Acta Academica 2001 33(3): 1-35

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Realism and determinism: some thoughts on neoclassical economics

Summary

Neoclassical economics is often criticised for being deterministic and disconnected from social reality. A related criticism is that neoclassical economic theory is instrumentalist. This article argues that neoclassical economics, if properly understood, can be given a realist interpretation. The origins of classical and neoclassical economics are briefly discussed and the scholarly shift away from political economy is located in the marginal utility revolution in economic thought in the 1870s. It is argued that the core assumptions of neoclassical economics capture essential aspects of social reality and are not merely convenient, fictitious abstractions; that the charge of instrumentalism is not entirely justified, and that neoclassical economic theory does not imply that social processes are deterministic or mechanistic in reality.

Realisme en determinisme: enkele gedagtes oor neoklassieke ekonomie

Neoklassieke ekonomie word dikwels gekritiseer omdat dit deterministies en derhalwe verwyderd van die sosiale werklikheid is. Kritiek wat hiermee verband hou is dat neoklassieke ekonomiese teorie instrumentalisties is. Die oorsprong van klassieke en neoklassieke ekonomie word kortliks bespreek. Die wetenskaplike wending weg van politieke ekonomie hang saam met die omwenteling wat die grensnutbegrip in die 1870s in die ekonomiese denkwyse teweeggebring het. Daar word aangevoer dat die kernaannames van moderne neoklassieke ekonomie wesenlike aspekte van die sosiale werklikheid verreken en nie bloot gerieflike, fiktiewe abstraksies is nie; dat die beskuldiging van instrumentalisme nie heeltemal geregverdig is nie, en dat neoklassieke ekonomiese teorie nie impliseer dat sosiale prosesse in werklikheid deterministies of meganisties is nie.

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My aim in this paper is to explain the meaning of realism and determinism in neoclassical economics. How these issues have been debated in the natural sciences is also touched on by way of comparison. This is because the methodology and metaphors of the natural sciences, especially physics, have had such a direct influence on economics, and in particular on neoclassical economics. The emphasis in this paper is on scientific realism, but determinism is also mentioned because this version of realism has been so controversial in the social sciences. Neoclassical economics has often been accused of being unrealistic in the sense of its theories being mechanistic or deterministic. Such critics hold a different view of social reality and believe that neoclassical economics cannot explain this reality satisfactorily.

The paper introduces the classical origins of neoclassical economics in Adam Smith and ends with a discussion of rational expectations. Section 1 explains the meaning of realism and determinism and the way these terms have been received in economics. Section 2 outlines Adam Smith's natural law perspective, while section 3 locates the marginal utility revolution as the decisive scholarly shift away from political economy in the 1870s. Section 4 comments on the concepts of determinism and reality within the context of neoclassical economics. Section 5 extends this discussion to expectations, in particular the role played by the rational expectations hypothesis in the new classical macro-economics. The somewhat wide scope of this paper implies that the discussion is not very tightly structured (and, of course, that some of the issues could well be examined far more closely). However, it is hoped that the thoughts offered will be of interest. Section 6 concludes by tying together some of the strands of thought teased out in the preceding discussion. The main conclusion is that despite some economists' critiques of realism, neoclassical economics can be given a realist interpretation.

Before discussing these issues it is necessary to define what is meant by the term "neoclassical economics". This is not easy: despite its widespread use, the term means different things to different economists. Historically, it is usually taken to mean the school of thought that began with the marginal utility revolution of the 1870s and which has continued, through various refinements and permuta-

tions, to the present day. It reached its zenith during the late 1930s and in the post-war period it was gradually absorbed into a broader and more eclectic mainstream. Neoclassical economists would arguably include early pioneers such as Menger, Jevons and Walras; those who widened the applications of the marginal principle, like Marshall, Edgeworth, Chamberlin and Robinson, and those who formally teased out the logical implications and connections of the theory, such as Hicks in *Value and Capital* (1939) and Samuelson in his *Foundations* (1947). The post-war orthodoxy is sometimes simply called "modern economics" and is far more eclectic and permissive in terms of content. Colander (2000) distinguishes between the general model-building *method*, which he argues is the central feature of modern orthodox economics ("New Millennium Economics", as he calls it), and the content or attributes of neoclassical economics.

Today, neoclassical economics is generally regarded as a brand of economics which builds models under the assumption of constrained maximisation, far-sighted rationality, market clearing, and methodological individualism. Although this list may vary (for example, some might include the emphasis on relative prices and the allocation of scarce resources as defining features), it captures the aspects of neoclassical economics of which realists have been most critical. In the context of this paper, neoclassical economics includes the new classical economics of Lucas, Sargent and Barrow but excludes Keynesian economics and what is commonly called the neoclassical synthesis (of Keynesian and Classical ideas) formulated by Samuelson. Realists are also particularly critical of the formal Walrasian general equilibrium approach, but it would be wrong to regard this as a hallmark of neoclassical economics. Much of neoclassical price theory engages with partial equilibrium analysis along Marshallian lines and, unlike most Walrasian economics, is concerned about the empirical adequacy and testing of its models.

1. Realism and determinism

It is also helpful to start with a rough definition and explanation of realism and determinism. This is intended only as a preliminary indication of their meaning. Some of the various aspects thereof will be discussed as they are encountered in the history of neoclassical

thought. Realism is the idea that objective states of the world exist independently of an observer. It is thus a broader proposition than determinism, which asserts a particular kind of reality. Realism does not exclude purely mental states if it is accepted that such states of mind are minimally accessible to objective description at a particular time and place (as, for example, in psychology). This distinction allows a realist construal of theories in subjects like economics even though direct observation of things like pleasure (utility), pain (disutility) and expectations is not possible. At the level of explanation, scientific realism is the belief that our theories do not alter that which actually exists at a given time. Moreover, realists want their theories to explain real events or facts in terms of the actual causal mechanisms that produce such phenomena. Often this implies a degree of reductionism whereby macro-phenomena are to be explained by the operation of deeper or more fundamental causal mechanisms at the micro-level. The realist appraisal of theories emphasises explanation and understanding even at the expense of prediction. Explanation and understanding are sought as ends in themselves and scientific explanations are not to be thought of simply as prediction in reverse.

In contrast to realism, the opposing attitude towards facts and theories in economics is usually labelled instrumentalism. Instrumentalists are not so much interested in whether or not their theories are realistic as in their ability to generate predictions consistent with the empirical evidence. The basic criterion is not how well a theory portrays reality but whether it is successful or unsuccessful in these terms. If different theories are equally successful in accounting for the phenomena, according to this view, the choice between them depends on pragmatic considerations such as simplicity and mathematical tractability. Instrumentalism and realism are not mutually exclusive, however. If instrumentalists use data and attempt to predict, then they are realists about the phenomena recorded by the data. Instrumentalists argue merely that success in prediction is sufficient, whereas realists want theories to do more than simply be consistent with the data.

In earlier debates in economics, these issues have concerned the realism of theoretical assumptions and the tendency to construct the-

ories or models that explain phenomena "as if" the entities or mechanisms supposed by the theory were true. Lawson (1989) argues that theories in orthodox or mainstream economics rely on artificial or "fictionalised" abstractions such as "universal perfect competition, rational expectations, perfect foresight etc", compared to realist abstraction where the aim is to "identify the *real* causal mechanisms and necessary relations that govern the flux of *real* phenomena of the economic and social world" whereby such abstractions "obtain not only in thought but also in the real world" (Lawson 1989: 69-71, his emphasis). Lawson, who advocates a realist approach to theorising in economics, sides with other critics of neoclassical economics, such as Kaldor, who believe that the formal model-building approach, as exemplified by general equilibrium theory, has led to a sterile dead-end, disconnected from the real-world problems with which we should be concerned. Economists such as Lawson are thus not against abstraction or the use of mathematics *per se*. Their complaint is that mainstream economics does not abstract features of the world that bear any resemblance to actual economic and social reality because many of its assumptions are false. Such assumptions, it is argued, are employed simply because they allow the use of mathematics to construct formal models which impart a spurious sense of precision and scientific rigour that does not exist in the real social and economic world.

Besides such artificial or fictionalised abstraction, Lawson is also critical of what he calls abstracting the most general, rather than that which is essential. Here he seems to have in mind basic axioms such as "individuals have preferences" and "individuals can choose from an ordinal ranking of preferences" and "if X prefers A to B and B to C, then X must prefer A to C". Lawson (quoting Dobb) argues that such axioms are illegitimately combined with the fictionalised assumptions mentioned above, to derive theories that are devoid of any substance or economic significance. By contrast, realist abstraction is concerned with that which is essential:

> The aim is to identify connections and relations essential to the existence and efficacy of some structure of interest — to gauge the stratification and internal complexity of some significant entity (Lawson 1989: 71).

One of the aims of the present paper is to suggest that Lawson's realist critique of contemporary economic theory is inapplicable, in some important respects, to neoclassical economics.

Natural scientists are also divided between realism and instrumentalism (or other empiricist versions thereof, as argued by Van Fraassen 1980). However, their differences concern the epistemological rather than the ontological levels of debate. All physical scientists are realists in the ontological sense that they believe in the actual existence of things like electromagnetic waves, electrons, viruses and DNA, and that the nature of these entities does not depend on what observers think about them. Scientists may be mistaken about such beliefs and modify their theories accordingly (for example, the concept of the ether and the early Bohr model of the atom) but this does not alter their realist commitment to such theories. The differences of opinion emerge at the epistemological level as to whether scientific theories should aim to be true representations of reality or whether it is sufficient for them to give an empirically adequate account of the phenomena (Van Fraassen 1980). In a social science like economics there are doubts about realism at both the epistemological and the ontological level. For example, what is the ontological status of theoretical constructs such as utility, class, the market, equilibrium and value? Do such postulated entities actually exist outside the mind of the theorist? These sorts of doubts are carried over to the status of laws in the two domains. In the physical sciences there is less discomfort with the idea that theoretical entities and natural laws have been discovered than in the social sciences where we are inclined to say that theoretical constructs and social laws have been invented rather than discovered.

Differences regarding the realism of economic theories are important fault-lines which partly demarcate different schools or research programmes. Some version or aspects of realism are said to inform, for example, Marxist, Austrian and Institutionalist theorising (see Maki 1990) whereas neoclassical economics is believed to be less concerned with the realism of its theories. In neoclassical economics a further split is discernible between "formalists", who are concerned purely with exploring the logical implications and mathematical expression of their theories (as in neo-Walrasian general equilibrium

theory), and less formal empiricists (such as Friedman), who believe that predictive success is necessary.

Determinism is the idea that, given the state of the world at a given time, there is only one possible compatible future state of the world (or universe). This implies that the present is the unique and inevitable consequence of previous states of the world, either in an infinite regression or back to a finite prime cause or state. The definition presupposes the realist belief that the world as it is exists independently of the observer and that the state of the world is fully specified by phenomena represented by their location in time and space. Like realism, determinism does not have to assume materialism since even mental or psychological events (states of mind) are examples of such phenomena if they have such a space-time representation. Issues relating to determinism have emerged at various levels in economics. As in the physical sciences, there is a basic choice between what to include as endogenous and what to exclude as exogenous variables in economic theories and how to decide on the relationship between the chosen endogenous variables (what determines what). In neoclassical economics, the debate has concerned the determinateness of theories and models in the sense of path-independent arrival at a unique equilibrium position. The efforts to formally prove the existence, uniqueness and stability of equilibrium positions in general equilibrium theory come readily to mind here, as does research into the existence of multiple equilibria and hysteresis effects. More generally, certain theories and methods in economics have been criticised for being deterministic or mechanistic.

Although determinism is closely associated with the concepts of cause-and-effect, it is not synonymous with them. That every event has a cause is a weaker thesis than determinism because it allows for the possibility that the identified causal relationship may change in different temporal or spatial locations. Cause-and-effect approaches the meaning of determinism if one adds the clause that the same causes always produce the same effects. However, marrying a problematic concept like determinism with an equally problematic concept like causation is not very helpful and some philosophers recommend that determinism be analysed without such terms (see Earman 1986). The same recommendation applies to predictability, an idea joined to

determinism most famously by Laplace in supposing an omniscient intelligence which, knowing both the true laws and all the information about a given state of the universe, would be able to predict unerringly the entire course of its past and future history. The problem is that perfect predictions by such an intelligence do not tell us whether their perfection is due to the revealed deterministic unfolding of events or to the perfect foresight implied by omniscience. In the absence of such superhuman capacities, human error entails the corollary that the universe may be predetermined even though it may be impossible to make accurate predictions. For example, the future path of events may be very sensitive and thus unstable with regard to changes in variables comprising the initial conditions of a given state. Bringing in the idea of predictability often ends up confusing questions about the ontological status of determinism with problems in the domain of epistemology. As we shall see, such considerations also play an important role in economics.

For the layperson rather than the more critically minded philosopher, the idea that the physical world is determined by the operation of natural laws is unlikely to evoke surprise, serious qualms or distaste. To suggest that the behaviour of individuals, institutions and societies is similarly determined by such laws is likely to arouse a more varied response. This is because it appears to deny the existence of free will — the strongly held conviction that we could have done otherwise, that we can voluntarily change our minds and behaviour and, with perhaps greater effort, other minds and behaviour as well. When applied to the social realm, Laplace's dream metamorphoses into Popper's nightmare in which "all our thoughts, feelings, and efforts can have no practical influence upon what happens in the physical world" where we are "nothing but little cogwheels, or at best sub-automata, within it" (Popper 1972, quoted in Earman 1986: 9). Throughout the history of economic thought, as in the other social sciences, there have always been those who have rejected the application of the deterministic preconceptions and methods of the natural sciences to the human domain. In economics, this dispute has often taken the form of a tension between explanations of social phenomena based on natural law and those based on an alternative historical and institutional interpretation. This tension may be discerned even

within the writings of the same author, the first sustained evidence of this being found in Adam Smith. Because of his influence on neo-classical economics' choice to model itself on the natural sciences, it will be helpful to explore this dichotomy in Smith's work a little further. Here I follow Clark's (1992) interpretation of Smith's natural law perspective.

2. Adam Smith's natural law perspective

As an admirer of the method and theories of Isaac Newton, Smith's explanation of society flows from the idea that there is a natural order, arrived at by the operation of natural laws. Smith's admiration of Newton is not made explicit in *The wealth of nations* but is clearly apparent in his essay *The history of astronomy*:

> His system, however, now prevails over all opposition, and has advanced to the acquisition of the most universal empire that was ever established in philosophy. His principles, it must be acknowledged, have a degree of firmness and solidity that we should in vain look for in any other system (Smith, quoted in Heilbroner 1986: 35).

The answer to the question whether Smith tacitly applies Newton's ideas and methods to the social and economic domain depends on the interpretation given to *The wealth of nations* and other sources.

For both Newton and Smith, the natural order of the physical and social worlds is the design of a benevolent Creator which is revealed to us through the discovery of the relevant laws of nature. The social parallel of Newton's physical laws is to be found in the laws of human nature which for Smith are similarly universal and predetermined by the intentions of the Creator. These natural theological preconceptions are reflected in Smith's social and economic theories. At the social level we have the famous invisible hand thesis whereby individuals pursuing their own self-interest unintentionally promote the welfare of others and thereby, in the absence of government interference, achieve a natural harmony and social order. In particular, the natural impulse of self-interest will lead to mutually advantageous exchange (trucking and bargaining) based on a spontaneous division of labour and specialisation.

Smith's theories of value similarly reflect the operation of natural law. In his primitive labour theory of value, the exchange value or price of a commodity is determined by the amount of labour time necessary to produce it relative to that of another commodity for which it is exchanged. As society develops, other factors of production are included in a broader cost-of-production theory of value, in which the natural value is the price which exactly pays the just reward or natural rate of return for the various factors (rent, wages and profit). Smith recognises that the actual market price of a commodity may deviate from its natural price but, in the absence of government interference, this is thought to be temporary. The bigger the discrepancy between the two prices the keener the competition between self-interested individuals to take advantage of the greater opportunities for profit. Thus the market price will have a tendency to "gravitate" towards the natural price over time.

Besides the obvious appeal to Newton's physics in using the metaphor of gravitation, there is the idea of a balancing of forces or equilibrium, a notion which is later reworked to become the central organising concept in neoclassical economics. Just as Newtonian physics envisaged the physical universe to be a self-equilibrating system which, when disturbed, would automatically call forth reactionary forces that would re-establish a state of rest, so Smith envisaged a self-adjusting economic system in which exogenous disturbances would provoke a social mechanism whereby equilibrium would be regained. Moreover this would be a just outcome, because in terms of Smith's moral theory it results from the free operation of natural laws.

Smith distinguishes between a primitive labour theory of value and a broader cost-of-production theory, including profit and rent in a more developed society. This distinction introduces the idea of society as undergoing historical and institutional change, since the cost-of-production theory is incomplete without an explanation of what determines the natural rates of return for labour (wages), land (rent) and capital (profit). Here Smith relies on historical and institutional observations, an inductive method which conflicts with a social theory derived from his natural law outlook. On the one hand, Smith's theory of society relies on an indeterministic interpretation of historical and institutional change, while on the other it is deter-

ministic in the sense of moving inexorably towards the preordained natural order, guided by the operation of the constant and universal laws of human nature (see Clark 1992: 85).

3. Marginal utility, apriorism and the scientific turn

Smith's cost-of-production theory of value does not give a coherent explanation of what would cause the market price of a commodity to deviate from its natural price. The missing link was provided by the theory of the consumer and market demand developed by the marginal utility theorists in the 1870s, and enshrined in their law of diminishing marginal utility. In turning to the marginal revolution and the transition to neoclassical economics, we see that it was the natural law aspects of Smith, via their reified expression in Ricardo and the influence of the utilitarians, that was chosen as the foundation upon which to build a true science of political economy. The inductive historical and institutional approach in Smith was discarded altogether by the early or proto-neoclassicals in favour of a thoroughly *a priori* deductivism. The main protagonists were inspired by their shared belief in the discovery of the natural laws of the economy and their vision of economics as a science modelled on the natural sciences, particularly physics. Henceforth, the adjective "political" in political economy was to become redundant as the new science of economics took root and gained in confidence. Moreover, this emulation of nineteenth-century physics was not subconscious, tacit or implicit. Jevons, Walras, Pareto and Edgeworth all appropriated metaphors from physics and were lucidly explicit about their desire to impose a rational mechanics framework on the study of economics and to express economic theories mathematically. As Mirowski (1989: 3) puts it,

> the progenitors of neoclassical economic theory boldly copied the reigning physical theories in the 1870s [...] those neoclassicals did not imitate physics in a desultory or superficial manner; no, they copied their models mostly term for term and symbol for symbol, and said so.

Two strands of thought with regard to realism and determinism can be detected in the transition stage of neoclassical economics. One of these was the inclination towards *a priori* deductivism while the

other was a more empiricist strain, as expressed in logical positivism and thereafter in the less radical version of logical empiricism. Aprioriism received its clearest exposition from Robbins in the 1930s. In his hands, neoclassical economics bordered on denying the necessity of subjecting either the premises or the logical implications of economic theory to empirical test. Concerning the premises of economics, Robbins (1935: 105) asserts that

> the ultimate constituents of our fundamental generalisations are known to us by immediate acquaintance. In the natural sciences they are known only inferentially. There is much less reason to doubt the counterpart in reality of the assumption of individual preferences than that of the assumption of the electron. It is true that we deduce much from definitions. But it is not true that the definitions are arbitrary.

These sentiments clarify Robbins's belief that although the premises of an economic theory are often derived from subjective introspection, they are as ontologically real as any objects that we may contemplate in the external world. In closing the circle with regard to testing the validity of economic theories via their logically deduced implications, Robbins often argues that this is also unnecessary because

> Economic laws describe inevitable implications. If the data they postulate are given, then the consequences they predict necessarily follow [...] If, in a given situation, the facts are of a certain order, we are warranted in deducing with complete certainty that other facts which it enables us to describe are also present (Robbins 1935: 121).

What cannot be explained — what is taken to be indeterminate or "the irrational element in the economist's universe" — is the formation of individual preferences and technological change, which must be taken as given or subject to investigation by non-economic theories in a different domain. But given the initial conditions and premises of the theory, given to us *a priori* by introspection, everything else must follow inevitably, just as "in pure Mechanics we explore the implication of the existence of certain given properties of bodies" (Robbins 1935: 83).

At this point we have the epitome of a closed, deterministic economic theory which begins and ends inside the head of the theorist. However, Robbins, like Cairnes before him, avoids solipsism by offering an escape route. For Robbins, empirical or "realistic" studies do

not constitute a genuine test of the theory itself — this would be superfluous or misleading — but they do play a part in suggesting new problems to be solved, the limits or range of application of the theory, or possible new assumptions about our natures. However, as Robbins (1935: 120) insists, "it is theory and theory alone which is capable of supplying the solution". As it happens, the *a priori* deductive method was not fully adopted by neoclassical economics, which followed the logical positivist, empiricist and falsificationist train of thought in the natural sciences instead, but it continues as a distinctive feature of the Austrian school.[1] However, strong elements of apriorism remain, particularly in micro-economics (see Hausman 1992), and can be detected in the neoclassical attitude towards survey data and the results of econometric "tests" as not to be taken seriously either for verification or falsification of a theory.

The language used in modern neoclassical economics resonates with terms and concepts extracted from nineteenth-century physics: the central concept of equilibrium and the balancing of the forces of supply and demand; analysing changes in equilibrium positions over time by means of the comparative statics approach; elasticity; and frictional unemployment. The classical economists' belief that economic laws reflect the harmonious operation of natural forces and tend to lead to a natural order in society is similarly reflected in the use of terms such as the natural rate of unemployment and the distinction between voluntary and involuntary unemployment. Perhaps of even greater importance in the scientism of economics than the appropriation of such metaphors has been the widespread application of the mathematical techniques of nineteenth-century physics that began with the marginalists, in particular the use of differential calculus to solve various optimisation problems in economics. As Colander (2000: 135-6) points out, the use of mathematics in modern economics has moved well beyond marginal analysis and calculus. However, the issue here is that the use of formal mathematics (whether in neoclassical or the broader mainstream economics) has led the charge

1 Maki (1990) shows how the *a priorism* of the Austrians, and their concern with scientific explanation based on the "essential natures" of what is behind empirical appearances, can be given a realist interpretation.

against the unreality and irrelevance of much economic theory, especially general equilibrium theory. Such theories seem to be little more than elaborate and sophisticated thought experiments with little connection to the real world. For some economists, the intention is that such theories will eventually reach the stage where they can be applied to the real world, although it is not clear whether or when this point might be reached. For others, the use of formal mathematics in economics is justified simply because it can be done. Backhouse (1997) notes that Samuelson's claim that his mathematical methods were moving towards greater realism (in his article on the multiplier-accelerator, for example) is completely unsubstantiated. Mirowski (1989: 378-86) also notes that despite Samuelson's anti-scientism rhetoric and espousal of operational empiricism, in practice he made much use of physics metaphors and rarely moved beyond the mathematical exploration and expression of economic theory in his various theorems.

In the natural sciences, few would question the idea that the use of mathematics has played an indispensable role in deepening our understanding and broadening our knowledge of the physical world. An even stronger argument may be made that mathematics has allowed us to come closer to reality in the sense that the essence of natural scientific laws may be expressed mathematically, or at least that the equations used reflect some existing underlying reality. Although mathematics is useful in many areas of economics, it has also been perceived as a mixed blessing and in many areas as moving us away from, rather than towards, social and economic reality (see, for example, Leontief 1982 and Leamer 1983). Underlying these misgivings is the suspicion that, unlike physics, social phenomena cannot be adequately explained by mathematical formulae and equations representing their own "laws of motion". Moreover, even where mathematical modelling has led, unlike formal general equilibrium theory, to efforts to check the empirical consistency of models, the instrumentalist approach to such research has been questioned (as may be seen, for example, in the dissatisfaction with "innocuous falsification" and the abuse of econometrics in data mining exercises). This is not a problem in economics if we content ourselves with empirically adequate explanations of the phenomena. However, it will not do for a realist

account of economic theory which aims to identify the real causal powers or the structures believed to lie behind the appearances. As argued in sections 3 and 4 below, it is wrong to portray neoclassical economics in general as either formalist or instrumentalist.

Mirowski (1988; 1989) narrows down the source of inspiration of the marginal utility theorists to the fledgling energetics school of physicists that was influential during the mid-nineteenth century. The Mirowski thesis asserts that their law of conservation of energy was taken over by the marginal utility theorists to describe a utility function, with utility being understood as the economic value-equivalent of potential energy. The variational principles and differential equations used to describe the conversion of energy from one form to another were similarly used to describe the conservation of utility in the exchange of commodities. The problem, says Mirowski, was that the economists who made this translation did not properly understand the physics and in some cases (Walras receives special attention here) had not mastered the mathematics either. The logical errors made in the mathematical translation from energy to utility, when patiently pointed out by more competent practitioners in physics, were met with a varied assortment of *non sequiturs* or dismissive replies. Moreover, with the waning influence of the proto-energetics school towards the end of the century, neoclassical economics had boxed itself within the confines of the utility-as-potential-energy model and could not accommodate itself to the implications of the radical changes that occurred in physics shortly thereafter, including the implications of the second law of thermodynamics and the concept of entropy, relativity theory and quantum mechanics.

Despite the advances made by later economists such as Samuelson in correcting the errors of the marginalists and extending mathematics to new areas in economics, the neoclassical research programme, according to Mirowski, remains stuck in a time-warp from which it is unable to extricate itself. He contends that modern neoclassical economics faces a fundamental internal contradiction in which the various attempts to construct a dynamic theory of production, based on the classical idea of value as a substance which can be created and destroyed, do not fit the essentially static neoclassical theory of value in exchange based on a conserved utility function with given com-

modity endowments. Mirowski concludes that, despite its superficial appearance of robust good health, neoclassical economics is suffering from a terminal disease alternatively called scientism or mechanism.

4. Determinism, realism and the neoclassical research programme

This is not the place to give an extended analysis and critique of the whole Mirowski thesis.[2] But two points regarding the modelling of neoclassical economics on physics may be made here. First, the argument that neoclassical economics is fixated on a nineteenth-century proto-energetics model is not very persuasive. Mirowski seems to be saying that this model is not simply metaphorical, but that it was copied term for term and symbol by symbol, and that neoclassical economics cannot dump or even modify it because to do so would threaten the integrity of the entire research programme. If he is thinking of a Lakatosian research programme, this seems to suggest that "utility as potential energy" must be regarded as an untouchable hard-core assumption. Many economists disagree as to just what the hard-core assumptions of the neoclassical research programme are. If we take constrained maximisation and market clearing to be the core assumptions of the neoclassical research programme, then various models of utility and consumer behaviour such as ordinal utility, indifference curve analysis and revealed preference are all acceptable adjustments within the programme. There does not seem to be any convincing argument that the utility-as-potential-energy model has not been or cannot be modified, or even dispensed with. Such modifications may ultimately prove unsatisfactory because they are not corroborated by empirical tests but that does not imply that they have not (or cannot or should not) be attempted. Moreover, the oft-predicted collapse of the neoclassical research programme is unlikely to occur, despite the signs of degeneracy in the programme, unless

2 Mirowski's fascinating portrayal of the way in which the early marginal utility theorists misappropriated metaphors and particular equations from physics is very persuasive. I would dispute only his arguments regarding the consequences thereof for the neoclassical research programme. See also Margaret Schaba's (1993) comments concerning "physics envy" in economics.

there is a better alternative. Mirowski is a Veblen fan and favours the institutionalist research programme. It is difficult to say whether or not this programme is theoretically or empirically superior to neoclassical economics because Mirowski does not make the comparison explicit. Colander (2000) says that the general model-building approach to economics, which he claims is the new orthodoxy, has long ago shed the old-fashioned assumptions of neoclassical economics. Whether the model-building heuristic alone is sufficient to unify the many other research agendas of such orthodox economists within a coherent research programme remains to be seen.

Secondly, it is not clear why mechanistic metaphors and scientific methods in economics should be so objectionable. Perhaps it is because they conjure up Popper's nightmare of human beings as automatons without the irreducible free will believed to be the essential characteristic of humanity. Such beliefs are thought to imply that economic theories cannot explain real social structures and processes, as expressed, for example, by Lachmann (1986: 114-5):

> The task of economic theory, as of other social sciences, is to make the world of human action intelligible to us. This world offers little scope for determinism. Our aim is to understand why men, hence entrepreneurs, act in the way they do [...] no theory of choice worth its name is compatible with determinism.

But this view of theory mistakes epistemological and ontological conceptions of determinism. The fact that neoclassical theories are closed, deterministic explanations of economic phenomena and use mechanistic metaphors does not imply that, in reality, our actions and decisions are predetermined or mechanistic and that the belief in our freedom of choice is false. The reason is similar to that given by J S Mill in his defence of the fictional abstraction of economic man as

> a being who is determined, by the necessity of his nature, to prefer a greater portion of wealth to a smaller in all cases, without any exception than that constituted by the two counter-motives already specified (aversion to labour, and desire of the present enjoyment of costly indulgences). Not that any political economist was ever so absurd as to suppose that mankind are really thus constituted, but because this is the mode in which science must necessarily proceed.

Political economy does not concern itself with the whole realm of human conduct. Within its chosen domain, however, where the acquisition of wealth is the acknowledged end,

> [t]he manner in which it necessarily proceeds is that of treating the main and acknowledged end *as if* it were the sole end; which, of all hypotheses equally simple, is the nearest to the truth (Mill 1967: 321-3, emphasis mine).

At another level it is also important to distinguish between mechanism and determinism. A machine is made from different parts, a unitary system which, once it is put into motion, has the desired properties of regularity and predictability. However, these determinate properties of the machine as a unity do not necessarily pertain to the individual components. For example, the properties of a gas inside a closed container, such as the relationships between volume, temperature and pressure, can be reliably determined by the kinetic theory of gases. However, the theory says nothing about the paths of the numerous collisions of the gas particles with each other or the precise distribution of subsequent collisions against the sides of the container. At this level the process is essentially indeterminate but if the velocity and direction of the colliding particles is essentially random, then the aggregate result can be explained using a deterministic law such as Boyle's Law.

Similarly in economics, the inverse relationship between the price and quantity demanded of goods may be regarded as a statistically determinate law, even though it would generally be an impossible task to predict a particular individual's response to a change in the price thereof. At this level the behaviour of the individual is indeterminate. Of course, if we had sufficient information about all the relevant circumstances of the individual, then in principle it would be possible to make such a prediction, just as it would be to predict the behaviour of an individual gas particle inside the container. A related distinction should also be made between a stable deterministic and a stable stochastic system (for example, see Sheffrin 1996: 12-3). Critics of deterministic economic theories often have the former in mind, whereby a system, if disturbed, will always return to a stationary state of equilibrium. This is thought to be an unrealistic metaphor for economic and other social processes in which pervasive un-

certainty is regarded as the rule rather than the exception. By contrast, a stable stochastic system is continually prone to unpredictable shocks, so it is always in a state of flux. However, it obeys stable laws of probability and patterns may thus be observed between certain events, in the same way that weather patterns are said to exist. Similarly, many markets (such as the stock, currency and commodity markets) appear to be unpredictable, with prices never seeming to settle at a stable equilibrium. However, the behaviour of such prices has been found to obey stable laws of probability. It is thus possible to learn about the probability distributions of certain events even though one cannot say with absolute certainty that any particular equilibrium will prevail. Stable stochastic systems or processes thus fall between the extremes of complete uncertainty and mechanical determinism (see also the discussion in section 5 on rational expectations).

It is considered ironic that neoclassical economics remains wedded to a nineteenth-century classical mechanics model, when physics itself has been transformed by the acceptance of the relativity and quantum theories in the twentieth century. The popular idea of this irony is that these theories have discovered an irreducible relativity and indeterminism at the macro- and micro-physical scale respectively. Even the most non-scientifically minded layperson has probably heard of Einstein's theories of relativity and Heisenberg's uncertainty principle. It is thought to be doubly ironic that such indeterminism has been discovered by physicists rather than by social scientists concerned with the behaviour of self-willed human beings.

These ironies are only apparent, for two reasons. First, as argued above, neoclassical economic theories do not assume that the actions and decisions of human beings are in reality predetermined. Secondly, it is a mistake to believe that either relativity or quantum theory demonstrates indeterminism compared to the determinism of Newtonian physics. As argued by Earman (1986: 55-79), without imposing certain supplementary conditions (such as somewhat arbitrary boundary conditions) it is not possible to find a unique solution to the initial value problem for some of the fundamental equations of motion in classical physics. Paradoxically it is only for the special theory of relativity (for a field rather than a particle) that determi-

nism can be demonstrated without qualification. As far as quantum theory is concerned, its alternative rubric "quantum mechanics" should alert one to the fact that in some respects the theory envisages physical processes that are at least as deterministic as classical physics. It is precisely this feature of the theory that accounts for its acclaimed empirical successes. What is more controversial is whether the Copenhagen version is ontologically correct in suggesting that nature really does consist of irreducible stochastic processes at the micro-physical level — a metaphysical question on which Einstein answered Max Born with the famous retort: "You believe in the God who plays dice, and I in complete law and order in a world which objectively exists ..." (quoted in Earman 1986: 199). Many physicists are not convinced that Heisenberg's uncertainty principle marks the absolute limit beyond which we cannot with any certainty objectively infer physical processes (for example, see Bohm 1957).

An interesting case study highlighting some of the issues of determinism and realism in economics has been conducted by Latsis (1972). He develops three main arguments. First, the neoclassical theory of the firm may be regarded as a Lakatosian research programme in which the overriding positive heuristic is to represent the price and output decisions of a firm as a single-exit or straightjacket solution. In view of the constraints imposed by the theory on the firm he calls this programme "situational determinism". Secondly, Chamberlin's theory of monopolistic competition, far from being an alternative research programme, shares the same hard-core assumptions as the neoclassical research programme. Thirdly, the theories of Simon, Baumol, Quandt and others, which rely on different behavioural assumptions of the firm, constitute an alternative research programme called economic behaviouralism. Given the hard-core assumptions of the neoclassical theory of the firm identified by Latsis (profit maximisation; perfect knowledge; independence of decisions; perfect markets) and the auxiliary assumptions applicable to perfect competition and monopoly respectively, under either of these conditions the firm is faced with a single-exit solution: to produce at the point where marginal cost equals marginal revenue, or to go bankrupt.

In this theory, the reality of the entrepreneur who must in practice make decisions under conditions of uncertainty and the hun-

dreds of other conceivable constraints under which firms actually operate is generally ignored. But in the context of the neoclassical research programme, this simplification of reality does not matter. Unrealistic assumptions[3] are not a serious concern because any theory necessarily simplifies and abstracts from reality. Especially in a complex economic world, where everything depends on everything else, such simplifications of reality are a desirable attribute of the theory rather than a liability. Neoclassical assumptions such as constrained maximisation, market clearing, and rational expectations may be thought of as caricatures or cartoons in which certain features of the real world are deliberately exaggerated. The caricature does not exist in the real world but we can nevertheless recognise these features in different real-world contexts. According to Hahn, even at the more general level of basic economic axioms (for example, that consumers can rank their preferences and choose accordingly, and that in any production function, more output requires more input), it is not that such axioms are divorced from reality and experience but that any theory must have some starting point beyond which it does not seek to explain:

> Axioms are not plucked out of the air and far from distancing the theorists from what somewhat mysteriously is called the 'real' world, they constitute claims about this world so widely agreed as to make further argument unnecessary (Hahn 1985: 5).

3 A familiar related criticism of the neoclassical theory of the firm is that it uses terms like marginal cost and marginal revenue, of which many businesspeople are unaware, so even if the assumptions of the theory are true, the implication that profit-maximising firms produce at the point where marginal cost equals marginal revenue cannot be true in reality — for how can firms maximise profit if they do not know what the theory tells them is the optimisation rule? According to Machlup, this criticism is unwarranted because it is not necessary for economic agents to be aware of a theory in order to behave in accordance with the logical implications and predictions thereof. All that matters is that such agents act "as if" they knew the theory and its implications. Thus true consequences may result from descriptively false assumptions and from theories using terms that in reality are unknown to the economic agents concerned.

For example, Hahn regards the belief that firms maximise some function of profits as axiomatic, whereas the precise form of the function would constitute an assumption. Such an axiom

> is not plucked out of the air or from dreams. It encapsulates an empirical phenomenon which many practical people and economists believe to be the nature of the capitalist (Hahn 1984: 6).

Thus Lawson's argument (see Lawson 1989: 76 and 1997: 227-37) that contemporary economic theory uses the wrong kind of abstraction because it relies on abstracting the most general rather than that which is essential, and that such generalisations result in the theory relying upon assumptions which are nothing more than "convenient fictions", is not an entirely valid criticism of neoclassical economics. Of course, what neoclassical economics regards as axiomatic and what it chooses to exaggerate, and the theories derived therefrom, may ultimately have proved to be unfruitful, but that is a different matter from saying that such theories cannot be given a realist interpretation. Any alternative theory will have its own set of axioms and assumptions which in some other respects will also greatly simplify and exaggerate aspects of the complex economic reality that actually exists. If we want scientific economic theories that give rise to testable implications, then Lawson's arguments apply to all theorising in economics, not just to neoclassical economics. If we do not believe that economics is or can be a science, then we will have to eschew theory altogether and be content with historicism or some other way of explaining reality.

Lawson, however, is not against theory in economics and in the preface to his 1997 book favourably cites economists such as Veblen, Keynes, Marshall, and Dobb. Now in what sense are the theories of, say, Keynes, more realistic than those of neoclassical economics? For example, which abstraction or stylised fact is the better (more realistic) simplification: that most people in market economies are involuntarily unemployed, or that for the most part the markets clear and most of them in fact do have jobs? If the average rate of unemployment in the European Union over the past ten years was about 10 per cent (or even the more common 20 to 40 per cent it is estimated to be in many developing countries), it is as realistic to suppose that markets clear as it is to presume that markets routinely fail on a large

scale. Similar remarks can be made about the existence of perfectly competitive markets. As a literal description of the real world, perfect competition is inaccurate. However, it is not fictitious. For example, in the South African economy a range of markets exists, from highly competitive markets in fresh produce and foreign currencies, to less competitive markets in beer and steel manufacturing. Even in the latter examples of near monopolies, competitive pressures exist in the form of imports and domestic substitutes. Neoclassical economics is quite capable of giving a realistic account of both highly competitive and monopolistic markets. It has more difficulty in explaining the behaviour of oligopolistic markets, due to the interdependence of firms' decision making and the formation of expectations (see also section 5), but this is in recognition of such realities, not because neoclassical economics pretends that they do not exist. The subsequent development of game theory was an attempt to provide a theoretically explicit account of such phenomena, so neoclassical economics can hardly be accused of ignoring these aspects of reality.

Moreover, as argued by Machlup in his debate with Hutchinson in the 1950s (see Caldwell 1994: 139-72), it is counter-productive to insist on empirical verification of the individual assumptions of a theory. It is the implications deduced from the premises of the theory that are meant to be tested empirically, not the assumptions themselves. Within the context of a Lakatosian research programme, the acid test is that the related series of theories making up the programme have predicted novel facts, some of which should be corroborated by empirical tests. Latsis suggests that the neoclassical theory of the firm has generated some novel theoretical implications but that it has had little empirical success. The question then is whether an alternative research programme has shown any sustained theoretical and empirical progress in comparison to neoclassical economics. Latsis does not believe this to be the case for economic behaviouralism:

> Indeed, as a research programme, it is less rich and much less coherent than its neoclassical opponent. One sees a maze of low level generalisations guided mainly by common-sense psychological considerations and growing chaotically in very different directions. No real hard core or comprehensive positive heuristic has emerged yet from the 'behavioural' trial and error (Latsis 1972: 234).

It may yet be objected that this is an instrumentalist interpretation whereby economic theories should be appraised solely on their performance in generating empirically corroborated predictions. The main realist criticism against instrumentalism in economics, particularly in macro-economics, is that it does not provide a satisfactory explanation of the phenomena concerned — the predictive success of the "theory" or model may be due purely to the statistical techniques being used, with very little economic content or value being added by the theory. However, this objection loses some of its force if we accept that a theory should not be appraised in isolation but as part of a unified research programme. For example, instrumentalist criteria offer no guidance on what to do if a previously successful forecasting technique fails, whereas the heuristics of a research programme will give some direction regarding the acceptable modifications to be made to an empirically defective theory. Such modifications should not be *ad hoc*, that is, the theory should not be modified in a way that does not accord with the heuristics of the research programme of which it is a part. According to Lakatos (1978), this would be an example of an unacceptable *ad hoc*$_3$ modification. Lakatos also identifies *ad hoc*$_1$ modifications, which do not lead to any novel facts or independently testable predictions, and *ad hoc*$_2$ modifications, which do predict novel facts but without corroboration. Hands (1988) suggests that neoclassical economists are less concerned with *ad hoc*$_1$ and *ad hoc*$_2$ modifications than they are with hypotheses that are *ad hoc*$_3$. Thus in new classical macro-economic models, for example, acceptable non-*ad hoc*$_3$ modifications would presume neoclassical, choice-theoretic micro-foundations:

> If you see me driving north on Clark Street, you will have good (though not perfect) predictive success by guessing that I will still be going north on the same street a few minutes later. But if you want to predict how I will respond if Clark Street is closed off, you have to have some idea of where I am going and what my alternative routes are — of the nature of my decision problem (Lucas, quoted in Snowdon & Vane 1999: 159).

5. Expectations

The neoclassical theory of the firm has encountered considerable difficulty where price and output decisions are interdependent, for example in the case of oligopoly. In this case, the firm's price and output decisions depend partly on how it expects other firms to respond to changes in its prices and levels of output. In this case there is incomplete knowledge about the competitors' state of mind and the logic of situational determinism is threatened because an indeterminate many-exit solution is possible (the standard neoclassical tactic has been subjected to unsatisfactory *ad hoc* modification of its auxiliary hypothesis so that a single-exit solution is restored). The recognition that model-determinate solutions are dependent on the expectations of the agents that populate the model has had far-reaching consequences in economics. It is an obvious example where economic theory must contend with a problem that the natural sciences do not face — in formulating a theory of planetary motion in the solar system, an astronomer does not have to consider the possibility that Mercury's orbit around the sun depends on what it thinks Neptune's preferred orbital path is, and whether it expects this to change in the near future! The presence of expectations in economics sharpens the awareness that there may be areas in which an artificial, socially created reality exists in contrast to the natural reality contemplated by physicists and other scientists.

Although significant work has been done on expectations in micro-economics, its biggest impact has been in macro-economics and in applications to the financial markets. Keynes regarded expectations as crucial in determining the long-term interest rate and thus, indirectly, the amount of desired investment spending. But he regarded the modelling of expectations as so fraught with difficulty that he chose to treat them as exogenously determined in the exposition of his *General Theory*. A basic theme of macro-economic theory since the Second World War has been the attempt to endogenise expectations and to explain how they are determined in a non-*ad hoc* way, consistent with the hard-core assumptions of the theory. An influential early attempt to model expectations was Cagan's (1956) adaptive expectations hypothesis. Cagan developed a monetarist model in which the expected inflation rate is a function of past inflation

rates. The model was helpful in explaining various episodes of hyper-inflation.

From the perspective of neoclassical economists the adaptive expectations approach is disadvantageous in that it disregards the fact that maximising agents do not ignore relevant new information and that they may learn about systematic relationships in the economy. For example, workers may be aware of a positive relationship between changes in the money supply and inflation. Large increases in money supply growth rates may thus lead to expectations of a higher inflation rate. Under the adaptive expectations approach workers are assumed to wait until an increase in the money supply results in higher prices before they adjust their expectations. This is not consistent with the maximising assumptions of neoclassical economics where the efficient use of information is assumed. Thus, within the neoclassical research programme, adaptive expectations may be seen as an unsatisfactory *ad hoc*$_3$ hypothesis.

In neoclassical economics, the preferred approach to modelling expectations is the rational expectations hypothesis. The adjective "rational" was appended by John Muth in the sense that

> expectations, since they are informed predictions of future events, are essentially the same as the predictions of the relevant economic theory (Muth 1961: 316).

In this sense, the rational expectations hypothesis may be seen as a logical extension of the efficient markets hypothesis, which says that maximising economic agents do not ignore any relevant information in their decision-making and that prices fully reflect all the available, relevant information. The rational expectations hypothesis goes a step further and says that the predictions of the relevant economic theory are part of this information set. The hypothesis does not specify what the relevant economic theory must be. However, because rational expectations are a neoclassical invention, the chosen theory or model should be consistent with the maximising, choice-theoretic assumptions of the neoclassical research programme.

Rational expectations may thus be thought of as the opposite of Herbert Simon's assumption of bounded rationality and satisfying behaviour on the part of decision-makers. Simon and Muth collabo-

rated on problems of production scheduling and inventory management but diverged as regards the best way in which to model expectations in the theory of the firm (see Sheffrin 1996: 1-9). The main applications in macro-economics have been to theories of the labour market and in interpreting the trade-off between inflation and unemployment. The debate has often concerned the controversial policy implications of the hypothesis. The focus in this section is on the meaning of rational expectations and its implications for realism and determinism in economics, rather than on applications or policy issues.

The objection that the rational expectations hypothesis is unrealistic is reminiscent of previous criticisms of neoclassical theory. The argument is that it is implausible to suppose that people know or are able to learn the true structure or model of the economy (or that part of the economy that is of concern to them) or that they can assimilate the mass of information available at any given time. How are they to distinguish between relevant and irrelevant information? Moreover, the hypothesis seems to imply that everyone has the same "true" mental economic model. What happens if members of the public work with different models of the economy and thus have divergent expectations?

The response to these objections has varied. The main defence of the hypothesis is that it is not meant to be literally true, just as the neoclassical theory of the firm discussed above is not held to be a realistic portrayal of how firms actually make decisions. As Muth (1961: 317) puts it, the rational expectations hypothesis "does not assert that the scratch work of entrepreneurs resembles the system of equations in any way". Once again the "as if" metaphor is appealed to here and the defence of the rationally efficient maximising agent reminds us of Mill's defence of the simplifying assumption of economic man alluded to earlier (see section 3). Not everyone will subscribe to the same economic model. In reality it is likely that, at any given time, various groups will work with different models while some will not entertain any serious thoughts on such matters at all. The rational expectations hypothesis proceeds from the simplifying descriptive fiction that everyone believes in the same true model. However, it should not be regarded as an example of Friedman's F-twist, whereby

the assumptions of the most useful economic theories should be false in the sense of counter-intuitive. The rational expectations theory only requires that a sufficient number of people know or learn the actual structure of the economy (or the relevant part thereof), acquire the relevant information and process it, and act accordingly.

Although the rational expectations theory may be a major simplification of reality it is not intuitively false — we observe many individuals and organisations who make a living out of just such a process, particularly in the highly competitive financial and commodities markets. A relatively small number of these agents may be sufficient to push economic variables in the direction implied by the true structural model. Thus the evidence of survey data which shows that, on average, the respondents do not behave in the way implied by rational expectations does not falsify the hypothesis. Moreover, the hypothesis can be modified to account for differences in the costs of information search and the expected return therefrom (Grossman & Stiglitz 1976; 1980). It is also important to emphasise that the implications of the rational expectations hypothesis only follow if it is joined with the auxiliary assumption of maximising behaviour and the broader rationality postulate that individuals behave appropriately in accordance with their expectations. Only with these supporting assumptions in tow can it be argued that people will have an incentive to learn the true structure of the economy, acquire the relevant information and act on the expectations so derived.

If information were literally free, so that anyone could effortlessly know the true model of the economy (and assimilate and process all the relevant information), and if there were no unpredictable changes in the exogenous variables, then the rational expectations hypothesis would be the social equivalent of Laplacean determinism. In this case, it would collapse to perfect foresight, whereby all economic variables would follow a unique, predetermined path from a given state or set of initial conditions. In reality, expectations will be disturbed by unpredictable events such as wars, droughts, changes in preferences, inventions, innovations and so on. However, if the hypothesis is correct, then such unforeseen disturbances should not result in any systematic forecast errors. If people are using the relevant information efficiently, then there should be no serial correlation of the fore-

cast errors and their expected value should be zero. Systematic bias in forecasts implies that the wrong model is being used and, recognising the maximising assumption and rationality postulate, there will be an incentive to discover the reasons for such errors and to learn the correct model.

The appeal to the "as if" metaphor suggests that Muth and new classical economists such as Lucas regard their theories from a non-realist or instrumentalist perspective (although not in the strong sense of Friedman's F-twist). What matters for economists such as these is the empirical adequacy of their theories — the extent to which the observed data are consistent with the logical implications thereof (Van Fraassen's "saving the phenomena"). This is most evident in new classical macro-economics where the rational expectations hypothesis is combined with classical assumptions such as perfect wage and price flexibility, market clearing, and the neutrality of money. Considerable effort has been made to see just how far new classical macro-economic theory can explain or reinterpret the empirical evidence on inflation, unemployment and the business cycle. Moreover, at the ontological level such economists do not appear to regard the constructs used in their theories as existing independently of the mind of the theorist. A good example of the neoclassical attitude to economic reality is the following response by Lucas to an interview question (Snowdon & Vane 1999: 154):

> I think general discussions, especially by non-economists, of whether the system is in equilibrium or not are almost entirely nonsense. You can't look out of this window and ask whether New Orleans is in equilibrium. What does that mean? (*laughter*). Equilibrium is just a property of the way we look at things, not a property of reality.

The argument here seems to be that theoretical constructs like equilibrium are organising concepts that we impose on reality and which do not refer to or reflect an ontological existence outside the mind of the theorist. Similar comments might be made about constructs such as "utility" and "the market" in neoclassical economics. Concepts like "class" in Marxist economic theories may be argued to fall into the same category.

However, such economists are also non-instumentalist. The rational expectations hypothesis is the epitome of a theoretically consistent, non-*ad hoc* hypothesis in the sense of Lakatos's *ad hoc*$_3$. Thus alternative empirically adequate explanations of expectations are not acceptable unless they conform to the maximising, flexible price and market-clearing assumptions of the neoclassical research programme. Indeed much of the criticism of the rational expectations hypothesis has arguably been misdirected in that it is often these assumptions that are objected to, not the hypothesis itself. At another level, rational expectations theorists like Lucas show a distinctive realist twist. For example, they are not satisfied with purely subjective explanations of expectations along the lines of Savage or Bayesian conditional probability. Expectations must be related to objective, measurable events and data. To derive a theory with empirically testable implications one must have a way of inferring the actual probability distributions attached to the endogenous variables of the true model.

An important issue concerning the realism of economic theories is whether the structure of the economy (or parts thereof) is sufficiently stable to permit of any judgement about its future. If the relatively stable and enduring changes (if any) to economic variables are generally overwhelmed by unpredictable events then no theoretical explanation, whether of rational expectations or not, would be possible. Under conditions of complete uncertainty, we would be unable to assign any subjective probability distribution to the expected changes in such variables — the most we could say is that event x either would or would not occur. Since no predictive economic theory could be formulated, the only possible mode of explanation open to us would be historical, with successions of unique events being interpreted retrospectively. Rational expectations theorists do not deny that structural change is an inherent characteristic of the economy and that these changes are sometimes unpredictable (or that there may be unexpected shifts in economic policy by the authorities). Indeed, recognition of this fact is the basis of the Lucas critique that naive extrapolation from econometric models is misconceived because the estimated parameters are not constant. However, like anybody with a theory rather than a historical anecdote, they believe that there is sufficient stability and persistence in the structure of the eco-

nomy to allow for the construction of models that are applicable for at least a time. In addition, these same models guide the information search of economic agents and thereby serve as the basis upon which they form their expectations.

6. Concluding remarks

A nagging criticism of neoclassical economics is that its assumptions are unrealistic, implying that the theories derived from them have little relevance to the real world. A related criticism is that such theories are pseudo-theories because they are concerned primarily with prediction or empirical adequacy rather than with genuine explanation. This paper suggests that the position is not that simple.

First, although many of the assumptions of neoclassical economics are simplifications of reality they are not unrealistic in the sense of being merely the most general, non-essential or "convenient fictions". As distinct from axiomatic starting points concerning preferences, rationality and so on, strengthening assumptions such as constrained maximisation, market-clearing, and rational expectations capture essential aspects of the real world. Other research programmes with different axiomatic starting points and assumptions capture different aspects of reality. The Institutionalists, the Post-Keynesians or the New Radical Economists may prove to be more successful in achieving theoretical and/or empirical progress than the neoclassical research programme (and in the eyes of their adherents have already proved so) but they are similarly simplistic in their core assumptions and what they regard as essential. The acid test is how theoretically and empirically progressive the alternative research programmes are, not how realistic or unrealistic they appear to be.

Secondly, the charge that neoclassical theory is inherently instrumentalist is less than persuasive in the context of a scientific research programme. The heuristics of the research programme direct the researcher where to look (and not to look) when faced with empirical anomalies. If the research were truly instrumentalist there would be no concern or interest in trying to explain such anomalies. Researchers would simply say that the theory was not applicable under the circumstances of those particular empirical tests and move on to

some other *ad hoc* model in the hope that it would be more consistent with the data. But this is not a strong feature of neoclassical economics; a premium is placed on non-*ad hoc* explanations to account for anomalous empirical evidence. Far from merely wanting to "save the appearances", neoclassical economists insist on a theoretically consistent explanation of the facts.

The rational expectations hypothesis is a good example of how both realist and instrumentalist considerations present themselves in neoclassical economics (at both the micro- and macro-economic levels). On the one hand, such theorists emphasise tests for the empirical adequacy of rational expectations models and their consistency with the available data. On the other hand, they are not purely instrumentalist since it is not sufficient for a new model merely to fit the data. The model or hypothesis must also conform to the maximising and market-clearing heuristics of the neoclassical research programme. In a further (ontological) realist twist, rational expectations theorists are not content with purely subjective explanations of expectations either. The attraction of the rational expectations hypothesis for such theorists is that it is a way of inferring what the (probability distributions of) expectations about economic variables and policies in the real world actually are.

A related criticism of neoclassical economics is that it is deterministic or mechanistic and that this is not a realistic portrayal of how individuals or social processes actually behave. The determinism of the theory is inferred from its use of terms and metaphors borrowed from nineteenth-century physics. An example given in this paper is Latsis's characterisation of the neoclassical theory of the firm as one of "situational determinism". However, the fact that such theories or models are deterministic does not mean that the individuals or social processes themselves are believed to be so determined or mechanistic. To believe this is to confuse the epistemological status and the ontological status of economic theories.

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