The First Essay on Methodological Background in Finance

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This essay is to review exegetically the literature on methodological problems in economics and finance as a guide to construct the basic framework in order to avoid the unnecessary confusion which would otherwise occur. A general idea will be gained on crucial points of scientific methodologies developed in the field of philosophy of science when applied to the explanation of the history and structure of economic theory. The concept of Kuhnian paradigms is employed in clarifying the characteristics of neoclassical economics. As a counterexample of the neoclassical paradigm, the Keynesian framework on dynamics, uncertainty, and disequilibrium is reviewed in an exegetical way.

This essay will be followed by several articles treating both theoretical and empirical aspects of finance. The bibliography for the present and subsequent articles is rather comprehensive, and will appear in the end of the final article.

Introduction

The purpose of this essay is to review exegetically the literature on methodological problems in economics as a guide to construct the basic analytical framework in order to avoid the unnecessary confusion which would otherwise occur.[1] I start with a general discussion of inference in empirical sciences in the next section, which is followed by an overview of three different scientific methodologies which have been applied in the last few years to explaining the structure and history of economic theory. Section 1.3 takes a critical look at the neoclaasical 'paradigm' in economics, and Section 1.4 gives a brief summary of Keynesian economics[2] as one of the alternative paradigms or the counterexamples of neoclassical economics.

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[1] It goes without saying that methodological studies play a crucial role in any science in the sense that the progress of science has been greatly speeded up or slowed down by good or bad methodology. For more on this as well as the function of methodology, see, e.g., Lakatos (1968) and Latsis (1976). To borrow Leijonhufvud's words, the "philosophically amateurish" (Leijonhufvud (1976, p. 65n)) discussion which follows will be forgiven.

[2] More precisely, 'the economics of Keynes' (Leijonhufvud (1968)).

1. 1　Inference in Empirical Sciences

The primary concern in the following articles is with theoretical and empirical studies of investment, financing, and dividend decisions of corporations. According to standard textbooks on finance, the 'financial' decision of corporations comprises these three decisions.[3] On the other hand, needless to say, the theory of finance is a branch of microtheory in economics. If, following the conventional dichotomy, one intends to classify sciences into logical (or mathematical) sciences and empirical sciences, economics belongs to empirical sciences,[4] which consist of natural (or physical) and social sciences.[5] The fundamental logical procedure required for economics as a social science in empirical sciences should be followed also in studies of the financial decision of corporations. Let me begin with a general discussion of the validity of inference by induction with a special reference to empirical sciences.

According to Nicod, "induction is usually defined by the logical form of inference's premises and by that of inference's conclusion, as a passage from the particular to the universal······. What induction arrives at is a proposition about *all the members,* or about any *given member* of a certain class of individuals or species"[6]. Harrod[7] is one of the most energetic economists who has been consistently advocating the validity of induction. In establishing the validity of induction, Harrod rejects any *a priori* assumptions, i.e., the law of universal causation, the uniformity of nature, and the initial prior probabilities.[8] His assertion is totally based upon the principle of experience which is "not an assumption but an *a priori* certainty".[9] Harrod defines this principle by that "the mere fact that things have been found in experince to be thus and thus gives, in and by itself, a valid reason for holding that they will continue to be thus and thus for the time being."[10] The principle of experience is followed by sampling induction. "This principle (sampling induction or induction by simple enumeration) lies at the basis of all arguments where we infer from the characteristics of a limited set of phenomena the characteristics of a larger unobserved universe. It is on the basis of the generalities that we can proceed to other methods of discovery such

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3　E.g., Van Horne (1977), and Schall and Haley (1977).

4　Some use 'real' sciences instead of 'empirical' sciences. See, e.g., Kornai (1971, pp. 7–11).

5　The clear distinction between social and natural sciences is very important, particularly in methodological discussions in economics, since "most methodological frameworks transplanted from the natural to the social sciences fail to fulfil even these minimal adequacy requirements when applied to economic theory" (Latsis, op. cit., p. 1). Kornai seems to fail to distinguish between social and natural sciences in real sciences. A brief, critical comment on Kornai for this point is given in Section 1.3 below.

6　Nicod (1969, p. 178).

7　Harrod (1956).

8　Harrod, op. cit., p. vi., and Annex by Harrod to Nicod, op. cit., p. 243.

9　Annex by Harrod to Nicod, op. cit., p. 244.

10　Harrod, op. cit., p. 50. According to this (Locke's) principle, "everything we know about nature we have had to learn from experience" (Harrod, op. cit., p. 1).

as a single laboratory experiment".[11]

Harrod restates his main argument given above 'in a more easily intelligible presentation' in 1971.[12] His position is unchanged.[13] The point of departure is his considering *Home sapiens* as *Homo ignorans*. "*Homo sapiens* starts from total ignorance about all connections between items of experience. The central problem of inductive logic is how he can validly get from the state of total ignorance to the privileged position from which modern scientists start".[14]

Let me summarise the assertion of Harrod. To begin with, *Homo sapiens* (*Homo ignorans*) is taken forward on his first step to knowledge by the principle of experience. He then infers from the characteristics of a particular set of phenomena the characteristics of a larger unobserved universe by simple enumeration. Finally, he acquires knowledge about the world and establishes a proposition or an hypothesis. Assessment of the logical force that the verification in question has in establishing the truth of the hypothesis can be made by induction.[15] The inductive process thus defined by Nicod and Harrod may be called the induction in a narrow sense.

It seems that the principle of experience, and therefore, the inductive logic can be automatically validated in any empirical sciences, since 'empirical' is usually defined as "deriving theoretical or practical understanding of subject from experience alone".[16] However, one should keep it in mind that as long as the subject concerned remains in a 'scientific' field and aims at discovering 'truth', a deductive approach must be employed at least in some stages of establishing a proposition.[17] Total rejection of the validity of deductive inference may result in the abandonment of the subject's being a science. Many efforts have been made to solve this dilemma in

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11 Harrod, op. cit., p. 248.

12 Harrod (1971).

13 "I think that deduction could only have this power in fringe cases - induction must be our primary tool for gaining knowledge about the world" (Harrod, op. cit., p. 26)."……Knowledge cannot be extended by deduction save the aid of induction……whatever is in the conclusion of a deduction is already present in the premises" (Harrod (1956, pp. 1-2)).

14 Harrod (1971, p. 27).

15 Harrod (1956, p. 6). The logical process of establishing the hypothesis is sometimes called 'abduction'.

16 "In the real (natural and social) sciences, the only criterion of "truth" is experience……. In the real sciences, the criterion is not whether the proposition is logically true and tautologically deducible from earlier assumptions. The criterion of "truth" is, whether or not the proposition corresponds to reality" (Kornai, op. cit., pp. 8-9). Kornai also cites the statement of Albert Einstein : "Experience alone can decide on truth" (Kornai, op. cit., p. 10).

17 The following example shows that inductive inference sometimes fails to establish a true proposition. Let $f(n) = n^2 + n + 11$. For $n = 1, 2, \ldots, 9, f(n)$ always gives a prime number. By naive induction one may be validly inclined to infer that the value of $f(n)$ is always a prime number. But this proposition is obviously wrong, since for $n = 10$, one has $f(10) = 11 \times 11$ which is not a prime number. "The so-called law of induction cannot possibly be a law of logic, since it is obviously a proposition with sense. ……Nor, therefore, can it be an a priori law" (Wittgenstein (1961, p. 67)).

empirical sciences.[18] Details are not followed below but a basic rule is presented in using inductive and deductive inference in empirical sciences.

First, one acquires a knowledge of the real world from empirical observations or personal experience. Assumptions and objectives are framed in this stage.[19] One can also generate an 'inductive hypothesis' from empirical data alone as a starting point for further investigation. The hypothesis or proposition as defined by Harrod is an inductive hypothesis based upon simple enumeration. The next stage is a process of logical deduction. Additional propositions or theorems are deducible based upon a set of hypotheses and assumptions derived by the careful observation of empirical facts in the first stage. A theory is a set of propositions which is a product of logical deductive process based upon inductive hypotheses and relevant assumptions. The final and the most vital stage is that of testing the theory with real world data to determine its explicability and predictability. Theories are accepted if they have a better explanatory power and predictability of the empirical world than others. If they don't, they are rejected or modified. Statistical analysis of the empirical data is a typical example of testing theories in the final stage. The basic logical procedure[20] presented above should be followed in any empirical science. Excessive reliance on deduction alone leads theories lacking relevant empirical contents and rejecting empirical verification. Sole use of induction leads theories lacking logical rigour.

The first stage is particularly important[21] in economics, since it has been said that the crisis of the orthodox or neoclassical school is mainly due to its unrealistic and empirically unobservable assumptions and hypotheses.[22] As has been stated recently by Nishibe, "the reality in theory should be judged by whether or not the theory has the potential energy to generate the hypotheses which correspond to the empirical world".[23]

Part of the methodological background of neoclassical economics originates from Friedman (1953), whose main argument is to emphasise the role of the so-called performance test. He asserts that "······theory is to be judged by its predictive power for the class of phenomena which it is intended to 'explain' ······" (ibid, p. 8). This is

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18 E. g., J. S. Mill's hypothetico-deductive method.

19 "······assumptions······are *empirically* derived (from observations)" (Kaldor (1972, p. 1237)). From this viewpoint, Kaldor criticises the noeclassical school. See Section 1.3 below.

20 See also Barton (1977) and Lipsey (1971).

21 "The formation of hypotheses gives scope for the play of the creative imagination ; it is in that activity that scientific genius can show its cunning" (Harrod, op. cit., p. 8).

22 See Section 1.3 below.

23 Nishibe (1975, p. 8) (my translation). He also cites A. Martinet, a linguist, who asserts that every hypothesis can be established by experience alone, and his methodology is called 'experience-deduction' instead of 'hypothesis-deduction' of J. S. Mill.

criticised by Cyert and Grunberg (1963)[24], since according to Friedman, "assumptions" need not be "reslistic". Friedman's assertion not only contradicts the view that economics is an empirical science, but also leads any theory to be a closed one which may prevent one from the further scientific creation and development. Friedman seems to neglect the self-evident truth that in empirical sciences, any new theory is open-ended and generated by the conflict between reality and the old theory.[25] I agree with the following view of Blaug: "The idea that unrealistic "assumptions" are nothing to worry about, provided that the theory deduced from them culminates in falsifiable predictions, carried conviction to economics long inclined by habit and tradition to take a purely instrumentalist view of their subject".[26]

1. 2   Scientific Methodologies

In this section, I review the scientific methodologies which have been recently applied to explaining and clarifying the structure and history of economic theory. Three methodologies taken up below are

(1)   Kuhnian paradigms;
(2)   Lakatosian methodology of scientific research programmes; and
(3)   Hegelian dialectics.

1. 2. 1   Kuhnian Paradigms

The term 'paradigms' has become very popular even among economists since the publication of T. S. Kuhn's challengeable and controversial book.[27] First of all, however, one has to bear it in mind that 'paradigms' should be used carefully in social sciences. As Kuhn himself states, the concept of 'paradigms' is derived by the recognition of the difference between social scientists and natural scientists on fundamental scientific problems and methods.[28]

Kuhn defines 'paradigms' as sufficiently unprecedented achievements to attract an enduring group of adherents away from competing models of scientific activity, and sufficiently open-ended achievements to have all sorts of problems for the redefined group of practitioners to resolve, and therefore, some accepted examples of actual scientific practice - examples which include law, theory, application, and instrumentation

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24 Computer simulation models are strongly recommended by Cyert and Grunberg. However, it should be kept in mind that these simulation models whithout theoretical framework might often provide one with meaningless results accelerated by random experiments.

25 This rudimentary view is extensively developed by the two authorities on 'theoretical' physics. See Einstein and Infeld (1947).

26 Blaug (1975b, p. 399).

27 In which follows, I refer to the second enlarged edition published in 1970, which contains Postscript-1969 to the first edition published in 1962.

28 Kuhn (1970, pp. vii-viii).

together – which provide models from which spring particular coherent traditions of scientific research.[29] According to Kuhn, "acquisition of a paradigm ······ is a sign of maturity in the development of any given scientific field".[30] Thus, the transition from an older paradigm to a new one can be characterised as a non-cumulative process.[31] Some call this Kuhnian conception a 'discontinuous'[32] or 'catastrophist'[33] view.

In spite of severe criticisms against Kuhn which have inevitably made Kuhn give up his original concept of 'paradigms'[34], an application of Kuhnian 'paradigms' to the history and structure of economic theory seems useful with some reservation. The next section is an attempt to apply the concept of 'paradigms' to neoclassical economics which may be considered the only one in social sciences having the above characteristics as a paradigm. A couple of remarks remain to be made here. First, the decision of paradigm-choice can only be made on *faith*, and cannot be resolved by *proofs*.[25] This implies that in choosing paradigms one is free.[36] The paradigm selection is not a matter of a logic but a matter of faith and passion. Secondly, and more importantly, the Kuhnian paradigm approach is very 'historic',[37] much more than Lakatosian research programmes and a little less than Hegelian dialectics. This is the reason why it can be successfully applied to the *history* of sciences as well as to the *structure* of sciences.

1. 2. 2　Lakatosian Research Programmes

Lakatosian methodology of scientific research programmes developed in several places[38] could be best followed and clarified when contrasted with Kuhnian 'paradigms'. Kuhnian transition from one paradigm to another which characterises a

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29　Ibid., p. 10.

30　Ibid., p. 11.

31　Ibid., pp. 84-85, and p. 92.

32　Blaug, op. cit., p. 402.

33　Coats (1969).

34　According to Masterman (1970), there are twenty-one different definitions of 'paradigms' in Kuhn. Instead of ambiguous and misleading 'paradigms', Kuhn (1974) introduces two new concepts : 'disciplinary matrix' which are 'shared elements which account for the relatively unproblematic character of professional communication and for the relative unanimity of professional judgement', and 'exemplars' which are 'concrete problem solutions, accepted by the group as, in a quite usual sense, paradigmatic' (ibid., pp. 462-463). Suppe (1974a) gives a succinct summary of Kuhn (1970) using new notions of 'disciplinary matrix' and 'exemplars'. Suppe (1974b) comments critically on Kuhn (1974). I do not go in detail on these matters here. For other topics on methodology of science, see the papers in Suppe, ed. (1974).

35　Kuhn (1970, p. 158 and p. 148). That decision always contains "ideological elements that go beyond logical or mathematical proof" (Blaug, op. cit., p. 404).

36　Kuhn, op. cit., p. 90.

37　See Kuhn's first section on a role for history. In this respect, Leijonhufvud is suggestive : "Kuhn's original version comes off best if read as a work of historic induction" (Leijonhufvud(1976, p. 83n)).

38　Lakatos (1968), (1970), and (1971).

scientific revolution is a *discontinuous* (or *catastrophic*) jump, and Kuhnian paradigm-choice is made on faith, *irrational* psychology. Lakatos' criticism against Kuhn starts here. "*In Kuhn's view there can be no logic, but only psychology of discovery······in Kuhn's view scientific revolution is irrational, a matter for mob psychology······*the reduction of philosophy of science to psychology of science······Individual psychology is now re-placed by social psycology".[39] "There is no particular rational cause for a 'crisis' which leads to the overthrow of a 'paradigm'".[40] In sum, "I look at continuity in scien-ce through 'Popperian spectacles'. Where Kuhn sees 'paradigms', I *also* see rational 'research programmes'".[41]

Lakatos' methodology which is an extended and improved version of Popperian methodology is called the 'methodology of scientific research programmes'. A scien-tific research programme consists of "a conventionally accepted (and thus by pro-visional decision 'irrefutable') '*hard core*' and a '*positive heuristic*' which defines prob-lems, outlines the construction of a belt of auxiliary hypotheses, foresees anomalies and turns them victoriously into examples, all according to a preconceived plan".[42] Around the hard core, 'a protective belt' is formed which contains "auxiliary, 'obser-vational' hypotheses and initial conditions".[43] "The basic unit of appraisal must be not an isolated theory or conjunction of theories but rather a '*research programme*' ······The best opening gambit is not a falsifiable (and therefore consistent) hypothesis, but a research programme".[44]

In a following essay, I attempt to apply Lakatosian methodology to the structure of the recently developed theory of finance. It is my understanding that Kuhnian para-digms can be more appropriate for explaining the external *history* of sciences, and Lakatosian methodology for the internal *structure* of sciences.[45]

1. 2. 3 Hegelian Dialectics

Another methodological stream against Kuhnian paradigms is Hegelian dialectics. Bronfenbrenner (1971) suggests that the three major revolutions in economic

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39 Lakatos (1970, pp. 178–179).

40 Lakatos (1968, p. 181).

41 Lakatos (1970, p. 177). I do not go too far into Popper. For the Popperian continuous history of science and the Kuhnian discontinuous history of science, see, e.g., Blaug, op. cit.

42 Lakatos (1971, p. 99).

43 Lakatos (1970, p. 133). The protective belt is "non-essential, replaceable" (Latsis, op. cit., p. 15) and "flexible" (Blaug, op. cit., p. 408) components of a scientific research programme.

44 Lakatos (1971, pp. 99–100). In this sense, a 'scientific research programme' is "an organic unity" containing the hard core and the positive heuristic as essential components and the protective belt as non-essential ones (Latsis, op. cit., p. 14) or "a cluster of interconnected theories" (Blaug, op. cit., p. 406).

45 For comments on Lakatos, see the papers by Kuhn, Hall, Koertge, and particularly Feigle on research program-mes and induction, and the reply by Lakatos, all of which are in Buck and Cohen, eds. (1971).

thought, i.e., the laissez-faire, the utility, and the macro-economic revolutions can be described and explained better by Hegelian dialectics of thesis-antithesis-synthesis than by Kuhnian method. This is because there are two crucial differences between Hegelian dialectics and Kuhnian approach which result from more basic differences between economics and natural sciences. The first difference is that Hegelian approach allows "outmoded" ideas longer lives in economics than Kuhn's, and therefore, the second difference is that important advances in economic thought tend to be major accretions without any corresponding rejections of existing paradigms.[46] "Kuhnian paradigms, once displaced, are displaced definitively and relegated to the antiquarian's dustbin".[47] There have never been such examples in the history of economic thought.[48]

A more thorough application of Hegelian dialectics to facilitate the understanding of the evolution of economic theories and phenomena is made by Karsten (1973). Evidently, the dialectical method is more useful and appropriate for an explanation of a relatively long period of history of economic thought in the sense that "it emphasises communication, feedback, and continuity".[49] Kuhnian paradigms or Lakatosian research programmes might be sufficient for the present purpose of analysing the structure of neoclassical economics or the theory of finance.

1. 3   Crisis of the Neoclassical Paradigm

In spite of incessant attacks from all quarters, the neoclassical school[50] has been widely accepted as an established 'paradigm' in economics. A paradigm in Kuhnian sense is an accepted example of actual scientific practice.[51] Consistent scientific research can be accomplished following this sort of example. In this sense, neoclassical economics is said the first and the one and only paradigm[52] in economics, and even in social sciences. The establishment of a paradigm is a sign of maturity.[53] Therefore,

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46 Bronfenbrenner (1971, p. 150).

47 Ibid., p. 137.

48 Kunin and Weaver (1971) emphasise the historic element in economics resulting in the fundamental difference between physical sciences and social sciences. In attempting to apply Kuhnian paradigm approach to the history of economic thought, Coats (1969) concludes that economics is more 'uniformitarian' than natural sciences.

49 Karsten, op. cit., p. 418.

50 The definition of the neoclassical school seems somewhat ambiguous even among the economists. It may be defined as the Marshallian Cambridge School by some, or as the microeconomics based on marginalism by others, or more rigorously, as the neo-neoclassical school by Joan Robinson. I define the noeclassical school, for convenience, as a 'logical system with a set of assumptions and characteristics' discussed below.

51 Kuhn (1970, p. 10).

52 Economics has been "dominated by a single paradigm – the theory of economic equilibrium via the market mechanism" (Coats, op. cit., p. 292). See also Leijonhufvud (1968, p. 217n and p. 234), Loasby (1971), Murakami (1974), and Uzawa (1974a).

53 Kuhn, op. cit., p. 11.

"when the individual scientist can take a paradigm for granted, he need no longer, in his major works, attempt to build his field anew, starting from first principles and justifying the use of each concept introduced".[54] Further developments are accelerated by practitioners' concentration on problems defined in a paradigm.[55] In any scientific field which has acquired a paradigm, this phenomenon is seen in the professional academic journals full of detailed, over-subtle, and sometimes hairsplitting articles. It is possible for the neoclassical school as a paradigm to 'solve the problems' such as uncertainty, dynamics, and disequilibrium within its analytical framework.[56]

In clarifying the structure of the neoclassical paradigm, let me start with summarising recent discussions by several economists. According to Kornai, neoclassical economics (or general equilibrium theory in a more specific sense) can be characterised as having the following basic assumptions, i.e., (1) static or stationary character, (2) constancy of the set of organisation, (3) exclusive existence of producers and consumers, (4) constancy of the set of products, (5) simultaneous operation, (6) convexity of the production set, (7) profit maximisation, (8) maximisation of consumer utility, (9) constancy of production and consumption sets and of preference ordering, (10) exclusivity of price information flows, (11) anonymity of market relations, and (12) lack of uncertainty. From a theoretical point of view, Kornai considers the assumptions of preference ordering (optimisation) and convexity as the most important and characteristic ones.[57] Weintraub characterises the general equilibrium system by similar assumptions : (1) existence of differentiable utility function, (2) existence of nonsatiation for any indifference curve, (3) convexity of utility function, (4) utility maximisation, (5) perfect competition, and (6) fixed stocks of goods.[58]

Uzawa points out five characteristics of neoclassical economics : (1) existence of competitive markets, (2) quantifiability and measurability of scarce resources, (3) rationality of economic behaviour, (4) independence of subjective measurement of value, and (5) stationarity of market equilibrium.[59] According to Murakami, methodological characteristics of the neoclassical paradigm are its (1) mechanical property (i.e., (a) isolated system (b) atomism or methodological individualism, and (c) quantifiability), (2) theory of choice, and (3) distinction between value judgement and fact judgement.[60]

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54   Ibid., pp. 19-20.

55   Ibid., p. 37.

56   E.g., to solve the subjective uncertainty as a calculable risk, the non-steady growth as a steady growth, the disequilibrium as a Walrasian dual-decision hypothesis, within the choice-theoretic neoclassical paradigm using sophisticated tools. See the next section.

57   Kornai, op. cit., Chapter 3.

58   Weintraub (1974, pp. 24-25).

59   Uzawa (1974a) and (1977) (my translation).

60   Murakami (1974) (my translation).

One of the typical end products of the neoclassical school characterised above is G. Debreu's work on axiomatic approach to economics,[61] which is nothing but a "deductive and logical operation in fictitious world".[62] A more definite objection against the neoclassical school is expressed by Kaldor : Debreu's general equilibrium theory, the core of the noeclassical paradigm, "has become a major obstacle to the development of economics as a *science*······meaning by the term 'science' a body of theorems based on assumptions that are *empirically* derived (from observations) and which embody hypotheses that are capable of verification both in regard to the assumptions and the predictions······no attempt is made (by Debreu) to show how these axiomatic concepts are to be defined or recognised in relation to empirical material".[63] In this sense, it is said that the neoclassical paradigm is in crisis. The recognition of crisis gives rise to a new paradigm.[64]

Before going to the Keynesian view, let me take a glance at the two major streams attempting to conquer the difficulties of neoclassical economics. The first one may be called the 'systematic or systems' approach. Kornai (1971) suggests the approach of economic 'systems' theory using the methods of cybernetics, automata theory, and mathematical systems theory. Nishibe (1975) emphasises the importance of 'comprehensive structurism' in economics. Cybernetics is recommended as the "revolutionary" approach to monetary theory by Leijonhufvud (1968), too. However, the emphasis of these systematic approaches may mean 'the biter bit' as an alternative framework for the neoclassical paradigm, since the general equilibrium theory, a core of the paradigm, has, more or less, systematic and comprehensive properties.[65] Furthermore, as Weintraub points out, general systems theory is "less successful in normal sciene, or the work of falsification of hypotheses".[66] The second stream is the 'microfoundations of macroeconomics'. One example is Hahn's theory of agents, which, he

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61 Debreu (1959).

62 Uzawa (1974a, p. 112). "A theory (defined by Debreu) is the set of theorems logically deducible from precisely formulated assumptions which are mutually consistent" (Kornai, op. cit., p. 8).

63 Kaldor (1972, pp. 1237-1238). This view is shared with Kornai, "The work (=Debreu (1959)) does not consider the relationship between its basic assumptions and axioms on the one hand and reality on the other ; the question of whether the former reflect the latter exactly,approximately, or not at all is ignored. Nor is the question of how the deduced theorem related to reality ever discussed" (Kornai, op. cit., p. 7). Cf. the basic logical procedure in empirical sciences presented in Section 1. 1.

64 "Discovery commences with the awareness of anomaly, i.e., with the recognition that nature has somehow violated the paradigm-induced expectations that govern normal science" (Kuhn, op. cit., pp. 52-53). "The transition from a paradigm in crisis······is a reconstruction of the field from new fundamentals, a reconstruction that changes some of the field's most elementary theoretical generalisations as well as many of its practical methods and applications······the switch of gestalt······is a useful elementary prototype for what occurs in full-scale paradigm shift······Crisis is an appropriate prelude to the emergence of new theories" (ibid., pp. 84-85).

65 See Weintraub (1974).

66 Ibid., p. 10.

claims, is a generalisation of Arrow-Debreu equilibrium economics and also of Keynes, since Hahn recognises that "about two thirds of the *General Theory* deals with the theory of action of agents".[67] Another is Shubik's mathematical institutional economics, which is intended as an interlinkage between micro and macro economics.[68] The other important contributions to this field[69] are too many to be reviewed here. The only concluding remark I should like to make is this : "the analytical devices and routines of neo-Walrasian general equilibrium theory and Keynesian theory will not 'mix'"[70]

1. 4   The Keynesian View[71]

It is now about sixty years since the publication of Keynes' *General Theory* (1936). While some economists emphasise the fact that the Keynesian Revolution was a single and exceptional paradigm-change in the history of economic thought,[72] most of the general equilibrium theorists still feel doubtful as to the degree of influence of the *General Theory* on the general economic analysis. In what follows, I attempt to reappraise Keynes' contributions to economic analysis in comparison with the neoclassical school as much as possible.[73] An exegetical style is adopted again.

1. 4. 1   Uncertainty

For some economists, Chapter 12 of the *General Theory* and the article in the *Quarterly Journal of Economics* of 1937 are the essence of the economics of Keynes.[74] In these places Keynes develops a brilliant description of the role of uncertainty and its relationaship with risk, expectations, confidence, and animal spirits. First of all, Keynes rejects the naive view of choice theory under uncertainty :

> Human decisions affecting the future, whether personal or political or
> economic, cannot depend on strict mathematical expectation, since the

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67 Hahn (1973, p. 34).

68 Shubik (1975).

69 For a critical survey of the recent literature, see Weintraub (1977).

70 Leijonhufvud (1976, p. 103). Two paradigms cannot coexist.

71 This section is a summary of my unpublished paper, "Uncertainty, Disequilibrium, and Dynamics - A Reappraisal of Keynes, #1" March 1977.

72 See Coats (1969, p. 293), and Leijonhufvud (1968, p. 389n).

73 "The decision to reject one paradigm is always simultaneously the decision to accept another, and the judgement leading to that decision involves the comparison of both paradigms with nature *and* with each other" (Kuhn, op. cit., p. 77).

74 See Coddington (1976, pp. 1258-1259). For Patinkin, on the other hand, "Chapter 19 is the apex of the *General Theory* (Patinkin (1976, p. 106)), since he understands that "what did concern Keynes was the dynamic situation of an economy in s state of unemployment disequilibrium"(ibid., pp. 118-119). For a discussion of dynamics and disequilibrium, see below.

basis for making such calculations does not exist.[75]
Keynes naturally emphasises the distinction between risk and uncertainty. From this standpoint, he criticises the classical theory :

> ······(in the classical economic theory) at any given time facts and expectations were assumed to be given in a definite and calculable form ; and risks, of which, though admitted, not much notice was taken, were supposed to be capable of an exact actuarial computation. The calculus of probability, though mention of it was kept in the background, was supposed to be capable of reducing uncertainty to the same calculable status as that of uncertainty itself ; ······I accuse the classical theory of being itself one of these pretty, polite techniques which tries to deal with the present by abstracting from the fact that we know very little about the future.[76]

Therefore, "it should be remembered that he explicitly rejected the "actuarial calculus" as a permissible basis for an attack on the problem".[77] One cannot rely much on the simple calculation of mathematical expectation under the situation involving uncertainty. Keynes introduces the concept of expectations and confidence, and emphasises that these psychological factors play a vital role in human decision-making.[78]

Keynes takes another step forward. The recognition of the importance of subjective and psychological aspects of human decisions under uncertainty leads him to emphasise the role of 'animal spirits' :

> Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as a result of animal spirits – of a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities.[79]

An attempt to formalise the 'animal spirits function' in the context of economic dynamics has been made by Joan Robinson :

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75 Keynes (1936, pp. 162-163).

76 Keynes (1931, pp. 212-215).

77 Leijonhufvud (1968, p. 124n). Weintraub points out that Keynes' treatment of uncertinaty is "an innovation of sublime importance ignored for almost thirty years by most economists and still ignored by many" (Weintraub (1975, p. 530). "In modern parlance, it was Keynes' view that a major leap of faith is involved in treating situations characterised by uncertainty as situations involving only risk. Any choice now among future alternatives is thus fundamentally uncertain, since the future is logically unknowable. No sampling from the future is feasible to ascertain probabilities for future alternatives, so there is no way uncertainty problems can be reduced to prolbems involving risk······in traditional theory situations involving uncertainty had been handled by probability tools appropriate for dealing with risk" (ibid., pp. 532-533).

78 Keynes (1936, pp. 148-149). For a very compact summary of the relationship between uncertainty, risk, and confidence, see Weintraub, op. cit., p. 532.

79 Keynes, op. cit., p. 161.

······"animal spirits" of the firms can be expressed in terms of a function
relating the desired rate of growth of the stock of productive capital to
the expected level of profits.[80] The state of the "animal spirits", which is
largely a function of the energy and competitiveness of groups of firms,
is the most important factor in capitalist development······[81]

The subjective and psychological factors are regarded by Keynes as being more im-
portant than rational simplification in explaining the investment behaviour of cor-
porations in capitalist economy.[82]

To sum up, Keynes distinguishes the situation under uncertainty and the situation
involving only risk. A simple calcualation of mathematical expectation is useless and
cannot be a decision guide under uncertainty. Rather, subjective and psychological
elements of human nature like 'confidence' and 'animal spirits' play a very important
role. The emphasis of this point leads Keynes to say that :

Even apart from the instability due to speculation, there is the instability
due to the characteristic of human nature that a large proportion of our
positive activities depend on spontaneous optimism rather than on a
mathematical expectation, whether moral or hedonistic or economic.[83]

Keynes, although not explicitly, suggests that expectations caused by uncertainty give
rise to the instability and therefore disequilibrium of an economic system.[84]

1. 4. 2 Disequilibrium

In the *General Theory,* Keynes does not directly refer to disequilibrium problems.
The only place where Keynes implicitly expresses his view on this particular subject
of the working of market system is Chapter 19[85] on Changes in Money-Wages :

There is, therefore, no ground for the belief that a flexible wage policy is
capable of maintaining a state of continuous full employment ; - any more

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80 Robinson (1962, p. 38).

81 Robinson (1971, p. 108). For further modifications and elaborations of the animal spirits function, see Rose
(1963), Hahn and Matthews (1964), and Marglin and Aoki (1973).

82 "Keynes kept reminding his reader and himself that the marginal efficiency of capital was a fragile convention
exposed to all the mutabilities of thought ; to the shifts of expectation fed on fragmentary, confusing and ran-
domly self-selected "news" ; that its foundations were in the minds of men who could lose their nerve when they
wearied of whistling in the dark" (Shackle (1974, p. 81)). This should be considered a remark on the accepted
view that "the Keynesian theory of investment is nothing more than the neoclassical theory of firm's behaviour"
(Fujino (1975)).

83 Keynes, op. cit., p. 161. Shackle has developed this point more extensively. See, e.g., Shackle (1970) and (1974).

84 Moggridge (1976, pp. 165-167). Uncertainty has another face ; that is, it is a cause of unemployment. The re-
lationship between uncertainty, the existence of liquidity assets, and unemployment is very concisely summa-
rised by Shackle (1974, pp. 27-28). For more discussions on uncertainty in relation to the monetary theory,
see Davidson (1972).

85 According to Patinkin, this chapter is the apex of the *General Theory.* See footnote 74 above.

than for the belief that an open-market policy is capable, unaided, of achieving this result. The economic system cannot be self-adjusting along these lines······[86]

There has been a controversy on whether Keynes' theory is an equilibrium or disequilibrium one. It is my understanding that Keynes' theory is designed to treat a disequilibrium situation. This is consistent with the discussion of uncertainty in the last section.[87] Therefore, it may be said that I agree partially with Leijonhufvud (1968), who has developed the idea of the 'dual decision hypothesis' originally presented by Clower (1965). The dual decision hypothesis and the work of Leijonhufvud[88] are an attempt to understand Keynes' theory from a disequilibrium point of view. Clower and Leijonhufvud begin their work with the following intention : "······we have yet to resolve the central question posed by Keynes' assault on received doctrine : Is the *existing* economic system, in any *significant* sense, self-adjusting ? "[89] Their recognition that orthodox econimics has failed to answer the above question leads them to the dual decision hypothesis and the subsequent works.[90] The most significant contribution of the dual decision hypothesis[91] is that it could understand Keynes' theory as a disequilibrium model, and, moreover, as a non-tâtonnement process.[92]

To sum up the role and limitation of the dual decision hypothesis, I quote from Leijonhufvud (1974), who sheds light on the hypothesis from another different point of

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86 Keynes (1936, p. 267).

87 This is shared with Weintraub : 'if investment is volatile, because of uncertainty, no one level of output or employment might ever be maintained. It is in this sense that uncertainty can be called a disequilibrium phenomenon, and Keynes can be said to have dealt with disequilibrium problems. At any rate, it should be clear that adjustments to an equilibrium level of employment are meaningless in a world of uncertainty, for there might be no equilibrium in the sense of a maintained state of the system' (Weintraub (1975, p. 535)). The similar re-evaluation of Keynes is found in Blaug ; '······the classical and neoclassical "hard core" had always contained the idea of rational economic calculation, involving the existence of certainty equivalents for each uncertain future outcome of current decisions. Keynes introduced pervasive uncertainty and the possibility of destabilising expectations, not just in the"protective belt" but in the "hard core" of his programme' (Blaug (1975b, p. 413)). However, Blaug is one of the economists who claim that Keynes' theory is an equilibrium one ; therefore, his view is ambiguous. See footnote 100 below for a further discussion.

88 "So perhaps we should test Leijonhufvud's discussion of disequilibrium not strictly as the 'Economics of Keynes' but as 'Economics Keynes would have liked if he had a chance to read it" (Bliss, (1975, p. 204)). Bliss disagrees with Leijonhufvud's interpretation of Keynes. See below.

89 Clower and Leijonjufvud (1975, p. 182).

90 See their comment on Arrow and Hahn (1971), the most elaborate text in the neoclassical paradigm. In contrast to the *General Theory*, Arrow and Hahn's work is "an almost literal description of an idealised economy in which the notional economic plans of individual economic agents are costlessly coordinated by a central intelligence unit – the so-called auctioneer······(and) the auctioneer model of standard theory (is) unsuitable for analysing any but virtual disequilibria" (Clower and Leijonhufvud, op. cit., 183-184). Weintraub is again very suggestive on this point : "······the Walrasian framework of general equilibrium theory was too narrowly circumscribed by (a) its reliance on current markets, and (b) its inability to deal with essentially disequilibrium phenomena" (Weintraub, op. cit., p. 547).

view, i.e., from the point of view which emphasises the difference between Walrasian and Marshallian models :

> The Walrasian general equilibrium model deals exclusively with (*ex ante*) "questions of plans" problems ; it does not even ask any questions about the execution of plans or about realised results. Keynes' Marshallian construction, in contrast, describes actual (*ex post*) behaviour, but leaves "notional" magnitudes undefined. The dual decision hypothesis forces realised sales--a Marshallian element--into the frame of the Walrasian notinal calculus. The result is an apparatus that enables us to keep track of "effective" and "notinal" solutions at the same time. By highlighting the tension between where the system is and where it *would be* in this manner, it directs analytical attention to *communication* (effective demand) failures as possible sources of system malfunctioning. Yet, the dual decision hypothesis is a not altogether clear mix of Marshallian oil and Walrasian water. While it has served admirably as a vehicle for escaping from the cul-de-sac in which Keynesian theory had landed ten years ago, it is unlikely that it would hold up as the linch-pin joining disequilibrium macro theory to explicit and consistent microfoundations.[93]

Keeping it in mind that the dual decision hypothesis is a non-tâtonnement explanation of dynamic disequilibrium aspects[94], let me review Leijonhufvud (1968), a very

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91 For thorough discussions of the hypothesis, see Clower (1965). A literal description of the hypothesis is found in Hines : 'Transactors maximise their utility subject to the constraint of their notional income······if actual incomes are not equal to notional incomes a second round of decision making is in order : The transactor must maximise utility subject to the constraint of realised income which is the money value of the receipts from the sale of factor services. It is the resulting income-constrained excess demand functions which provide relevant market signals' (Hines (1971, pp. 17-18)).

92 This was already pointed out in 1965 : "······the main point of Professor Clower's paper was that we had to look at the Keynesian system in terms of a disequilibrium model rather than an equilibrium model······ The most important point to be borne in mind when discussing Professor Clower's paper was that his Keynesian model was not possible with a perfectly working tâtonnement. Essentially his paper should be regarded as a contribution to the theory of non-tâtonnement positions" (Patinkin (1965a, pp. 301-302). The importance of the latter, i.e., non-tâtonnement processes was also pointed out by Negishi (1965). The relationship between uncertainty and non-tâtonnement processes is described more speciffically by Weintraub : "······the speculative nature of non-tâtonnement processes is produced by fundamental uncertainty about the future, and information about the future cannot exist today". (Weintraub, op. cit., p. 546). This is exactly what Leijonhufvud (1968) has done. See below.

93 Leijonhufvud (1974, p. 167n). See also the last paragraph of Section 1. 3.

94 See Grossman (1969) for a discussion of three alternative models of disequilibrium phenomena, i.e., the dual decision hypothesis, the non-tâtonnement model, and the spillover effect of Patinkin (1965b, p. 235). Another succinct explanation of a Keynesian dynamic disequilibrium process is given by Patinkin (1976, pp. 105-107) whose main argument is that the change of expectations leads to a state of dynamic disequilibrium.

controversial book, mainly because, "in general, it is hard to tell in his book where the economics of Keynes leaves off and the economics of Leijonjufvud begins".[95] My viewpoint here is that Leijonhufvud has contributed to the extension and elaboration of Clower's dual decision hypothesis and to the disequilibrium economic analysis "in a Walrasian perspective".[96] According to Leijonhufvud, the distinction between Keynes' theory and orthodox economics should be found in their treatment of information. This is the starting point of the whole story :

> Wiener once noted······ *In the nineteenth century physics, it seemed to cost nothing to get information.* In context, the reference was to Maxwell's Demon. In its economic reincarnation as Walras' auctioneer, the demon has not yet exorcised. But this certainly must be what Keynes tried to do. If a single distinction is to be drawn between the economics of Keynes and the economics of our grandfathers, this is it. It is only on this basis that Keynes' claim to having essayed a more "general theory" can be mainteined. If this distinction is not recognised as both valid and important. I believe we must conclude that Keynes' contribution to pure theory was nil (ibid., p. 397).
>
> In Keynes's theory······*the information requirements* for keeping the system on an equilibrium path are fulfilled only by purest luck······ *Keynes rejected the Neoclassical notion that the price mechanism would efficiently perform the information function in the short run. He did not take a position on the effectiveness of price incentives in controlling the behaviour of individual transaction units.* (ibid., pp. 382-392). This uncertainty about equilibrium price is the main implication that follows from removing Walras' auctioneer······ in the system lacking tâtonnement mechanism······ the 'right' price information required for the perfect coordination of the economic activities of innumerable traders is not guaranteed in the short run. (ibid., p. 390).

The nub of Leijonhufvud's argument is this : the removal of Walras' auctioneer, insufficient information requirements, uncertainty, the lack of tâtonnement process, etc. ······are intermingled to produce a disequilibrium state.[97]

Some economists disagree with the work of Leijonhufvud, especially as an interpretation of Keynes. Even among them, the common view, except Grossman,[98] may be

95 Blaug (1975a, p. 215).

96 Leijonhufvud (1974, p. 164).

97 The reversal of the ranking of quantity adjustment and price adjustment velocities, the non-wage rigidity, etc. are necessary and indispensable for the discussion of disequilibrium phenomena in a general framework. See comments by Bliss, op. cit.

98 "······Keynes has nothing like Clower's conception in mind and······Keynes' own formulation of the consumption function was simply *adhoc*" (Grossman (1972, p. 27)).

that "the interpretation (of Keynes by the dual decision hypothesis of Clower) is a good one".[99] As for the disequilibrium interpretation of Keynes by Leijonhufvud, Bliss' comments are :

> Evidently Keynes was deliberately trying to overthrow the contemporary orthodoxy, and that orthodoxy was concerned with a system which in many regards a system of market equilibrium and it is by no means fortuitous that this was his concern. Obviously, however, he was concerned with short-run equilibrium······Keynes' fundamental contribution to the theory of value, the reversal of the ranking of adjustment velocities, turns out to be applied exclusively to the labour market. In other respects Keynes' theory is indeed an equilibrium theory if we admit, as we surely must, that temporary equilibrium is a kind of equilibrium'. (Bliss, op. cit., pp. 205-207).[100]

My viewpoint is, as stated above, that both Clower and Leijonhufvud have contributed to the development of disequilibrium economics.

1. 4. 3   Dynamics, Disequilibrium and Uncertainty

Uncertainty and disequilibrium are closely related to dynamics. A bold summary of Keynes by Leijonhufvud is very suggestive : "His model was static, but his theory was dynamic".[101] The disequilibrium process can be properly treated only in a dynamical context.[102] In relation to uncertainty, Weintraub points out"······the existence of the former (= time) necessarily entails the latter (= uncertainty). Keynes' system, then, was dynamic in the traditional sense of involving time in an essential manner."[103]

Keynes himself emphasises uncertainty and time elements in investment.[104] However,

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99   Bliss, op. cit., p. 206.

100   The similar statement is made by Blaug : 'If we were considering Leijonhufvud's book as a contribution to disequuilibrium economics, our verdict might be favourable. But as a reassessment of Keynes, it suffers from gross exaggeration' (Blaug (1975a, p. 215)). However, Blaug's emphasis of 'Keynes' repeated appeal to equilibrium conditions such as wages being equated to the marginal product of labour, the marginal efficiency of capital being equated to the interest rate, etc.' (Blaug, op. cit., p. 215) is a somewhat superficial reading of Keynes. See footnote 82 above. Furthermore, while he is saying that 'Keynes introduced pervasive uncertainty and the possibility of destabilising expectations' (Blaug (1975b, p. 413)), Blaug's understanding of Keynes is that 'despite what Leijonhufvud would have us believe, Keynes leaned heavily on the concepts of general equilibrium, perfect competition, and comparative statics, making an exception only for the labour market, which he seems to have regarded as being inherently imperfect and have always in a state, not so much of disequilibrium as of equilibrium of a special kind' (Blaug, op. cit., p. 413). This seems misleading and self-contradictory.

101   Leijonhufvud (1968, p. 36).

102   See Leijonhufvud, op. cit., Chapter II.

103   Weintraub, op. cit., p. 535.

104   For Keynes' criticism on the traditional static theory, see Keynes (1937, p. 213).

it should be noted that the ambiguity in his treatment of marginal efficiency of capital, which is one of the three major theoretical underpinnings in the *General Theory,* has also been pointed out by several economists. Keynes' fault is his misuse of the term of marginal efficiency of capital as a variable which determines the amount of investment. Keynes' marginal efficiency of capital should be interpreted as marginal efficiency of investment.[105]

The Keynesian discussion of uncertainty, disequilibrium, and dynamics can be schematically summarised as Figure 1. 1.

Figure 1. 1
Keynesian Framework for Uncertainty, Disequilibrium and Dynamics
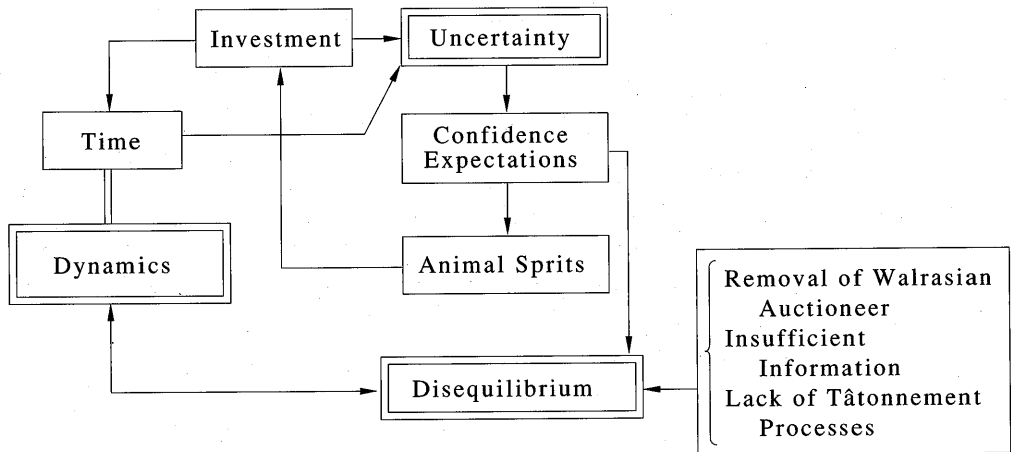
In other words, uncertainty, disequilibrium, and dynamics do belong in the same skein of ideas.

105　"Investment is no exercise in comparative statics, in which different stationary societies are imagined, but is a dynamic process which *takes* time." (Lerner (1944, p. 333)).

　　"The essential difference between the margical efficiency of investment (= Keynes' marginal efficiency of capital) and the marginal productivity of capital is that the former is concerned with the effects of decision to increase the rate at which investment is carried on, while the latter is concerned with what would be the effects of a miraculous increase in the capital stock······the marginal productivity of capital is a concept that can be used only for speculative comparisons of different stationary states of society. *Capital* considerations are never the basis of action. All the relevant practical matters fall under the heading of *investment*." (Lerner (1952, p. 176)).

　　Lerner's discussion may be considered as one of the Keynesian dynamical processes, combining the rate of interest, the marginal efficiency of investment, and the marginal productivity of capital. Recently, more elaborate Keynesian dynamic models have been developed. Among them, special attention should be paid to the macro dynamic model by Uzawa (1973) and (1974b), and the micro dynamic model by Marris (1972).

1. 5 Summary

Let me summarise the foregoing discussions on methodological problems. Section 1. 1 concluded with the basic rule of inference in empirical sciences, which should be contrasted with the neoclassical paradigm (Section 1. 3). The basic Keynesian view on uncertainty, disequilibrium, and dynamics was illustrated in Figure 1. 1.

A final remark on the relationship between physics, mathematical systems theory, and economics should be made, since recently some economists (e.g., Kornai and Leijonhufvud) have paid special interest in modern developments of physics and applied mathematics, and emphasised their usefulness (especially automata theory and cybernetics)[106] when applied to economics. As is well-known, Walras is strongly influenced by the Newtonian physics,[107] which is very suitable for the description of deterministic and equilibrium states. Under the situation involving uncertainty, information,[108] and disequilibrium, cybernetics and systems theory are, according to Kornai and Leijonhufvud, extremely powerful. However, naive and careless adoption of the technology from physics or mathematics seems sometimes nonsensical.[109] In this context, it is worth noting Keynes' comment on economic thinking and mathematical economics :

> The object of our analysis is, not to provide a machine, or method of blind manipulation, which will furnish an infallible answer, but to provide ourselves with an organised and orderly method of thinking our particular problems ; and, after we have reached a provisional conclusion by isolating the complicating factors one by one, we then have to go back on ourselves and allow, as well as we can, for the probable interactions of the factors amongst themselves. This is the nature of economic thinking······It is a great fault of symbolic pseudo-mathematical methods of formalising a system of economic analysis, ······, that they expressly assume strict independence between the factors involved and lose all their cogency and authority if the hypothesis is disallowed······too large a proportion of recent "mathematical" economics are mere concoctions, as imprecise as the initial assumptions they rest on, which allow the author to lose sight of the complexities and inter-dependencies of the real world

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106 See Section 1. 3 above.

107 "Professor Jaffe told of the tremendous impression which a treatise in "Celestial Mechanics" made on the young Walras and of his determination to demonstrate the "Harmony of the Spheres" prevailing in the free enterprise system" (Leijonhufvud (1968, p. 394n)).

108 Einstein and Infeld, op. cit. point out the probabilistic character of the modern quantum mechanics.

109 However, an historical study whether there exists any logical relationship between physics, mathematics and economics might be an interesting subject, e.g., between Newton's *Principia* (1687) and William Petty's *Political Arithmetic* (1690), between Turing's *Automaton* (1936) and Keynes' *General Theory* (1936), and more recently between *Differential Topology* and *Equilibrium Economics,* etc.

in a maze of approximations and unhelpful symbols.[110]

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110 Keynes (1936, pp. 297-298). See also a sketchy, ironical description of the hierarchy in the neoclassical
      school by Leijonhufvud (1973).