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MODERN PHYSICS AND MAINSTREAM ECONOMIC METHODOLOGY

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Introduction

The main methodological features of mainstream economics — the distinction between 'normative' and 'positive', the extensive use of abstract, mathematical methods, the isolation of economic phenomena from their social, political and cultural context, methodological monism, emphasis on prediction and generally the trend towards formalization— are manifestations of the mechanistic-positivist approach of mainstream economics.

The mechanistic-positivist approasch of orthodox economics has been a product of the conceptual framework of the past three centuries. The foundations of this conceptual framework are firstly classical physics and secondly (since the nineteenth century) the various positive philosophies of science. The most crucial and influential feature of this conceptual framework was the idea that all disciplines if they are to be sciences must adopt the methodology of classical physics. The great success of classical physics in explaining and predicting phenomena had placed this discipline in the position of the ideal model of science. In the nineteenth century, the above idea was strenghtened further by the positive philosophies which praised the status of classical physics and called the other disciplines to adopt the mechanistic and positivist approaches in order to become exact, positive sciences.

In the beginning of twentienth century, a major scientific revolution took place. This revolution was extremely important because it introduced a new conceptual framewaork. Modern physics (quantum and relativity theories) replaced classical physics and a few decades later, a modern anti-positive philosophy of

science undermined the dominant positive scientific philosophy. These fundamental developments challenged the validity of the mechanistic-positivist approach. The new conceptual framework introduced a new way of thinking and consequently a radical change of the meaning of the word 'science'. In this paper we are going to concentrate on some key methodological aspects of mainstream economics in comparison with the new conceptual framework and especially with the new approach of modern physics. The main purpose of this comparison is to demontrate that the methodology of positive economics is not consistent with the new conceptual framework whose vital parts are modern physics and modern philosophy of science. These key methodological issues are the following:

1. The concept of economic law
2. Prediction
3. Perfect knowledge
4. Positive-Normative distinction
5. Reductionism
6. The stochastic method of the theory of rational expectations.

The concept of economic law

If one looks at a mainstream economic theory textbook, one will find expressions like 'Say's Law', 'Law of Diminishing returns', 'Law of Supply and Demand' and so on. The usage of the word 'Law' with capital 'L' implies that a lot of economists thought of economic laws as those of classical physics, that is of deterministic character, with absolute validity.

Many classical, marginalist and positivist-oriented economists, inspired by the absolute certainty that the laws of classical physics offer, attempted to establish universal economic Laws which would give the same certainty as those of physics. Thus, for instance, David Ricardo's aim, which was to find the 'Laws' of political economy, can be seen in this perspective [Hutchison, 1978, p. 26]. In the same spirit W. S. Jevons writes in his 'Principles of Economics' (a systematic examination of classical and marginalist views can be found in Houmanidis, 1972):

> 'The theory of the science consists of those general laws which are so simple in nature and so deeply grounded in the constitution of man and the outer world, that they remain the same throughout all those ages which are within our

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The other famous marginalist, L. Warlas, also writes about Laws
ı economics. In his main work 'Elements of Pure Economics' he
ontinuously refers to the law of variation of equilibrium prices, the
aw of the cost of production or of cost price. Above all Walras refers
ɔ the 'scientific formulation of the LAW OF SUPPLY AND DEMAND'
Walras, 1965, pp. 180, 181, 211, 254]. The capital letters which he
ısed demonstate the importance that he attributed to this Law.

C. Menger held that if economics is an exact science (appa-
ently like physics) then it must have economic laws. As he himself
writes:

> 'I wish to contest the opinion of those who question the existence of laws of economic behaviour by refering to human free will, since their argument would deny economics altogether the status of an exact science'. [Menger, 1950, p. 48]

After the extreme belief of marginalist economists to the existence of absolute, physical science-like, economic laws, L. Robbins adopted a moderate position. According to Robbins, economic laws are valid whithin certain limitations, which characterize all other scientific laws:

> 'Economic laws describe inevitable implications. If the data they postulate are given, then the consequences they predict necessarily follow. In this sense they are on the same footing as other scientific laws, and as little as capable of suspension.' [Robbins, 1946, p. 121]

In essence, however, Robbins does not reject the absolute (under certain conditions) character of the economic laws and he persists in their parallelity with those of physics. He adopts the nowadays well-known term of 'ceteris paribus' or other things being equal.

> 'Of course, if other things do not remain unchanged, the consequences predicted do not necessarily follow. This elementary platitude, necessarily implicit in any scientific prediction, needs especially to be kept in the foreground of attention when discussing this kind of prognosis. The statesman who said 'ceteris paribus be damned' has a large enthustiatic following among the critics of Economics. Nobody in his senses would hold that the laws of mechanics were invalitated if an experiment designed to illustrate them were interrupted by an eartquake.' [Robbins, 1946, p. 123]

laws and he seems to say that the condition of ceteris paribus holds for every scientific law. Moreover, the reference to the laws of mechaniscs is indicative of the influence of his methodological views from physics. Indeed classical physicists held that their absolute laws hold under some conditions which essentially is the same as saying 'ceteris paribus'. However, as we shall see, modern physics supports a completely different view. As will become clear in the following pages, in modern physics, the absolute laws of classical physics are not considered absolute even under certain conditions. In short, even under ideal conditions physical laws are not absolute, and that is the new and most important point of the new conceptual framework.

With the appearance of the school of positive economics, orthodox economists once again thought of the economic laws as those of classical physics. For instance, P. Samuelson's parallel of the Laws of thermodynamics with those of economics reflects the same reasoning. M. Friedman's usage of the law of falling objects as an example for the construction of economic theories can be seen in the same context [Coddington, 1972, p. 12].

With the emergence of the new physics, however, the concept of natural law, as it is used in classical physics (absolute and deterministic), has to be discarded. As one of the founders of quantum physics, W. Heisenberg, writes

> '... It took two and a half decades before it became clear that quantum theory actually forces us to formulate these laws precisely as statistical laws, and to depart radically from determinism'. [Heisenberg, 1962, p. 39]

Even fundamental laws of classical physics are not considered as absolute and universally valid. For instance, the law of universal gravitation is viewed by Sir A. Eddington as follows:

> 'The law of gravitation is only a truism when regarded from the macroscopic point of view. It presupposes space, and measurement with gross material or optical arrangements. It cannot be refined to any accuracy beyond the limits of these gross appliances; so that it is a truism with a probable error-small but not infinitely small.' [Eddington, 1964, p. 288]

Modern physics has reservations even for the iron laws of mathematics. One of the great founders of modern physics A. Einstein declares: 'As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.'

[Einstein in Capra, 1983, p. 42]. Moreover, modern physics views natural laws completely differently (as far as their detetministic character is concerned) from classical physics:

> 'These laws (quantum laws) indicate several possibilities in the future and state the odds on each... It is quite true that the quantum laws for individuals are not incompatible with causality: they merely ignore it.' [Eddington, 1964, p. 291].

From the above, it can be seen that most mainstream economics perceive economic laws as those of classical physics. This means that they view economic laws as deterministic and absolute (even the ceteris paribus approach of L. Robbins sees economic laws as those of classical physics). However, modern physics and generally the new conceptual framework, rejected the above conception of scientific laws as deterministic and absolute. This is of major importance for the economic methodology because it means that the methodological model that mainstream economists follow is seriously challenged. Even the physical law model that mainstream economists strive to meet, is no longer acceptable to modern physics.

Prediction

The issue of exact economic laws is connected with the emphasis on prediction. Thus, mainstream economists, having developed a number of economic laws, thought that they could make predictions about future economic phenomena. This tendency is not very new in economics. Since the 1930's economists like H. Schultz attempted, mainly through the use of theoretical models and statistical findings, to make predictions about the future bahaviour of economic variables. All these led J. M. Keynes to express his reservations about the use of statistics for making predictions. As he wrote to R. Harrod:

> 'The object of statistical study is not so much to fill in missing vatiables with a view to prediction, as to test the relevance and valitidy of the model.' [Keynes, 1973, p. 296]

In the post-war period the school of positive economics placed much emphasis on prediction. The main representatives of this school emphasized so much prediction that they placed the predictive power of an economic theory as the sole criterion of its valitidy. In the words of Friedman: 'Viewed as a body of substantive hypotheses, theory is to be judged by its predictive power for the

p. 214]. Moreover, prediction became the goal of positive economics:

> 'The ultimate goal of a positive science is the development of a theory or hypothesis that yields valid and meaningful predictions about phenomena not yet observed.' [Friedman; 1984, p. 213].

Another representative of the positive school, R. Lipsey, writes in the same context:

> 'One of the main practical consequences of a theory is that it enables us to predict as yet unobserved facts.' [Lipsey, 1983, p. 11]

Moreover, most econometricians agree with the above expressed views of Friedman and Lipsey. The ideas on this issue by econometrician professor Walters are indicative. After having distinguished the 'assumptionists' from the 'predictionists' (who hold that «the validity of a theory is determined solely by the efficiency of the model in predicting events») he chooses the predictionists [Walters, 1970, p. 15]. He justifies his decision as follows: «Between these two apparently polar views on the methodology of economics and econometrics one must choose the'predictionists'. These are the methods of experimental science which have generated the immense advances in our knowledge of the physical universe over the last century». [Walters, 1970, p. 16]. Again we find here the old ideal of economics, which is classical physics.

But before we go on it has to be mentioned that not all branches of mainstream theory accept prediction as the main criterion of a theory. For instance, F. Hahn, a well-knwon representative of the general equilibrium theory, objects the positivist emphasis on prediction [Hahn, 1984, pp. 5, 341].

However, the findings of modern physics and its methodology are on the opposite side to the ideas expressed above. In the positivist philosophies and classical physics the ability to make correct predictions was the basic criterion for the acceptance of a scientific theory and also the ultimate goal of every science. Modern physics rejects completely this criterion. A. Eddington writes:

> «The position is that the laws governing the microscopic elements of the physical world —individual atoms, electrons, quanta do not make definite predictions as to what the individual will do next». [Eddington, 1964, p. 291].

One of the founders of quantum mechanics, N. Bohr, is also very

sceptical about the criterion of prediction. In his Nobel lecture, he states:

> «The most that one can demand of a theory is that this classification can be pushed so far that it can contribute to the development of the field of observation by the prediction of the new phenomena. When we consider the atomic theory, we are, however, in the peculiar position that there can be no question of an explanation in this last sense...» [Bohr, 1965, p. 43].

The rejection of the criterion of prediction for the validity of a theory by modern physics is due to the so-called principle of indeterminacy. As was mentioned in the first section, this principle is the basis of quantum theory. It states that it is impossible to know the position and the speed of a given electron at the same time. This principle gives an indeterminate character to modern physics. Determinism, which was thought to be the basic concept for the description of nature in classical physics, is dropped by modern physics. Sir A. Eddington accounts:

> «Strict causality is abandoned in the material world. Our ideas of the controlling laws are in process of reconstruction and it is not possible to predict what kind of form they will ultimately take; but all the indications are that strict causality has dropped out permanently». [Eddington, 1964, p. 319]

Thus the continuous emphasis that mainstream economists put on the issue of prediction is in complete opposition with the findings of modern physics. Maybe the least that mainstream economists can do is to stop using as justification the argument that prediction and determinism are the basic building concepts of modern physics.

Perfect Knowledge

One of the basic assumptions of the theory of perfect competition (which is one of the basic building blocks of orthodox theory) is perfect knowledge. As F. Hayek points out: «According to the generally accepted view perfect competition presupposes... complete knowledge of the relevant factors on the part of all participants in the market» [Hayek, 1976, p. 95]. Moreover, the standard microeconomic textbook treatment of the theory of perfect competition requires an omniscient economic agent. In one of the most influential textbooks C. E. Ferguson: «Microeconomic Theory» one can read:

> «Consumers, producers and resource owners must possess perfect knowledge if a market is to be perfectly competitive... But this is only the beginning. In its fullest sense, perfect knowledge requires complete knowledge of the future as well as the present. In the absense of this omniscience, perfect competition cannot prevail». [Ferguson, 1972, p. 252].

The notions of equilibrium and market clearing are characteristic of mainstream economics (these notions can be traced back to Walras). More specifically, in order to attain equilibrium, the assumption of perfect knowledge has to be made as far as buyers and sellers are concerned. If perfect knowledge, and also correct forecasting, are not assumed then the equilibrium price would be one of the many possible ones. One of the main assumptions for the proof of the properties of market equilibrium is the following:

> «Choise is perfectly informed: the consumer is assumed to have perfect knowledge of the price characteristics of each good. At a given time this implies perfect information. From one period to another, it implies perfect prediction of all goods available in the future and of their future prices». [Stoleru, 1975, p. 11].

The profoundly unrealistic character of the above assumption has led some theorists towards its replacement with another one. More specifically, in place of perfect knowledge they have put 'a complete list of possible outcomes'. However, as B. Loasby states: «This approach does not in practice allow analysts to stray very far from perfection» [Loasby, 1976, p. 7].

Before going on, it has to be noted that there were and there are some economists who attempt to include uncertainty as a vital part of their theories. For instance, F. Knight introduced the concept of uncertainty in his book 'Risk, Uncertainty and Profit' (1933) in the 1930's. Moreover, Keynes emphasized the element of uncertainty, especially in macroeconomic phenomena.

However, the concept of uncertainty and imperfect knowledge that the new conceptual framework introduced is quite different than the one used by most mainstream economists. For instance, Knight spoke of uncertainty and imperfect knowledge which is due to the great number of incalculable factors. This means that he saw the whole issue as an epistemological problem. This view is in accordance with the one of classical physicists and positivist philo-

sophers of science who held that uncertainty and imperfect knowledge can be eliminated under the ideal condition in which all the variables under the ideal condition in which all the variables involved are known. By contrast, modern physics and the modern philosophy of science see uncertainty and imperfect knowledge as essentials to the theory which even under ideal conditions can not be eliminated. In general, uncertainty or better indeterminacy is considered as inherent in the theory. As Heisenberg observes:

> «Then, in the first half of our century, incomplete knowledge of atomic systems was recognized as being part of theory in principle». [Heisenberg, 1962, p. 50]

or

> Even without entering into the mathematics of quantum theory these brief comments might have helped us to realize that the incomplete knowledge of a system must be an essential part of every formulation in quantum theory». [Heisenberg, 1962, p. 41].

The above statements are of particular importance if we think that they are made by one of the leading physicists. Physics, the science which once was considered as the most certain, can no longer offer certainty but by contrast accepts imperfect knowledge as a basic element of the theory. The difference from nineteenth century physics, and generally from the mechanistic-positivist framework, is great. Clearly, mainstream economists when they theorize about perfect knowledge, are still drawing from the conceptual framework of the nineteenth century.

Positive-Normative Distinction

Another basic point of mainstream economic methodology, the complete separation of the positive and normative elements of economic theory, has been challenged by the new conceptual framework. More specifically, most mainstream economists supported the distinction between 'what is' and 'what ought to be'. Thus, many of the classicals, like N. Senior, J. S. Mill, and J. Cairnes, insisted that economics must occupy itself with the study of positive elements and by all means avoid the study of normative ones [Blaug, 1980, p. 59, Mill, 1874, p. 125, Cairnes, 1875, p. 20]. The marginalists were in the same line of thought with most of the classicals. Walras thought of pure economics as distinguished for its complete indifference to consequences, good or bad [Winch, 1972, p. 329°. A.

Marshall's introduction of the term «Economics» instead of the previous «Political Economy» meant an effort towards the isolation of the normative elements [Marshall, 1961, p. 1 and Hutchison, 1981, p. 54]. L. Robbins and J. N. Keynes were in the same line. For instance J. N. Keynes writes:

> «The object of a positive science is the establishment of uniformities, of a normative science is the determination of ideals». [Keynes, 1904, p. 54].

The main representatives of positive economics were even much stricter in the positive-normative distinction. Friedman saw economics as «independent of any particular position, or normative judgements» [Friedman, 1984, p. 211]. The same holds true for Lipsey: «The succes of modern science rests partly on the ability of scientists to separate their views of what does happen from their views of what they would like to happen». [Lipsey, 1983, pp. 4]. As has been stated, mainstream economists are influenced by the positivist philosophies' rejection of normative statements. The prime reason of this effort of orthodox economists to distinguish between 'positive' and 'normative' is the establishment of an objective, positive economic science. Especially, positive economics was created with the purpose of an objective science in mind. As Friedman put it:

> «... positive economics is, or can be, an 'objective' science, in precisely the same sense as any of the physical science». [Friedman, 1984, p. 211].

The ideal again is the objectivity of classical physics.

Classical physics achieves its absolute and prestigious objectivity by the complete detachment of the observer from the observed. Because of the detachment, the observer can not influence the object under observation. Thus, the ideal of perfect objectivity enters. Since mainstream economics viewed classical physics as an ideal for economics, they attempted to construct a perfectly objective economic science, and the only way to do that was to isolate all the non-positive (non-objective) elements. Thus, the economist could become an objective observer. If the concept of the objective observer is combined with the other concepts of economic laws, prediction and perfect knowledge, the ideal of the economist as a positive physical scientists is not very far.

However, in modern physics the complete detachment between

the observer and the observed is no longer possible. This means that complete objectivity is lost. As Sir J. Jeans writes:

> «The theory of relativity first showed that... the picture which each observer makes of the world is in some degree subjective». [Jeans, 1946, p. 143[.

Quantum theorists also emphasise the importance of subjectivity in their formulations. The well-known physicist M. Born explicitly states that in quantum theory «subjectivity is primary and the possibility of objective knowledge problematic» [Born, 1964a, p. 233].

Thus the notion of a detached observer cannot stand, and if the observer can not be detached from the object then it is a part of it, and thus his attitudes, values, and expectations are part of the observed too. Professor Weisskopf attempts to acount for the consequwnces of the above, in the field of economics:

> «What emerges under the impact of Heisenbergian thinking is a return to and a turn towards political economy; but even more so a turn towards the moral foundations of economics. These terms refer to the ultimately normative character of all economic questions. If according to the Heisenbergian scheme, we cannot know what the future will be, we can still think about what it should be». [Weisskopf, 1984, p. 360].

Thus, a value free economic science seems not to be possible, since the 'most advanced science', which is regarded to be physics by mainstream economists, views the normative elements as a necessary part of its theories.

The impossibility of the complete exclusion of normative elements, calls for a more open economic methodology where the economist should also be ready to consider the philosophical, sociological, psychological and political dimensions of the economic phenomena. Thus, there is nothing in modern physics which contradicts the following statement of a non-orthodox economist, G. L. S. Shackle:

> «To be a complete economist, a man need only be a mathematician, a philosopher, a psychologist, an anthropologist, a historian, a geographer and a student of politics;» [Shackle, 1968, p. 241].

Reductionism

In their effort to construct a positive, objective, physical science-like economic science, orthodox economists, attempt to exclude all the non-quantifiable elements from economic phenomena. The way to achieve this was to simplify them by reducing them to simple measurable parts. This method, reductionism, enjoyed the approval and theoretical justification of the positive scientific philosophies.

The tendency to view economic phenomena as simple and homogeneous, and thus easily quantifiable, appeared in the writings of the marginalists. By the beginning of the twentienth century it served as a prerequisite for the introduction of quantitative methods in economics. This fact made Keynes warn against those who promoted reductionism (he specifically referred to Clapman and Schulrz): «One has to be constantly on guard against treating the material as constant and homogeneous». [Keynes, 1973, p. 296].

Again the post war, positive economists view economic phenomena as homogeneous and not complex and thus able to be analyzed in even simpler parts. For instance Friedman declares that:

> «Any assertion that economic phenomena are varied and complex denies the tentative state of knowledge that alone makes scientific activity meaningful». [Friedman, 1984, p. 232].

This notion reveals another effort of imitation of classical physics [Coddington, 1972, p. 13]. Modern physics does not accept the reductionism of positivist philosophies and classical physics. As Nobel prize winner D. Bohm writes:

> «We see, then, that the existence of reciprocal relationships of things implies that each 'thing' existing in nature makes some contribution to what universe as a whole is, a contribution that cannot be reduced completely, perfectly, and unconditionally...» [Bohm, 1957, p. 146].

The tendency of modern physics is to emphasize the difficulty of the study of isolated elements. One could say that modern physics is moving towards a «holistic» approach in the study of physical phenomena. And also this is the general tendency of the new

conceptual framework. The important implication for economics is that the reductionist approach to the study of economic phenomena is at odds with the emerging new paradigm.

Rational Expectations

We now turn to a brief discussion of Rational Expectations Theory (RET), (the latest development of mainstream economics, although it is not universally accepted), having in mind the framework of modern physics. RET is based on the methodological principles of positive economics, and thus, our observations concerning modern physics and mechanistic-positivist methodology hold in this case too. However, there is a new element in RET and this is the 'stochastic' or 'statistical' method. Many mainstream economists believe that because RET uses statistical methods it is in accordance with the probabilistic character of modern physics. However, this is not true because there is a great difference between the two. More specifically, rational expectations theorists use statistical methods because they believe that apart from the estimated variables, there are others which are not included in a given model. The reason for the exclusion of some variables is that given the available data, their impact cannot be discerned. Obviously, there is always hope for the incorporation of unknown variables into the model. Thus, rational expectations theorists use the words «probability» and «statistics» as they are used in classical physics. However, in quantum theory probability has an entirely different meaning than it has in classical physics. As we noted earlier, in quantum physics, probability estimations can never be avoided because probability is the essence of the phenomena. Thus, the uncertainty which is due to probability is inherent in the phenomena themselves. More technically, the probability in quantum physics is due to the «non-local connections» (instantaneous connections to the universe as a whole) while the probability in classical physics is due to «local connections» (they reside within the objects involved). The «local connections» probability of classical physics permits us to make perfect predictions in principle (if we know all the variables involved). The «non local connections» probability of quantum physics does not permit us to make perfect predictions under any circumstances. Thus, it is evident that the «stochastic» or «statistical» methods of RET are like those of classical and not like those of quantum physics.

Conclusion

From the above, one can see that the mechanistic-positivist approach is seriously undermined. Physics is no longer the science of absolute laws and perfect certainty. Classical mechanics is not regarded as the ideal of all sciences; but it is simply a special and limited case of modern physics. The basic principle of classical mechanics (determinism) which had established it, from the eiht-eenth century and on as the most advanced science, is rejected by modern physics. Absolute laws have been replaced by probabilistic laws, perfect knowledge has been replaced by imperfect knowledge, causality by indeterminacy, predictability by uncertainty, reductionism by holism etc.

Along with the fall of the dominance of classical physics, the positivist philosophies which had the principles of classical physics as their basis, are also in a state of major crisis. Positivist philosophers (positivists in the nineteenth century and logical positivists in the twentieth century), in their great majority, viewed science as basically deterministic, with deterministic laws and freed from all kinds of normative elements. The new philosophies of science are profoundly against positivism. They call for an open, pluralist, and holistic methodological approach. Also they reject the positivist distinction between normative and positive. The increasing influence of philosophers of science like T. Kuhn, I. Lakatos and P. Feyerabend, demonstrates the decline of positivist scientific philosophies (see Kuhn, 1962, Lakatos, 1978, Feyerabend, 1975).

In addition, a number of modern physicists have rejected positivist pohilosophies. For instance, the first proponent of quantum theory M. Planck believed that positivism was a very inadequate theory. As V. Lenzen writes:

> «He (Planck) restated his rejection of positivism in the theory of knowledge. He interpreted positivism as a doctrine of criticism that would limit science to measurements». [Lenzen, 1959, p. 127].

Moreover, the strict emphasis on scientific knowledge alone and the rejection of all other elements, like ethical propositions, is not compatible with the findings of modern physics. As Heisenberg wrote (referring mainly to the positivist philosophies): «Many modern creeds which claim that they are in fact not dealing with questions of faith, but are based on scientific knowledge, contain inner contradictions and rest on self-deception». [Heisenberg, 1962,

p. 28]. Heisenberg also rejects the philosophy of positivism in his well-knwon book: 'Physics and Philosophy' [Heisenberg, 1978, p. 146].

In general, modern physics proved that the kind of science advocated by the materialists of the eighteenth century and the positivists of the nineteenth and twentieth centuries, is a false idea. In short, the message of modern physics is that our ideas about the nature of scientific knowledge must change. Physics ceased to be the ideal positive science for materialists, positivists and positive social scientists. In his Nobel lecture, M. Born explicitly rejected deterministic classical physics as the ideal model for scientific research:

> «... the determinism of classical turns out to be an illusion, created by overrating mathematico-logical concepts. It is an idol, not an ideal in scientific research and cannot, therefore, be used as an objection to the essentially indeterministic statistical interpretation of quantum mechanics». [Born, 1954b, p. 265].

As W. Samuels has pointed out: «A critical factor in understanding and interpreting the development of economic thought, is the role of recieved cognitive systems» (Samuels, 1974, p. 310). We believe that the development of orthodox economic theory has been greatly influenced by the classical physics-based conceptual framework. The building of economic theory along the lines of the mechanistic-positivist approach meant a positive economic theory with the ability of making predictions based on economic Laws; also exclusion of all normative elements and the isolation of economic phenomena from their social context. In additon, a greater degree of abstraction and quantification meant greater positivity and thus, a step closer to the ideal: classical physics. With the emergence of modern physics, it became evident that physicists have very litle knowledge of nature and that the idea of physics as a precise science must simply be abandoned. The very same discipline which was the main reason for the establishment of a conceptual framework based on «Positive Science» now calls for the abandonment of that framework. The mechanistic-positivist approach, which was the product of the above conceptual framework, was the dominant influence in the construction of mainstream theories of most of the social sciences. And thus. it was also responsible for the construction of mainstream economic theories and methodology.

The new paradigm in physics and in philosophies of science, has produced the first clear signs of the abolition of the mechanistic-positivist approach. The most important implication of the new conceptual framework for the field of economics is the call for a more open, pluralist methodology with emphasis on the social whole (context) and not on the isolated study of economic phenomena. Thus, the methodology of non-orthodox schools of economics (Institutionalists, Post-Keynesians etc) seems to be closer to the new paradigm.

Certainly, most of the methodological points of orthodox economics, deterministic economic laws, predictionism. perfect (or near perfect) knowledge, positive-normative distinction, reductionism, are at odds with the new conceptual framework which originated with modern physics. A big risk that orthodox economics faces in our age, is to be characterized as a science which is largely based on an outdated, nineteenth century conceptual framework.

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