannot be reduced to simpler parts is at the center of modern biology ... Complex systems very often have a hierarchical structure, and the hierarchical structure of living systems shares some important features with our hierarchy, one being that higher levels can affect properties of components at lower levels.

This implies 'downward causation' (Sperry, 1969; Campbell, 1974). This means that outcomes at a higher level can react upon and transform lower-level components. In economics an obvious example, emphasised by the institutional economist John K. Galbraith (1958), would be the effect of advertising and fashion in reconstituting individual preferences. The fact that structures or elements on one level can essentially reconstitute those at another level confounds reductionism. Although reductionism is still prominent, both in biology and in the social sciences, in biology strong and influential voices can be found against it, reflecting the history of the concept of emergence in that subject.

Emergence has been linked to chaos theory. Working on non-linear mathematical systems, chaos theorists have shown that tiny changes in crucial parameters can lead to dramatic consequences, known as the 'Butterfly Effect - the notion that a butterfly stirring the air today in Peking can transform storm systems next month in New York' (Gleick, 1988, p. 8). There are parallels here with the account of 'bifurcation points' in the work of Prigogine and Stengers (1984). After behaving deterministically, a system may reach a bifurcation point where it is inherently impossible to determine which direction change may take; a small and imperceptible disturbance could lead the system into one direction rather than another. Chaos theory suggests that apparent novelty may arise from a deterministic non-linear system. From an apparently deterministic starting point, we are led to novelty and quasi-randomness.

Accordingly, even if we knew the basic equations governing the system we would not necessarily be able to predict reliably the outcome. The estimation of 'initial conditions' can never be accurate enough. This does not simply undermine the possibility of prediction: in addition the idea of a reductionist explanation of the whole in terms of the behaviour of its component parts is challenged. As a result, the system can be seen to have emergent properties that are not reducible to those of its constituent parts. Chaos theory thus undermines the ideas that science is largely about prediction and reductionism. Furthermore, it can sustain a concept of emergence.

In recent years much work has been done with complex, non-linear computer systems, attempting to simulate the emergence of order and other 'higher-level' properties. Reviewing the modelling of such 'artificial worlds', David Lane (1993, p. 90) wrote that a main thrust 'is to discover whether (and under what conditions) histories exhibit interesting *emergent properties*'. His extensive review of the literature in the area suggests that there are many examples of artificial worlds displaying such attributes. This lends credence to the idea that emergence is important in the real world.

The notions of emergence and downward causation are used in critiques of methodological individualism and of the reductionist idea that macroeconomics can only be built on 'sound microfoundations'. If socio-economic systems have emergent properties - by definition not entirely explicable of constituent elements at a basic level - then the ideas of explaining the macro-behaviour of socio-economic systems level completely in terms of individuals and individual actions (methodological individualism) or, more generally, completely in terms of microeconomic postulates (the microfoundations project), are confounded. Furthermore, in explaining complex systems we may be *forced* to rely on emergent properties at a macro level.

8. Institutionalism and Macroeconomics

The suggestion here is that, by reference to the concept of emergence, the relative autonomy of macroeconomics and the idea of the workability of aggregates can be re-established. This idea was partially developed by the American institutionalists long ago. In his 1924 Presidential Address to the American Economic Association, the institutional economist Wesley Mitchell (1937, p. 26) argued that economists need not begin with a theory of individual behaviour but with the statistical observation of 'mass phenomena'. Mitchell (1937, p. 30) went on: 'The quantitative workers will have a special predilection for institutional problems, because institutions standardize behavior, and thereby facilitate statistical procedure.' Subsequently, Rutledge Vining (1949, p. 85) noted how 'much orderliness and regularity apparently only becomes evident when large aggregates are observed' and noted the limitations of a reductionist method in economics. Modern computer simulations and other studies of complex systems seem to underline similar points (Cohen and Stewart, 1994; Chiaromonte and Dosi, 1993).

Mitchell and his colleagues in the US National Bureau for Economic Research in the 1920s and 1930s played a vital role in the development of national income accounting and suggested that aggregate, macroeconomic phenomena have an ontological and empirical legitimacy. Arguably, this important incursion against reductionism in economics created space for the Keynesian revolution. Through the development of national income accounting the work of Mitchell and his colleagues helped to establish modern macroeconomics and influenced and inspired the macroeconomics of Keynes (Mirowski, 1989, p. 307).

In defending Mitchell's approach against the reductionist criticisms of Tjalling Koopmans (1947, 1949a, 1949b), Vining (1949, p. 79) argued that

we need not take for granted that the behavior and functioning of this entity can be exhaustively explained in terms of the motivated behavior of individuals who are particles within the whole. It is conceivable - and it would hardly be doubted in other fields of study - that the aggregate has an existence apart from its constituent particles and behavior characteristics of its own not deducible from the behavior characteristics of the particles.

Here the institutionalist Vining hints unknowingly at the concept of emergent properties, then regrettably a relatively unknown concept in the circles of both the natural and the social sciences.

The 'old' institutional economics did not attempt to build up a picture of the whole system by moving unidirectionally from given individuals. Instead there is the idea of interactive agents, mutually entwined in durable and self-reinforcing institutions. This provides a quite different way of approaching the problem of theorising the relationship between actor and structure.

The 'old' institutionalism saw institutions as connected to individual habits. Indeed, an institution was defined by institutionalists in the old tradition as 'a way of thought or action of some prevalence and permanence, which is embedded in the habits of a group or the customs of a people. ... Institutions fix the confines of and impose form upon the activities of human beings' (Hamilton, 1932, p. 84). Habits both reinforce and are reinforced by institutions. Through this circle of mutual engagement, institutions are endowed with a stable and inert quality, and tend to sustain and thus 'pass on' their important characteristics through time. Further, institutions play an essential role in providing a cognitive framework for interpreting sense-data and in providing intellectual habits or routines for transforming information into useful knowledge. The strong influence of institutions upon individual cognition provides some significant stability in socio-economic systems, partly by buffering and constraining the diverse and variable actions of many agents.

A rigorous and detailed exposition is lacking, but we may sketch out a possible argument along the following lines. The institutionalizing function of institutions means that macroeconomic order and relative stability is reinforced alongside variety and diversity at the microeconomic level. Ironically, by assuming *given* individuals, the microfoundations project in orthodox economics had typically to assume furthermore that each and every individual was *identical* in order to attempt to make the analysis tractable. The concept of an institution, properly handled, points not to a spurious supra-individual objectivity, nor to the uniformity of individual agents, but to the concept of socio-economic order, arising not despite but because of the variety at the micro-level. Without such micro-variety there would be no evolutionary development of the processes of conformism and emulation that can sustain order.

Generally, institutions fill a key conceptual gap in social and economic theory. Institutions simultaneously constitute and are constituted by human action. Institutions are sustained by 'subjective' ideas in the heads of agents and are also 'objective' structures faced by them. Choosing institutions as units of analysis does not necessarily imply that the role of the individual is surrendered to the dominance of institutions. Both individuals and institutions are mutually constitutive of each other.

The institutionalist John Commons (1934, p. 69) noted that: ‘Sometimes an institution seems analogous to a building, a sort of framework of laws and regulations, within which individuals act like inmates. Sometimes it seems to mean the “behavior” of the inmates themselves.’ This dilemma of viewpoint persists today. For example, Douglass North’s (1990, p. 3) definition of institutions as ‘rules of the game ... or ... humanly devised constraints’ stresses the restraints of the metaphorical prison in which the ‘inmates’ act. In contrast, Veblen’s (1919, p. 239) definition of an institution as ‘settled habits of thought common to the generality of men’ seems to start not from the objective constraints but from ‘the inmates themselves’. However, as Commons himself concluded, the thrust of the ‘old’ institutionalist approach is to see behavioural habit and institutional structure as mutually entwined and mutually reinforcing: both aspects are relevant to the full picture. A dual stress on both agency and structure is required.

What is significant is the *relative* invariance and self-reinforcing character of institutions: to see socio-economic development as periods of institutional continuity punctuated by periods of crisis and more rapid development. The fact that institutions typically portray a degree of invariance over long periods of time, and may last longer than individuals, provides one reason for choosing institutions rather than individuals as a bedrock unit. Hence the institution is ‘a socially constructed invariant’ (Mirowski, 1987, p. 1034n). As a result, institutions can be taken as the units and entities of analysis. This contrasts with the idea of the individual as the irreducible unit of analysis in mainstream economics.

However, the proposed alternative is not a crude holism. Complete explanations of parts in terms of wholes are beset with problems of equivalent stature to those of the inverse procedure. Just as structures cannot be adequately explained in terms of individuals, individuals cannot adequately be explained in terms of structures. Fortunately, there are sophisticated alternative approaches in philosophy and social theory (Archer, 1995; Bhaskar, 1979; Bourdieu, 1990; Giddens, 1984; Kontopoulos, 1993; Lawson, 1997; White, 1992) that emphasise the structured interaction of parts with wholes, and eschew single-level explanations.

9. In Conclusion - Some Implications for Economic Transformation

The first key conclusion to be emphasised here is that, after 300 years of effort, we have no robust theoretical explanation of how socio-economic order can emerge simply from the interactions of given individuals. A policy conclusion is obvious from this failure. There is no robust theoretical basis for the advice given to economies in the process of transition that markets will emerge spontaneously. Jeffrey Sachs (1993, p. xxi) was this quite wrong when he wrote: ‘markets spring up as soon as central planning bureaucrats vacate the field’.⁷ The development of markets and other vital institutions in a modern, complex economy requires a strategy of *institution building* working from the macroeconomic ‘top’ as well as from the microeconomic ‘bottom’. This is not an attempt to resuscitate old-style ‘state socialism’ and all its vices. A strategy of institution building should be aimed more at enabling, guiding and moulding economic activity rather than planning or directing it in a comprehensive fashion.

⁷ It should be noted that Sachs’s views have modified, and his position is now less blunt and simplistic.

Although much work remains to be done, the literature on complex systems and emergent properties lends support to the 'old' institutionalist idea that the economy can and must be analysed at different levels. There is a valid and sustainable distinction between the 'micro' and the 'macro', without reducing the former to the latter, or vice-versa. The concept of an institution provides a key conceptual bridge between the two levels of analysis. It connects the microeconomic world of individual action, of habit and choice, with the macroeconomic sphere of seemingly detached and impersonal structures. While analyses at each level must remain consistent with each other, the macroeconomic level has distinctive and emergent properties of its own.

We do not inherit an adequate body of systematic theory from the 'old' institutionalists and their predecessors, the German historical school. But we can still learn much from them. In particular, the German analytical tradition of *Nationalökonomie* started by Friedrich List and others in the middle of the nineteenth century can usefully be revived. Indeed, we find an answer to Sachs in List's classic 1841 text on the *National System of Political Economy*. In this work List accepts the obvious arithmetical point that the wealth of a nation is the sum of the wealth owned by the individuals or institutions in it. But he denies that this leads to the conclusion 'that the national industry would prosper best if only every individual were left undisturbed in the occupation of accumulating wealth.' Taking a dynamic view, based on latent powers rather than superficial aggregates, he argues:

for the point in question is not ... that of immediately increasing ... *the values of exchange* in the nation, but of increasing *the amount of its productive powers*. But that the aggregate of the productive powers of the nation is not synonymous with the aggregate of the productive powers of all individuals, each considered separately - that the total amount of these powers depends chiefly on social and political conditions (List, 1904, p. 137)

List thus emphasised the 'social and political conditions' of entrepreneurial activity that were the responsibility of the national government to foster and develop. These included an advanced system of education and training, and an infrastructure facilitating the flows of information, people and goods. His view of the economy was organic, rather than additive or mechanical. He focused on the organic whole, as well as the individual parts. His *National System of Political Economy* is still fresh and relevant reading, over 150 years after its publication. Anglo-American individualists may shudder at the suggestion that we should look at all this material again, for fear of revival of strident nationalism or even of fascism. But there is nothing fascist about List. And we are now in the context of a widening European Union, where a policy degeneration into nationalism or fascism can be resisted.

Indeed, from this political point of view, the individualistic alternative may well be worse. The mass unemployment and social disruption caused by the market libertarian policies of 'shock therapy' in Eastern Europe have proved to be a fertile ground for the agitation of the extreme right. Behold Russia and East Germany in the 1990s. The dangers are not all on one side. We must accept that there is a need for a major rethink about the theoretical foundations of economic policy. As economists we have a duty to carry this out, while warning of all the problems, pitfalls and dangers.

References

- Archer, Margaret S. (1995) *Realist Social Theory: The Morphogenetic Approach* (Cambridge: Cambridge University Press).
- Arrow, Kenneth J. (1986) 'Rationality of Self and Others in an Economic System', *Journal of Business*, **59**(4.2), October, pp. S385-S399. Reprinted in Hogarth and Reder (1987) and in Eatwell, John, Milgate, Murray and Newman, Peter (eds) (1987) *The New Palgrave Dictionary of Economics*, 4 vols. (London: Macmillan), vol. 2.
- Arrow, Kenneth J. and Hahn, Frank H. (1971) *General Competitive Analysis* (Edinburgh: Oliver and Boyd).
- Bhaskar, Roy (1979) *The Possibility of Naturalism: A Philosophic Critique of the Contemporary Human Sciences* (Brighton: Harvester).
- Bicchieri, Cristina (1994) *Rationality and Coordination* (Cambridge and New York: Cambridge University Press).
- Bourdieu, Pierre (1990) *The Logic of Practice*, translated by Richard Nice (Stanford and Cambridge: Stanford University Press and Polity Press).
- Campbell, Donald T. (1974) "Downward Causation" in Hierarchically Organized Biological Systems', in Ayala, Francisco J. and Dobzhansky, Theodosius (eds) (1974) *Studies in the Philosophy of Biology* (Berkeley and Los Angeles: University of California Press), pp. 179-86.
- Chiaromonte, Francesca and Dosi, Giovanni (1993) 'Heterogeneity, Competition, and Macroeconomic Dynamics', *Structural Change and Economic Dynamics*, **4**(1), June, pp. 39-63.
- Cohen, Jack and Stewart, Ian (1994) *The Collapse of Chaos: Discovering Simplicity in a Complex World* (London and New York: Viking).
- Commons, John R. (1934) *Institutional Economics - Its Place in Political Economy* (New York: Macmillan). Reprinted 1990 with a new introduction by M. Rutherford (New Brunswick, NJ: Transaction).
- Compte, Auguste (1853) *The Positive Philosophy of Auguste Compte*, 2 vols., translated by Harriet Martineau (London: Chapman).
- Coricelli, Fabrizio and Dosi, Giovanni (1988) 'Coordination and Order in Economic Change and the Interpretative Power of Economic Theory', in Dosi, Giovanni, Freeman, Christopher, Nelson, Richard, Silverberg, Gerald and Soete, Luc (eds) (1988) *Technical Change and Economic Theory* (London: Pinter), pp. 124-47. Reprinted in Hodgson (1993b).
- Debreu, Gerard (1959) *Theory of Value: An Axiomatic Analysis of General Equilibrium* (New Haven: Yale University Press).
- Debreu, Gerard (1974) 'Excess Demand Functions', *Journal of Mathematical Economics*, **1**(1), March, pp. 15-21.
- Degler, Carl N. (1991) *In Search of Human Nature: The Decline and Revival of Darwinism in American Social Thought* (Oxford and New York: Oxford University Press).

- Dorfman, Joseph (1934) *Thorstein Veblen and His America* (New York: Viking Press).
Reprinted 1961 (New York: Augustus Kelley).
- Durkheim, Emile (1982) *The Rules of Sociological Method*, translated from the French edition of 1901 by W. D. Halls with an introduction by Steven Lukes (London: Macmillan).
- Elster, Jon (1982) 'Marxism, Functionalism and Game Theory', *Theory and Society*, **11**(4), pp. 453-82. Reprinted in Roemer, John E. (ed.) (1986) *Analytical Marxism* (Cambridge: Cambridge University Press).
- Elster, Jon (1983) *Explaining Technical Change* (Cambridge: Cambridge University Press).
- Feyerabend, Paul K. (1965) 'Reply to Criticism', in Cohen, Robert S. and Wartofsky, Max W. (eds) (1965) *Boston Studies in the Philosophy of Science* (New York: Humanities Press), pp. 223-61.
- Furubotn, Eirik G. and Richter, Rudolph (1997) *Institutions in Economic Theory: The Contribution of the New Institutional Economics* (Ann Arbor: University of Michigan Press).
- Galbraith, John K. (1958) *The Affluent Society* (London: Hamilton).
- Giddens, Anthony (1984) *The Constitution of Society: Outline of the Theory of Structuration* (Cambridge: Polity Press).
- Gleick, James (1988) *Chaos: Making a New Science* (London: Heinemann).
- Hamilton, Walton H. (1932) 'Institution', in Edwin R. A. Seligman and A. Johnson (eds) *Encyclopaedia of the Social Sciences* (New York: Macmillan), Vol. 8, pp. 84-89.
Reprinted in Hodgson (1993b).
- Hobson, John A. (1936) *Veblen* (London: Chapman and Hall). Reprinted 1991 by Augustus Kelley.
- Hodgson, Geoffrey M. (1988) *Economics and Institutions: A Manifesto for a Modern Institutional Economics* (Cambridge and Philadelphia: Polity Press and University of Pennsylvania Press).
- Hodgson, Geoffrey M. (1993a) *Economics and Evolution: Bringing Life Back Into Economics* (Cambridge, UK and Ann Arbor, MI: Polity Press and University of Michigan Press).
- Hodgson, Geoffrey M. (ed.) (1993b) *The Economics of Institutions* (Aldershot: Edward Elgar).
- Hodgson, Geoffrey M. (1998a) 'The Approach of Institutional Economics', *Journal of Economic Literature*, **36**(1), March, pp. 166-92.
- Hodgson, Geoffrey M. (1998b) 'On the Evolution of Thorstein Veblen's Evolutionary Economics', *Cambridge Journal of Economics*, **22**(4), July, pp. 415-31.
- Hodgson, Geoffrey M. (1999) *Evolution and Institutions: On Evolutionary Economics and the Evolution of Economics* (Cheltenham: Edward Elgar) forthcoming.
- Ingrao, Bruna and Israel, Giorgio (1990) *The Invisible Hand: Economic Equilibrium in the History of Science* (Cambridge, MA: MIT Press).

- Kauffman, Stuart A. (1993) *The Origins of Order: Self-Organization and Selection in Evolution* (Oxford and New York: Oxford University Press).
- Kauffman, Stuart A. (1995) *At Home in the Universe: The Search for Laws of Self-Organization and Complexity* (Oxford and New York: Oxford University Press).
- Kirman, Alan P. (1989) 'The Intrinsic Limits of Modern Economic Theory: The Emperor Has No Clothes', *Economic Journal (Conference Papers)*, **99**, pp. 126-139.
- Kirman, Alan P. (1992) 'Whom or What Does the Representative Individual Represent?', *Journal of Economic Perspectives*, **6**(2), Spring, pp. 117-36.
- Kontopoulos, Kyriakos M. (1993) *The Logics of Social Structure* (Cambridge: Cambridge University Press).
- Koopmans, Tjalling C. (1947) 'Measurement Without Theory', *Review of Economics and Statistics*, **29**(3), August, pp. 161-72.
- Koopmans, Tjalling C. (1949a) 'Identification Problems in Economic Model Construction', *Econometrica*, **17**, pp. 125-44.
- Koopmans, Tjalling C. (1949b) 'Methodological Issues in Quantitative Economics: A Reply', *Review of Economics and Statistics*, **31**(2), May, pp. 86-91.
- Lane, David A. (1993) 'Artificial Worlds and Economics, Parts I and II', *Journal of Evolutionary Economics*, **3**(2), May, pp. 89-107, and **3**(3), August, pp. 177-97.
- Lavoie, Marc (1992) *Foundations of Post-Keynesian Economic Analysis* (Aldershot: Edward Elgar).
- Lawson, Antony (1997) *Economics and Reality* (London: Routledge).
- Lewes, George Henry (1875) *Problems of Life and Mind*, vols. 2 (London).
- Lindahl, Erik R. (1939) *Studies in the Theory of Money and Capital* (London: Allen and Unwin).
- List, Friedrich (1904) *The National System of Political Economy*, translated from the German edition of 1841 by Sampson S. Lloyd, with an introduction by J. Sheild Nicholson (London: Longmans, Green).
- Lucas, Robert E., Jr (1987) *Models of Business Cycles* (Oxford: Basil Blackwell).
- Macpherson, Crawford B. (1962) *The Political Theory of Possessive Individualism: Hobbes to Locke* (Oxford: Oxford University Press).
- Mantel, Rolf R. (1974) 'On the Characterization of Aggregate Excess Demand', *Journal of Economic Theory*, **12**(2), pp. 348-53.
- Mayr, Ernst (1985) 'How Biology Differs from the Physical Sciences', in Depew, David J. and Weber, Bruce H. (eds) (1985a) *Evolution at a Crossroads: The New Biology and the New Philosophy of Science* (Cambridge, MA: MIT Press), pp. 43-63.
- Mill, John Stuart (1843) *A System of Logic: Ratiocinative and Inductive, Being a Connected View of the Principles of Evidence and the Methods of Scientific Investigation*, 1st edn., 2 vols (London: Longman).
- Mirowski, Philip (1987) 'The Philosophical Bases of Institutional Economics', *Journal of Economic Issues*, **21**(3), September, pp. 1001-38. Reprinted in Mirowski, Philip (1988)

- Against Mechanism: Protecting Economics from Science* (Totowa, NJ: Rowman and Littlefield).
- Mirowski, Philip (1989) *More Heat Than Light: Economics as Social Physics, Physics as Nature's Economics* (Cambridge: Cambridge University Press).
- Mitchell, Wesley C. (1937) *The Backward Art of Spending Money and Other Essays* (New York: McGraw-Hill).
- Morgan, C. Lloyd (1927) *Emergent Evolution*, 2nd edn. (1st edn. 1923) (London: Williams and Norgate).
- Morgan, C. Lloyd (1932) 'C. Lloyd Morgan' in Murchison, Carl (ed.) (1932) *A History of Psychology in Autobiography, Volume 2* (New York: Russell and Russell), pp. 253-64.
- Morgan, C. Lloyd (1933) *The Emergence of Novelty* (London: Williams and Norgate).
- Murphy, James Bernard (1994) 'The Kinds of Order in Society', in Mirowski, Philip (ed.) (1994) *Natural Images in Economic Thought: Markets Read in Tooth and Claw* (Cambridge and New York: Cambridge University Press), pp. 536-82.
- North, Douglass C. (1990) *Institutions, Institutional Change and Economic Performance* (Cambridge: Cambridge University Press).
- Popper, Karl R. (1974) 'Scientific Reduction and the Essential Incompleteness of All Science', in Ayala, Francisco J. and Dobzhansky, Theodosius (eds) (1974) *Studies in the Philosophy of Biology* (Berkeley and Los Angeles: University of California Press), pp. 259-84.
- Popper, Karl R. (1982) *The Open Universe: An Argument for Indeterminism*, from the *Postscript to the Logic of Scientific Discovery*, edited by William W. Bartley, III (London: Hutchinson).
- Popper, Karl R. and Eccles, John C. (1977) *The Self and Its Brain* (Berlin: Springer International).
- Prigogine, Ilya and Stengers, Isabelle (1984) *Order Out of Chaos: Man's New Dialogue With Nature* (London: Heinemann).
- Radner, Roy (1996) 'Bounded Rationality, Indeterminacy, and the Theory of the Firm', *Economic Journal*, **106**(5), September, pp. 1360-73.
- Richardson, Lewis Fry (1922) *Weather Prediction by Numerical Process* (Cambridge: Cambridge University Press).
- Rizvi, S. Abu Turab (1994a) 'The Microfoundations Project in General Equilibrium Theory', *Cambridge Journal of Economics*, **18**(4), August, pp. 357-77.
- Rizvi, S. Abu Turab (1994b) 'Game Theory to the Rescue?', *Contributions to Political Economy*, **13**, pp. 1-28.
- Ross, Dorothy (1991) *The Origins of American Social Science* (Cambridge: Cambridge University Press).
- Sachs, Jeffrey D. (1993) *Poland's Jump to a Market Economy* (Cambridge, MA: Harvard University Press).

- Samuelson, Paul A. (1997) 'Credo of a Lucky Textbook Author', *Journal of Economic Perspectives*, **11**(2), Spring, pp. 153-60.
- Screpanti, Ernesto and Zamagni, Stefano (1993) *An Outline of the History of Economic Thought* (Oxford: Clarendon Press).
- Sonnenschein, Hugo F. (1972) 'Market Excess Demand Functions', *Econometrica*, **40**(3), pp. 549-63.
- Sonnenschein, Hugo F. (1973a) 'Do Walras's Identity and Continuity Characterize the Class of Community Excess Demand Functions?', *Journal of Economic Theory*, **6**(4), pp. 345-54.
- Sonnenschein, Hugo F. (1973b) 'The Utility Hypothesis and Market Demand Theory', *Western Economic Journal*, **11**(4), pp. 404-10.
- Sperry, Roger W. (1969) 'A Modified Concept of Consciousness', *Psychological Review*, **76**, pp. 532-36.
- Sperry, Roger W. (1991) 'In Defense of Mentalism and Emergent Interaction', *Journal of Mind and Behavior*, **12**(2), pp. 221-46.
- Tilman, Rick (1996) *The Intellectual Legacy of Thorstein Veblen: Unresolved Issues* (Westport, Connecticut: Greenwood Press).
- Tobin, James (1986) 'The Future of Keynesian Economics', *Eastern Economic Journal*, **13**(4).
- Udén, Lars (1987) *Methodological Individualism: A Critical Appraisal* (Uppsala: Uppsala University Reprographics Centre).
- Varoufakis, Yanis (1990) 'Conflict in Equilibrium', in Varoufakis, Yanis and Young, David (eds) (1990) *Conflict in Economics* (Hemel Hempstead: Harvester Wheatsheaf), pp. 39-67.
- Veblen, Thorstein B. (1919) *The Place of Science in Modern Civilisation and Other Essays* (New York: Huebsch). Reprinted 1990 with a new introduction by W. J. Samuels (New Brunswick, NJ: Transaction).
- Vining, Rutledge (1949) 'Methodological Issues in Quantitative Economics', *Review of Economics and Statistics*, **31**(2), May, pp. 77-86.
- White, Harrison C. (1992) *Identity and Control: A Structural Theory of Social Action* (Princeton: Princeton University Press).
- Walras, Léon (1954) *Elements of Pure Economics, or The Theory of Social Wealth*, translated from the French edition of 1926 by W. Jaffé (1st edn. 1874), (New York: Augustus Kelley).
- Wilson, Edward O. (1975) *Sociobiology: The New Synthesis* (Cambridge, MA: Harvard University Press).
- Zecchini, Salvatore (ed.) (1997) *Lessons from the Economic Transition in Central and Eastern Europe in the 1990s* (Boston: Kluwer).

