A UNIVERSE OF VARIABLES AND UNIVERSAL CONSTANTS

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Abstract: *This paper opens a number of other possible approaches by the authors to the need for inferentiating constants in physics, in order to turn them into universal constants, and thus making use of the global and profoundly integrative nature of physics. An introduction concerning the universal type of approach to constants inevitably leads to a brief history of knowledge in a universe dominated by variables and a delimitation of the philosophy of constants, which is followed by a final distinctive approach to universal constants in physics thinking and their resonance in economics. A few final remarks suggest new horizons based on the systemic approach, within the context of econophysics.*

Keywords: *variable, universe, physical constant, universal constant.*

1. INTRODUCTION

In a holistic approach, the economic system can become compatible with the universal physical system, being characterized by homogeneity, dynamics, general equilibrium described by partial imbalances, harmony and harmonized interdependences, etc. The physical system, centred on the principle complex causality, as well as its laws, is what requires the existence of constants that change the cause-effect relationship, and the "relative instability" of the constants, in the sense of variation in value, can generate another universe.

Changing these constants specific to a "terrestrial universe", through economic activities, may result in the extinction of the current universe, i.e. the extinction of humans and human civilization. One can cite here the example of the current context of development of human society, where failure to take account of sustainable development can be seen as maintaining the current constants, which certainly leads to another universe, where humans and human activity certainly disappear.

Thus, the 21st century can be viewed not only as a century of dramatic imbalances, but also a time of deep antinomies, such demographic explosion – implosion, economic convergence – divergence, extreme economic growth – severe and prolonged recession.

The structure of this paper comprises a first section representing a succinct introduction, followed by an equally brief survey of philosophy in search of the meaning of a constant, and a third section, describing the universal constants in physical thinking, which have already become classic, and impact the thinking of economics, or otherwise of full econophysical content, and their echo in economics. A few final remarks support the possible claim to originality as far as the approach announced in the abstract in concerned.

2. KNOWLEDGE IN A UNIVERSE DOMINATED BY VARIABLES, AND THE PHILOSOPHY OF CONSTANTS

The Pythagoreans drew, maybe for the first time in the history of the written and preserved word, a distinction in which they attempted to segment or partition mathematical knowledge in its broad sense, ranging from music to arithmetic, geometry and astronomy [1], in an *ab ovo* conceptual quadrilateral, such as that in Table 1:

An investigative conceptual synthesis of mathematical knowledge in the Pythagorean school, illustrated by discrete and continuous variables

Table no.1

HOW MANY – *discrete variable*, subsisting by itself (strictly arithmetic mathematical variable)
HOW MANY – *continuous variable*, which is required in relation to another variable (music variable)
HOW MUCH – *discrete* or *stable variable* (strictly geometric mathematical variable)
HOW MUCH – *continuous* or *moving variable* (astronomical variable)

Source: The figure represents a synopsis drawn from Bertrand Russell (1914), *Our Knowledge of the External World as a Field for Scientific Method in Philosophy*, Routledge Publishers, New Edition 1996, the Bertrand Russell Peace Foundation Ltd. pp. 168-169, with references to George Johnston Allman, *Greek Geometry from Thales to Euclid*, 23 and *Proclos*, Ed Friedlin, p. 23 and 35, *Nicomachi Geraseni Arithmeticam introductionem*, Ed Tennulius, p. 148

What was already apparent from this philosophical approach to variables was originally Pythagoras' theorem (the famous summation of the squared lengths of the catheters, which is equalled to the square of the hypotenuse ($a^2 + b^2 = c^2$), and then we have the finding that the first presence of a constant in the so diverse universe of variables exclusively referred to the Pythagoreans' mathematical thinking.

Moreover, Parmenides confirmed this statement in a poem dedicated to "one", in which he said that "everything is one", thus denying plurality, as the young Socrates characterized him in Plato's dialogues [2], only to confirm that it was by following the path of truth (that of constant-centred approaches), or via the approach focused on the opinions of the Pythagorean type, that one could found an extensive knowledge of external reality. Reality is described by a goddess in Parmenides's poem as being imperishable, unchanging, uncreated and indivisible (in fact, it was described as a synthesis of several constants aggregated or combined in her body).

Parmenides was joined by Zeno, whose paradoxes were meant to deny the presence and importance of variation and movement, and who even oversized the reality of constants (e.g. the famous paradox of Achilles and the tortoise that will never be caught up with, or the paradox of the flying arrow, which is yet at rest: during a moment, a moving arrow is where it is, but it cannot move because that would require time to have parts, and consequently a moving arrow is reduced to the constant of an arrow at rest.

In Greek antiquity coexisted no less important contributions to the philosophy of constants, coming from other important thinkers, from Euclid and his Euclidean space, to Aristotle and his treatise "On the indivisible lines"; the view of time and space was, for a long time, one of the types of equivalence space–time as a way of building with points, i.e. with

indivisible moments.

In Aristotle's *Physics* the Pythagoreans are considered as determinant in using the constant of vacuum, considered a "separator" between consecutive elements, including the world of mathematics and numbers differentiated by the same constant element called vacuum… "Nothing was born out of nothing. The universe consists of bodies and void" (Diogenes).

Another confirmation of the time constants later came from Leibniz (whose faith in finite or relatively constant sets thus became a certainty), through his demonstration of the fat that there can be no infinite numbers, i.e. by calculating the "number of all (finite) numbers", which cannot be greater than the number of even numbers, very much like the whole cannot be smaller than one of its parts. [3]

This brief overview of the philosophy of constants, linked to the human desire to know a reality described by a universe of variables, ends with Hegel, who recognized that you cannot think that what is not there is not really exists, which ensures complete similarity between being and thinking [4], thus highlighting the constant "to be" (under the relativized concept of possible), in full antinomy with inconsistency, turned into impossible, of nothingness.

A distinct attitude could be perceived in Galileo Galilei's *Dialogues*, where he identified a constant of infinite numbers, namely the fact that the attributes of equal, higher or lower have no meaning, nor can they find a place in the universe of infinite numbers (of infinity). [5]

As we make a shift into mathematical logic, at the end of this section, we can see in Gottlob Frege's *Grundgesetz der Arithmetik* [6] that the number itself becomes a non-sensitive logical concept (the similarity with constants is more than obvious) and objective, and later Bertrand Russell creates the notion of "logical constants", without however defining them as "entities", but having recourse to "the context and their formalism," while never transforming them into "logical subjects" [7] by themselves.

3. UNIVERSAL CONSTANTS IN THE THINKING OF PHYSICS, AND THEIR RESONANCE IN ECONOMICS

To understand the universe at its deepest level one needs to know its behaviour, and also why the Earth and the human population exist, why there is a particular set of laws and not any other for this universe, and what the role of constants generated by the laws of physics is.

The first and simplest definition given by astronomers about the universe could be the one according to which the universe was all that we can perceive. Thus delimited, the universe is reconceptualised through its quality as being observable or visible, and includes all the stars and galaxies, from the nearest to the farthest ones, which can be detected directly by receiving the radiation they emit. So the observable universe cannot be precisely defined, it essentially depends on the instruments available.

Another conceptualization identifies as universe everything observable, plus everything that might exist. This exhaustive delineation represents the whole universe, which forms rather the subject of mathematical and philosophical studies, by extrapolating of the data that are known in the observable universe.

The substance of the universe and nature has both matter and form [8]. Substance has several attributes, but the spatial one refers to its nature and essence. An object represents a synthesis of the components through which it exists, but is always something more, because a system is not equal to the sum of its components. An object is a frontier world, separating two different worlds.

Its existence separates three worlds; for the inner world, unlimited to the lower extremity, the object is the upper limit, and for the outer world, unlimited to the upper extremity, it is a lower limit. Therefore, in the object there are simultaneously three worlds, the world of the object, its outer world and its inner world. The object reflects the existence in its totality, and it is made by means of a dynamic equilibrium. An object has a scope or extension through which it also exists in space. At the same time, by having a beginning and an end and being permanently in change, it has aduration, it practically exists in time.

Objects exist in space and time, and German philosophy found, with Kant, that "one can conceive of a space without objects, but objects without space are not to conceive of." Objects may disappear, but not the space they occupy. Space is more general than the object, and Isaac Newton imagined space as a blank infinity (thus taking over the ancient Greek philosophers' idea of vacuum in his thinking). The density of matter and the energy in the universe can be justified if the dark matter greatly exceeds the detectable matter.

Cosmic vacuum is energetically a superfluid, where there is no phenomenon of friction or resistance, which allows information, imprints and its patterns to continually exist in the form of a memory, cosmic memory, and evolve dynamically in physical reality.

A third notional delineation encompasses the part of the whole universe which is described by the known laws of physics. This is the physical universe, a slight extension of the observable universe, including areas that cannot be observed directly, but whose presence can be inferred from their effects on a number of observable entities. Scientists discovered a deeper dimension of the universe, that they gave different names: the physical space – the physical time, hyperspace, holographic field, implicit order or non-ether.

This dimension is associated with a virtual ocean of mysterious energy improperly called *cosmic vacuum* (which contains virtual particles and energies that appear and disappear from the physical existence so rapidly that it has no effect whatever on the total energy of the universe), because it is not vacuum, but cosmic space that is not empty, called unified vacuum or unified field.

The universe, in its classical acceptation, proved to be erroneously described, conceptualized and analysed.

The primary element of the universe is energy rather than matter, and space is neither empty nor passive, but *full of virtual energies and information*. The universe is an integrated evolution system, astonishingly coherent and interconnected.

The universe today is remarkably homogeneous and approximately flat, although the calculations for the initial model show that it should not have been homogeneous, on the contrary, it should have numerous regions where space is strongly deformed. To solve the problem, cosmologists filled the model with the so-called inflationary theory, which claims that immediately after the birth of the universe, when it was only 10^{-35} seconds old, it went through a phase of extremely rapid, superluminal expansion, which must have turned it uniform and flat.

In 1998 there occurred a breakthrough concerning the nature of the universe, particularly related to the fact that its expansion seems to accelerate. The energy associated with the acceleration represents a mystery (since it cannot be detected

directly). This energy is the so-called dark energy, which is hidden in the cosmic void.

John Wheeler noted information to be a fundamental feature of the universe, present throughout space and time and at the same time everywhere. This led Einstein to say: The ancients apparently knew something that we have since forgotten.

There is an incomplete interpretation of the relationship between energy and the speed of light, according to which energy *converts* into mass, in keeping with the theory of relativity described by Einstein's well-known relationship ($E = mc^2$).

What should be emphasized is precisely the fact that the real aspect is not the transformation, but the *equivalence*, i.e. energy is not converted into mass, but rather *energy and mass are equivalent dimensions*. Mass becomes equivalent to *condensed or frozen energy*. *This approach leads to a first conclusion, concerning the universe, namely that the universe is created in accordance with physical principles centered on consistent constants of equivalence, and any change in these constants will finally result in a completely different universe.*

The immediate consequence is a brief listing of a set of stunning universal constants of today's physical universe, with simple references like the coefficient of friction, the general gas constant, Boltzmann constant, the constant of elasticity, the constants designated by analysis of density, electrical resistivity, viscousness, magnetic permeability, specific heat, caloric capacity, or references to more complicated phenomena of major impact, such as the constants related to the speed of light, gravitational acceleration, the specific load of the electron, the wavelength for sound and radiation, etc. Constants also become the specific ways of thinking, or physical approach to the universe, from determinism to materiality and predictability. Universal and absolute constants are purely mental in nature, thus exemplifying, with quantum physics, a process in the expression centred on energy and unpredictability. Newton's physics defines a universe at the limit of light speed, the universe of relativity or of relativism universe lies beyond the speed of light, and quantum mechanics lies beyond 6×10^{34}, or Planck's constant, etc.

A new hypothesis inferentiates this logic in the spectrum of demography, in the core of economic, social and political systems, which are, actually and really, under the impact of the same laws of the physical universe. It will be requisite to briefly list some of these constants of a complex type, derived by extending physical thought and modelling into the space of demography, economics, social or political phenomena…

Fertility at 2.3, which generates a constant population in demography, becomes an essential milestone like other physical constants.

The Club of Rome identified and subsequently theorized, under the pressure of economic resources, the first universal constant that seems to be purely economic, though extracted from the physical world, which can ensure protection and sustainable development in the famous formulation: "zero growth."

The threshold of GDP and public debt in GDP deficit, in the economic theory of convergence (amounting to 60%, and 3%, respectively) are essential constants, benchmarks of a process of statistical and mathematical rigor similar to statistical physics, as measured by the statistical indicator of the *coefficient of variation of GDP level per capita*, and are quite frequently exploited in analyses of economic convergence, by expression supported by the standard deviation indicator resulting from the calculation similar to the classical algorithm of dispersion, and finally of the coefficient of variation:

$$\sigma_t = \frac{\sqrt{\frac{\sum_{i=1}^{n}(Y_{it} - \bar{Y}_t)^2}{n}}}{\bar{Y}_t} \qquad (1)$$

The homogeneity threshold of the analyses of the qualitative variables or the alternative type of attribute variables (which are binary, and frequently expressed in marketing analyses as yes or not) generates a constant of market diversification in Pareto's optimum, expressed in an extended and approximate manner as 20/80, remains detached from the relationship:

$$\mathbf{Co} = \frac{\sqrt{p(1-p)}}{p} = 40\% \qquad (2)$$

(the correct and detailed solution determined being 0.14/0.86 or 14/86).

Capitalizing on the Gini–Struck coefficient (GS) and Hirschman coefficient (H) in curve ABC provides other constants, which are more extensive as impact and use of concentration and diversification in economic, social and political structural processes.

Introducing coefficients of the Gini–Struck (GS) and Hirschman (H) type [9] in ABC curve, determined following relations:

$$\mathbf{G-S} = \sqrt{\frac{n\sum_{i=1}^{n} g_i^2 - 1}{n-1}} \qquad (3)$$

$$\mathbf{H} = \sqrt{\sum_{i=1}^{n} g_i^2} \qquad (4)$$

where g is the internal structures specific to the processes analysed in the micro-economic, social and political universe, and n is the number of structures, typologies or groups composing it. The constants of excessive concentration and excessive diversification [10;11] are thus differentiated instrumentally:

The approximate values of the limiting instrumental constants in excessively concentrated or diversified phenomena

Table no.2

Limits of the indicator	Excessively concentrated markets	Excessively diversified markets
Gini-Struck coefficient	0.409	0.0
Herfindahl-Hirschman coefficient	0.667	0.557

Source: Săvoiu, Gheorghe, Crăciuneanu, Viorel, Iorga Simăn Ion, Dinu, Vasile 2012. *Taxes in Post–Accession Romania: Concetration and Specialization in the State Budget and Local Budget.* Economic Computation and Economic Cybernetics Studies and Research, Vol. 46, No. 4/201, pp. 143-161

Another phenomenon that is subject to the same universal constants is economic inflation, where peaks 3 to 5 percentages are considered significant initially, but later they

are re-accommodated to the phenomena of convergence by limiting constants in the bands expressed with a harmonized and negotiated support under the Treaty of Maastricht, and also depending on criteria such as *inflation* (IM3 + 1.5 p.p., where IM3 is the average inflation of the three EU member states that have the lowest inflation, etc.). These few apparently minor examples show the latent and potential capacity of econophysics, sociophysics, or even demographysics to shape ever newer solutions and scaling of processes and phenomena in the external universe through the agency of truly universal constants having a predominant role of equivalence.

4. SOME FINAL REMARKS

In a historical approach, the idea of cause was related to the idea of human will, often exemplified in economics through economic laws, decisions or solutions, which belong to individuals from the general area of humanity, and have generated immediate or delayed effects. A cause, no less than human will, is always considered active, in contrast to effects, which are continuously redefined as passive.

As an immediate consequence, an active cause and a passive effect require capitalization of prediction or forecasting assumptions. In classical physics, this kind of approach to causes and their effects is considered today as both anthropomorphic and unscientific, physics being redefined descriptively, in an attempt to practically describe how certain things happen.

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In the real world, a cause defined solely by the will hidden behind the cause (a falsely volitional cause) has nothing to do with the effect.

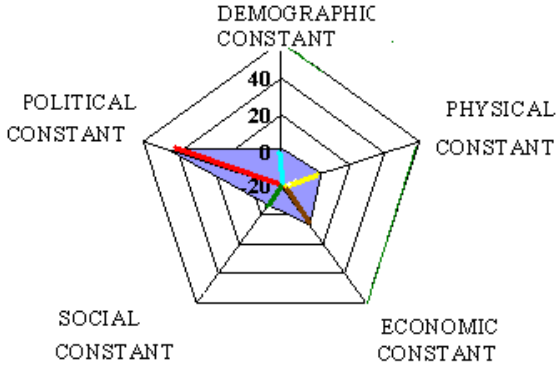
Any cause, when addressed physically, has to be reconceptualised as a set of events, either compensated or uncompensated, with connections or quantitative interrelations that are certain (which occurs rarely), or probabilistically known (more commonly), but not completely uncertain (which occurs very rarely), with a unique event analysed (in keeping with the *caeteris paribus* principle, which simplifies the act of knowledge of reality, although in reality many more items coexist).

Addressed from restrictive positions, the finality and uniqueness of the effect become rather a methodological preference, and a second artificialization considers cause as prior to the effect (although the effect can also be causally prior to, or concurrent, to complete the space and time of research or physical knowledge in economics or econophysics). Lightning, as cause, and thunder, as affect, are an extremely simplified causal example, which is however more easily perceived.

Complexity, compensation and decompensation are also natural explanations of the causal manifestations which mostly go beyond determinism and probabilistic thinking, belonging to indeterminism and appropriate causal risk, or risk of occurrence of the expected effect, although the strict, definite law of, as an originally philosophical rather than logical product, remains an ideal even under reconsideration, as essential truth, of the fact that "certain constant relations (or simply constants) always occur in the universe known to the human being, at time points determined among the members of a group of manifestations (or in a human population)…" [11]

Another solution that is becoming more probable, being validated even in some complex contemporary analyses of the multidisciplinary type [13], will become that of the system of constant combined into the concept of universal multiconstant, in accordance with the graphical model described in Figure 1

A graphical synopsis of a universal multiconstant
Figure no. 1



No doubt time deteriorates the constants identified, but even when these relationships are not proven, there instantly occurs the discovery of new relation, or new constants of even more extended impact…

Certainly there are many other constants, some more exciting than others, or perhaps much more interesting through their intrinsic beauty, but in the universe that could generate them man and humanity, or even planet Earth, may no longer exist, if the warnings of the current universal constant are not properly interpreted.

Perhaps a careful analysis of the physical constants in the physical universe may be a beneficial approach to both finding a solution for the reunification of the theory of relativity and quantum physics theory, as a table of universal physical constants such as the one conceived by Mendeleev constitutes a new beginning for creative resynthesizing. And, further on, an inferentiation of universal constants in the space of economics, demography, social and even political issues, can turn a seeming state of chaos into a long-awaited order...

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