How has Physics Influenced the Progress of Economics?

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Abstract: In the history of the conduct of its affairs, economic science has been confronted with the other natural sciences, where exchanges were necessary for the progress of its conceptual apparatus and the completion of its epistemological field through dialogue and permanent communication. Conversely, the hardest sciences have given rise to a real philosophical efflorescence from within. Paul Scheurer speaks of a return of speculative thought in the exact sciences. This had begun at the beginning of the 20th century with Poincaré, Mach, Einstein, Bohr, Born, etc. Beyond the effects of cultural, ideological, and historical constraints on the formation of economic science, this one has indeed been, throughout its history, periodically submerged by waves of immigrants from the natural sciences. And vice versa the economists were always conscious of the necessity of a free disciplinary exchange for the progress of the economy, the hardening of its scientificity, and the enrichment of its conceptual apparatus that imposed fertile cognitive requirements.

In their relations with economics, physicists have always migrated to this field to look beyond their disciplinary boundaries, using their methods to study, analyze and advance economic science and help it solve its methodological and epistemological problems. Such is the purpose of econophysics. Indeed, the tools of physics provide an ideal framework for addressing problems in economics. Throughout its history, physics has always held a fascination for economists. The influence of the natural sciences on the content and structure of economic theories covers the period from classical political economy through the marginalist revolution to the present day. Newtonian mechanics was of great use to A. Smith. Desiring to bring order to the chaotic realm of social phenomena, one would think that his contribution to the "social sciences" followed Newton's successful model. Smith was certainly another heir to an intellectual tradition that, with few exceptions, revered Newton and his legacy. Manifestations of the influence of physics on the neoclassical school are most evident in William Stanly Jevons and Irving Fisher. The purpose of this paper is to show how the progress of economic science has always been guided by the discoveries and metaphors of physics and how intrusions between the two disciplinary frontiers are made. How have these influences affected the scientificity of economic science and hardened the conceptual apparatus? Wouldn't imitation risk taking away the moral character of economics? Moreover, wouldn't the innovations in the field of physics be likely to exert other pressures on economists and their research programs? Isn't it time to declare their independence from the field of physics and rethink the scientific status of their discipline? Doesn't the rise of all kinds of crises (financial, ecological, inequalities, poverty...etc.) require the reappearance of a new research program, protected from any falsification by a belt of auxiliary hypotheses?

Keywords: Economics – Physics – Economic progress- Sciences- Relationship.

1. THE HISTORY OF THE RELATIONSHIP BETWEEN PHYSICS AND ECONOMICS

The political economy would be a science of social wealth. Wealth is both a general fact and an appreciable quantity. Consequently, this science can be as precise and rigorous as physics, chemistry, or mechanics. This explains the affinities that it has always sought to weave with the physical sciences. In his History of Economic Analysis, Schumpeter (1953, p. 216) reminds us that "*all the definitions of the period insist on the autonomy of economic science concerning the other moral or social sciences*" (Schumpeter, 1953).

Many economists such as John Stuart Mill and Say emphasized its analytical (scientific) character, its methodology, and its analogies with the physical sciences. Auguste and Léon Walras are part of this generation of economists, turned toward scientific progress and the search for truth.

In this section, we discuss the history of the relationship between political economy and the physical sciences, looking at three main periods that are crucial in the development of the neoclassical research program (Diemer, 1983).

The first period (1831-1874): it is based on the work of Auguste Walras and the first reflections of Léon Walras. Using

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a rigorous scientific approach and a classification of knowledge (Ampere, 1834), Auguste established a theory of general facts. The political economy would be a science of social wealth. Wealth is both a general fact and an appreciable quantity.

According to him, "I have tried, in my theory of wealth, to distinguish very clearly between utility and exchangeable value. I believe I have succeeded. I have insisted on this point of view that value is an appreciable quantity, like length, like gravity, like speed. So I have not pushed mathematics out of the realm of social wealth. On the contrary, I have made a sincere and motivated appeal for their intervention" (Walras, 1835-1836-1837).

The second period (1874 - 1900), introduces the tripartite vision of political economy. Pure economics and "elementary" mechanics have a common conception of the world: that of equilibrium. Léon Walras referred directly to the work of Poinsot (1811). If the mechanics of Lagrange and Laplace (frictionless machines) serves as an anchor for economic science, it is to better understand the relevance of mathematical physics. Mathematics allows the formulation of scientific laws, the substitution of functional relationships for causal relationships, and the emergence of mathematical economics (the science of quantities).

The third period (1901 - 1909): sought to consolidate the Walrasian work by turning to mathematicians. It also refers to the writing of the article "Mechanics and Economics". Léon Walras tried to give a certain scientific legitimacy to his work. His work refers to mathematical physics (Poincaré, 1902, 1906), rational mechanics (Leibniz, 1684; Cournot, 1875; Fisher, 1892), and celestial mechanics (Newton, 1722; Poincaré, 1902; Picard, 1905). All economic laws are linked to an emblematic mathematical figure, the "differential equation".

Auguste Walras intended to put the logical rigor of his reasoning and the use of his scientific method at the service of political economy. Three ideas would present themselves to him: wealth, value, and utility. In associating political economy with the science of wealth, Auguste Walras specifies that wealth is a general fact, "just as necessary as gravity, heat or light" (Walras, 1835-1836-1837).

Following the work of his father, Léon Walras called for a rapprochement between two sciences: physical science (already constituted) and economic science (in full mutation). This analogy concerns both economic and moral facts. The pure political economy must constitute a new science: "the science of economic forces analogous to the science of astronomical forces" (Walras,1965).

If economists have not known how to take advantage of natural facts and laws, it is because they have always been alien to the scientific spirit and method. The social economy is to be constituted from scratch; it is "the theory of moral forces to be elaborated after the theory of economic forces... it is Newton's law of universal attraction to be produced after Kepler's laws on planetary revolutions" (Walras,1965). Léon Walras insists on an important point: if the theory of property and taxation does not exist, it is precisely because the theory of social wealth has never been scientifically exposed.

Relying on the work of Newton (1722), Poincaré (1902), and Picard (1905), Léon Walras established a strong analogy between economics and celestial mechanics, based on the principles of gravitation and universal attraction (notions of force and mass).

If physics, and more precisely static mechanics, occupies an important place in the work of Léon Walras, it is appropriate to specify the scope and significance of these analogies. First of all, Walras' work is part of a direct father-son relationship. It is from the conceptions of Auguste Walras that Léon will forge a scientific program for the political economy from 1860 onwards. Political economy is part of the classification of human knowledge (Ampere, 1834), so it cannot be conceived without a theory of science in general.

Now all science is a theory of a general fact (nature, causes, species, laws, effects). Political economy is the science of social wealth. Wealth is both a general fact and an appreciable quantity. Consequently, political economy can be as precise and rigorous as physics, chemistry, or mechanics. It would even be a matter of arithmetic. If Auguste Walras was inspired by the scientific method (that of Bacon) that had worked so well in the field of physics, he also specified that the boundaries of political economy should be delimited.

It is from his father's methodological analogies, Ampère's classification of knowledge, and Poinsot's work (1842) that Léon Walras will develop his conceptions of economic science. Theoretical analogies gradually replaced methodological ones. Under the impetus of the mathematical sciences, the economist must no longer privilege the causal relationship, but rather the functional relationship and interdependence. Political economy and static mechanics would thus speak with one voice: that of the conditions and equations of equilibrium.

If Walras refers his readers to Leibniz's rational mechanics and Newton's celestial mechanics, it is only to remind them that all economic laws are linked to an emblematic mathematical figure, the "differential equation". The (mathematical) economy must follow in the footsteps of mathematical physics; only the latter symbolizes the quest for truth. Whether this is a scientific anachronism or a simple reversal of fate, it was at the moment when Léon Walras thought he had established the foundations of economic science that the physical sciences were shaken in their certainties by the theses of Albert Einstein (1905) (Sahyar,2014).

If the paper cannot be extended to develop further the history of the relationship between physics and economics in the work of other authors (Jevons, Fischer, etc.), the fact remains that economists, in their exchange relations with physics, have always shown a firm determination to succeed in conferring on economics the status of science in the same way as the natural sciences. The hardening of the conceptual apparatus is a fundamental aspect and the hard core of this scientificity.

2. THE ROLE OF PHYSICS IN THE HARDENING OF THE CONCEPTUAL APPARATUS OF ECONOMICS

The physical sciences have contributed a lot to the foundation of the conceptual scaffolding of economic science, the key concepts of this science, which constitute the hard cores of all the economic theories developed until today, have been, for a good part, borrowed from physics. This can be explained either by the fact that the economists highlighting these concepts are trained in physics or by a scientific and methodological conviction of the necessity of a methodological crossing between the two disciplines, which could result in a scientific hardening of the discipline.

It is not however excluded that the concepts elaborated in the field of physics suffered from major difficulties. Einstein already explained why scientific theories and concepts are fictions or "free creations of the human mind" and why only intuition, based on a benevolent understanding of experience, can reach them. The concept is therefore not identical to the totality of the sensory impressions to which it has been referred (Einstein,1985), a concept only takes its meaning from the totality of the sensory impressions associated with it.

In the whole history of physical science, the whirlwind of thought has always oscillated between what Edgar Morin qualifies as two disintegrations, one by insufficiency and the other by excess or "turbulence" (Edgar, 1986), which can alter or even paralyze the relevance of the conceptual apparatus of the discipline, which requires repetitive regulations through the implementation by the thought of processes of self-destruction (skepticism, relativism, self-criticism) (Edgar, 1986). Many physical theories are formulated mathematically, which means that these formalisms are linked to intuitions and concepts unfamiliar to common sense (Feyerabend, 1989). Disciplinary fields are generally fraught with difficulties and their realities and complexities require caution in any practice of conceptual transfer between disciplines. In establishing itself in a disciplinary area, a concept always needs a process of regulation and adaptation to the realities studied.

If we are interested in the economic science in its relation to physics, we can note that during its evolution the economy has been a fertile ground for the fertilization of concepts originating from the physical sciences and which until today constitute the hard core of all the economic theories and have allowed in one way or another an economy of thought, such as value, fluctuation, cycles, etc.

If we look at the concept of value, which constitutes the cornerstone of political economy, the first controversies on this concept reveal that the protagonists were looking for a value substance, something that would reify an invariant of social life, and thus provide the basis for quantification and formalization (Mirowski, 1989).

The conceptual schemes derived from the natural sciences have consequences, isolated or shared with others, which have been the subject of extensive investigations. Thus, equilibrium processes in physics have more or less strong stability properties that can be transposed directly to the economy.

On the other hand, imports from the social sciences create a strong tension insofar as the new concepts strongly solicit the usual framework (Walisser, 2010)

Other concepts of rational mechanics, such as body-movement-value, inspired classical economic theory until the middle of the 19th century. Approximately from the middle of the 19th century, the neoclassical school found the physical sciences a favorable field in which to improve and even harden its conceptual apparatus.

Thus, equilibrium processes in physics have more or less strong stability properties that can be directly transposed to economics. Similarly, classical mechanics suggested the transfer of the principle of optimization (of the Hamiltonian) of a system to the principle of optimization (of the utility) of an actor, it being understood that the latter act at the individual level and not collectively (absence of collective utility). It also introduced the principle of equilibrium, conceived as a stable global state in the absence of environmental disturbances, even though it is realized in economics in an intentional and non-causal way.

In parallel to the conceptual analogy, there is also an analogy between variables in economics and quantities in physics. Economics can be defined as having a measurable and usable concept on a ratio scale (Dombush, Stanley, and Richard, 2008). Some commonly used economic variables are taxes, interest rates, price, income, consumption, savings, production costs, output, inflation, and unemployment. Through several research results in economics, the variables have an analogy with certain quantities of Physics such as entropy analogous to the production function, the temperature analogous to the level of income, effort, or work analogous to the use of labor, and others (Mimkes,2006).

The existence of an analogy between physical quantities in economic variables allows the laws of physics to explain certain economic phenomena (Sahyar, 2014).

It is thus through an effort of analogy that concepts migrated from one field to another. For example, the utility became the equivalent of potential energy; the budget constraint is the relatively modified equivalent of kinetic energy. In their transfer from the field of physics to economics, the concepts maintain a dialectical relationship with the things of economics (fertilizability of the host field) which generates cognitive innovations and favors a diachronic cumulative of theoretical knowledge. Conversely, the transferred concept can disturb the host disciplinary field if it is not adapted to its specificities and to its socio-cognitive context, which can cause scientific turbulence and a rupture between the words and the things of the discipline.

3. A METHODOLOGICAL CONSENSUS BETWEEN THE TWO SCIENCES

As history unfolds, we can see an undisputed reality that the history of the progress of the methodology of the economic sciences is dependent on the transfers made by the sphere of the physical sciences. We must specify that economics was at its highest degree of fertility in the age of Newton's classical mechanics. For this physicist *"...(and) if natural philosophy and all its parts, by following this method, will at last be perfected, the limits of moral philosophy may also be enlarged*"(Newton, 1979). This shows the greater influence of Newtonian physics on moral philosophy, let alone on political economy. Adam Smith expressed his admiration for the Newtonian method, arguing that it "is undoubtedly the most philosophical, and in all the sciences, whether of Morals or of Nature" (Smith, 1983).

While the picture of similarities is quite complex, it is clear that Smith understood Newton better, and that the originality of Newton's great ideas had a great deal of influence on Smith's realist position on ethics and political economy.

Whether in his essay on "The History of Astronomy", or his essay on the nature and causes of the wealth of nations and his theory of moral sentiments, one can also always discover the methodological influence of Newton on Smith. Mark Blaug has argued that the central role of sympathy in the Theory of Moral Sentiments and that of self-interest in the United Kingdom, "must be seen as a deliberate attempt by Smith to apply this Newtonian method first to ethics and then to economics" (Blaug, 1992).

The classical economic theory had a very high degree of acceptability for physical science methods. This was due, on the one hand, to the moral implications of Newtonian physics and, on the other, to the fact that it was closely linked to the metaphor of value as distance and to the measurement of value as a standard. The moral behind this analogy was that there was a natural geometry and algebra that provided the basis for quantification and mathematical analysis, provided that men of science showed sufficient insight and had sufficient luck to find them (Mirowski, 1989).

However, this degree of admissibility varies from one author to another. It seems that Smith was more influenced by Newton's methodological recipes than Ricardo or J.S. Mill. The latter, faithful to a description of political economy as an "*essentially abstract science*" which uses "*the a priori method*", distances itself from Newtonian positivism, for him, economic science is a body of deductive analysis, based on psychological premises and disregarding, even about these premises, all the non-economic aspects of human behavior (Mill, 1994).

The laws of disruptive causes are an influential aspect of the physical sciences that Mill has used extensively. Like friction in mechanics, a phenomenon to which they are often compared. Instead of looking only at the specific aspects of an economic problem, we must - say, Mill - also look at other aspects that may exist in the problem and that may have escaped scientific research because they are not directly and strongly related to this category of problem. These other aspects are called disruptive causes.

To demonstrate the influence of the physical sciences on economics Mill expresses it clearly by saying "It is because of the influence of disturbing causes that he who is only an economist, he who has studied no other science than political economy, will fail if he wants to apply his science to practice (Mill, 1994). In his System of Logic, we learn that the research methods used in economics should be identical to those already in use in astronomy (Mill, 2011).

It is no exaggeration, however, to say that the progress of classical political economy was made in a context of strong dependence on science, and in particular on the physical sciences, which made it vulnerable to criticism that it was, at best, only vague and put the political economy in a difficult position when science itself was the object of profound transformations (Mirowski, 1989).

Does this blatant dependence of classical economics on the sciences mean that classical economists did not have their methodological principles? In other words, the socio-historical conditions as well as the legacy of mercantilist thought could not have been invested by the classical authors to forge their economic methodology. For some authors, it is very difficult to speak of an absence of methodological principles among the classics, but simply that they did not see the need to make them explicit, perhaps because they thought them too obvious to justify (Blaug, 1992).

Economics has forgotten, as Cairns observed, that it has an advantage over physics, in "economics the ultimate elements of our fundamental generalizations are known to us immediately. In the natural sciences, they are known only by inference. There is much less reason to doubt the real counterpart of the individual preferences hypothesis than of the electron hypothesis" (Cairns, 1992).

However, from the 19th century onwards, we witnessed a period of relative methodological emancipation made possible by the rise of the neoclassical school. Since then, economics has gradually become a deductive science. This does not exclude certain influences that can be seen in certain marginalists. The methodological scaffolding seems to have settled on a solid base, especially with the entry into the field of economics of men from the physical and mathematical sciences. Table **1** allows us to establish a comparison between the two disciplines in terms of methodology.

Table 1. Differences and Similarities between Physics and Economics.

No	Aspect	Physics	Economy
1	The research methodology	The scientific method	The scientific method
2	Object of research	Phenomena arising from changes in the value of the material or form of energy	Rational human behavior in decision-making in using limited resources efficiently and effectively
3	Variable measurement scale or magnitude	Ratio	Ratio
4	The results of the study	Universal	Universal
5	Truth	Not absolute, and the probability Tentative	Not absolute, and the probability Tentative
6	Relationship model variables	Have a regular pattern that can be arranged in the form of mathematical models	Have a regular pattern that can be arranged in the form of mathematical models
7	Instrument	Using a measuring instrument with standards	Observation sheet for recording economics variables
8	Data retrieval	Observation	Observation or secondary data

Source: Sahyar (2014).

It can be seen that there are many similarities between the science of physics and economics. This difference is the subject of research. Research in the physics of objects is the interaction between matter and energy, while economics examines human behavior in the context of a rational decision to use resources more efficiently and rationally. Rational behavior is behavior that uses logic that has a true or false value and a quantitative measure. Humans have the capacity for logic, ethics, and aesthetics. Size is good and bad logic, size is good and bad ethics, aesthetics while having a wonderful size and worse otherwise rational human decisions if an emotional dimension dominates, the human decision is emotional.

Economics is a science built with a rational approach, so economics can only explain the phenomenon of human behavior by making decisions rationally. The laws of physics are the laws of nature; in particular, the truth is rational and cannot be controlled by humans. This leads to making decisions a rational man must comply with the laws of nature. The practical application of economics in society can not always be applied scientifically, because human behavior is influenced by emotional factors, social factors, and political factors of the country.

4. ECONOPHYSICS OR THE PHENOMENON OF TRANSFER ITSELF

Econophysics is a very recent phenomenon that came into being in 2005, as an attempt to develop economics by transferring research methods and techniques from physics to economics. However, the beginnings of econophysics should be traced back to the middle of the 19th century and may go even further back. In the early 20th century, the developmental trajectories of economics and physics began to split, resulting in the disproportions observed today. In this context, it seems justified to divide econophysics into an old and new science, as proposed by Rasekhi and Shahrazi.

However, it should be noted that the foundations of the new economics were laid in 1958 by a Polish researcher (Rawita-Gawroński,1958) who understood the need to supplement the methodology of economics with some ideas from physics, including the theory of stochastic processes, which he called random. She criticized the traditional physics-based economics of the 19th century, where there was no room to capture the uncertainty of human behavior. In his view, a broad introduction of physics methods to economics would lead to a revision of the content of economic assumptions, which is currently observed. She saw the rationality of such a transfer in the fact that both sciences share the same subject, determined by an observable part of phenomena based on a specific number of parameters (*Jakimowicz, 2016*).

We are therefore dealing here with a second possibility. The physics methods most often applied in economics include the theory of stochastic processes, cellular automata, and nonlinear dynamics. This study represents the bulk of existing achievements in econophysics and attempts to reconcile them with traditional economic knowledge. The execution of a paradigmatic correspondence between econophysics and economics, both locally and globally, is a prerequisite for using the achievements of the former in economic policy.

The integration of econophysics and economics will be determined not only by theoretical premises but also by practical considerations. For example, in econophysics, one can find a wide range of stock market models that are proposed. All of them can explain the basic characteristics of price fluctuations, but since they do not offer verifiable predictions, it is impossible to differentiate between them. The inescapable conclusion is that this is not the kind of science found in physics. The ability to discriminate between different theories is a crucial element of any science.

As studies show, econophysicists have a good knowledge of current economic problems and have methods to examine them in greater depth. The security of financial and foreign exchange markets are areas of particular interest to econophysicists. Other areas of interest to econophysicists can also be cited, such as the reasons for business cycle fluctuations, the factors of economic growth, income distribution, problems of economic equilibrium, real estate markets, hyperinflation mechanisms, and the evolution of firms. Therefore, it seems logical to think that a wider application of physical methods in these areas will help economists to reject unnecessary ideological baggage, thus increasing the transparency of reasoning and bringing researchers closer to the truth.

5. ATTEMPTING TO MAKE ECONOMICS AUTONOMOUS

If economists, and more particularly neoclassical economists, have chosen to attribute the status of science to their discipline by imitating what physicists did, it is important to specify that this imitation has its own set of ironies and inconveniences. One can ask Mirowski (1989) the following questions:

Is mimicry not a stratagem of incurable cynicism, or can it in some cases serve as a gyroscope for a drifting research program? Once instituted, does imitation present in its functioning a durable pragmatic character? In other words, once they have embarked on this path, should economists continue to imitate and stimulate physics as it evolves? How can this mimicry function effectively if, at the individual level, many neoclassical economists are not aware of it? And does imitation, not risk - and it is in this sense that the Hayek episode is particularly revealing - arouse as much contempt as respect? Could it be that the physical metaphor generates more heat than light?

In our view, it is a question of immunizing economic research against the calamitous virus of physical and mathematical abstraction, which is an end in itself, to insert the economy into the social. Mathematical abstraction and physicalism must be considered as a moment, a stage in a process of knowledge whose rule and criterion reside in the social concrete. Only the knowledge of concrete practice can provide technique with "actionable" means, and economic policy with decisions about "preferable" socio-economic ends.

Ethnocentrism and physicalism, two flagships of liberal economics, lead, the first to the neoclassical discourse, managed by the International Monetary Fund, and the second to the illusion of an economy without subjects. The economy is no longer a natural (universal) logic, a pure arithmetic of pleasures and pains. It is, as a science, the knowledge of the "worlds" of production, which provide themselves with the material means of a determined social reproduction (a kind of life....). If there is a sense of measure, it is at the level of the conditions. But there is no measure of the sense, at the level of the effects (Cecconi, 2008).

The empowerment of the economy calls for a scientific revolution. In a recent article, Jean-Philippe Bouchaud (2008) calls for a scientific revolution in the field of economics. He observes that economics is based on a set of axioms that, unlike the principles of physics, have never really been tested by observation. He cites the view shared by many economists that "these concepts are so powerful that they prevail over any empirical observation".

He observes that the market has been "deified" in recent decades (Nelson, 2002). What were the motives and purpose of the "deification of the market"? Bouchaud (2008) points out that "the alleged perfect efficiency of a free market stems from the economic work done in the 1950s and 1960s, which in retrospect looks more like propaganda against communism than plausible science."

Moreover, if we accept for a moment the thesis put forward by Robert Nelson that the field of economics is more a religion and an ideology than a science, we can perhaps better understand the critical attitude manifested by many economists against econophysics and physicalism in general.

CONCLUSION

If physics has energized the movement of the economy in favor of reason, which gives a great margin to the freedom of criticism, this confirms the utilitarian conception compatible with the system of industrial accumulation. In other words, the more the industrial society will develop, the more science, technique, and industry will act, in a synergetic way, in the direction of utilitarianism. The notion of a mega machine integrates all these links. The rationality of the mega-machine pushes science in the direction of instrumentalism. This spider's web (instrumental culture, economy, science, technique, and industry) suggests the dangers and forms of alienation that an uncontrolled overdevelopment of the mega-machine causes (Zaoual, 2002).

If neoclassical economics kept its distance from the broader energy movement of the late nineteenth century, this reserved behavior saved it when the energy movement fell out of favor in the early twentieth century. Similarly, neoclassical economics kept its distance from complete identification with the energy metaphor whenever it faced serious challenges in the 20th century.

The topic of econophysics is one that interests many researchers. In fact, one of the most recent studies is that of Sharma and Khurana (2021), who conducted a bibliometric study over the period from 2000 to 2019, and showed that econophysics is gaining interest among researchers in terms of publication and that physicists represent the largest contribution in the field.

Today, with the recurrent financial crises, the problems of ecosystem degradation, the rise of inequalities, and the resurgence of new social problems such as violence, crime, divorce, and infertility. And so on. It seems that any attempt at theorizing within the neoclassical research program must not be taken hostage by the physical apparatus and its conceptual framework, this in no way advances an economic science already in crisis.

Classical economics came under attack during the crisis. Deregulated markets should, in theory, function efficiently, with rational individuals promptly rectifying any price or forecasting errors.

Prices should represent the underlying reality and guarantee efficient resource allocation. These "equilibrated" marketplaces ought to be stable because the market itself cannot start a crisis; only severe exogenous shocks may do so. In sharp contrast to most financial crashes, this one is.

The current economic crisis may present an opportunity for a paradigm shift, which so-called econophysics could support. Since economic physics tends to focus on financial markets, they provide an excellent testing ground for economic theories by comparing them to observations utilizing the terabytes of data created daily by financial markets. (Bouchaud, 2019)

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