

AUTHORS:

Constantin
ANDRONACHE
Radu
CHIȘLEAG
Carmen
COSTEA

Aretina – Magdalena
DAVID – PEARSON
Wolfgang
ECKER - LALA
Mircea
GLIGOR

Ion
IORGA-SIMĂN
Hans
SCHJÆR-JACOBSEN
Gheorghe
SĂVOIU

**EXPLORATORY DOMAINS OF
ECONOPHYSICS. NEWS**

Papers of the workshops

EDEN I & II

The 20th of March

2008 and 2009



EDITURA UNIVERSITARĂ

Coperta: Angelica Badea

Copyright © 2009
Editura Universitară
Director: Vasile Muscalu
Bd. Nicolae Bălcescu nr. 27-33,
sect.1, București.
Tel./Fax. (021) 315.32.47 / 319.67.27
www.editurauniversitara.ro.
e-mail: redactia@editurauniversitara.ro.

EDITURĂ RECUNOSCUTĂ DE CONSILIUL NAȚIONAL AL CERCETĂRII
ȘTIINȚIFICE DIN ÎNVĂȚĂMÂNTUL SUPERIOR (C.N.C.S.I.S.)

Descrierea CIP a Bibliotecii Naționale a României

Exploratory domains of econophysics : news / Constantin

Andronache, Radu Chisleag, Carmen Costea, ... –

București : Editura Universitară, 2009-

2 vol.

ISBN 978-973-749-662-1

Vol. 1. - 2009. - Bibliogr. - ISBN 978-973-749-663-8

I. Andronache, Constantin

II. Chisleag, Radu

III. Costea, Carmen

311

© Toate drepturile asupra acestei lucrări sunt rezervate Editurii Universitare

Distribuție: tel/fax: (021) 315.32.47
(021) 319.67.27
comenzi@editurauniversitara.ro

ISBN 978-973-749-663-8

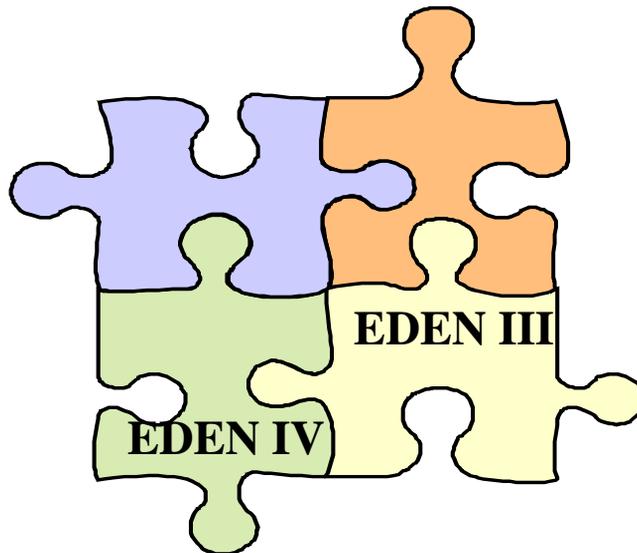
CONTENT

A BRIEF PRESENTATION OF THE EXPLORATORY WORKSHOPS EDEN I & II	5
FINAL PAPERS	10
Gheorghe SĂVOIU, Ion IORGA-SIMĂN - HISTORY AND ROLE OF ECONOPHYSICS IN SCIENTIFIC RESEARCH	10
Radu CHIȘLEAG - A PHYSICAL MODEL TO CONNECT SOME MAJOR PARAMETERS TO BE CONSIDERED IN BOLOGNA REFORM	18
Radu CHIȘLEAG - A QUANTUM MECHANICS MODEL TO EXPLAIN THE INFRINGEMENT OF SOME FINANCIAL RULES IN SPITE OF STIFF SUPERVISION	26
Carmen COSTEA - ECONOPHYSICS UNDER LENS: FASHION AND WORRIES IN THE NEW ECONOMIC TRENDS	33
Mircea GLIGOR - NONLINEAR MECHANISMS OF GENERATING POWER LAWS IN SOCIOECONOMIC SYSTEMS	41
Aretina - Magdalena DAVID-PEARSON - ABOUT USING AVAILABLE DATA TO FORECAST MACROECONOMIC PARAMETERS	55
Gheorghe SĂVOIU, Constantin ANDRONACHE - THE POTENTIAL OF ECONOPHYSICS FOR THE STUDY OF THE ECONOMIC PROCESSES	64
Gheorghe SĂVOIU, Ion IORGA-SIMĂN - MULTI-DISCIPLINARY MODELLING KNOWLEDGE, AND ONE-DISCIPLINE ISOLATION	74
Wolfgang ECKER- LALA - STATISTICAL ANALYSIS OF FUZZY INFORMATION	81

Hans SCHJÆR-JACOBSEN - POSSIBILITY AND PROBABILITY IN MODELLING OF ECONOMIC UNCERTAINTY	89
Mircea GLIGOR - STATISTICAL PHYSICS MODELS FOR GROUP DECISIONS MAKING	110
Wolfgang ECKER-LALA - BUSINESS INTELLIGENCE & ADVANCED ANALYTICS	128
Gheorghe SĂVOIU, Constantin ANDRONACHE - THE EFFICIENCY OF CAPITAL MARKETS: HYPOTHESIS OR APPROXIMATION ..	136
Aretina-Magdalena David-Pearson- WAS IT POSSIBLE TO FORECAST THE CREDIT CRUNCH? (MONTE CARLO SIMULATION OF INTEGRATED MARKET AND CREDIT RISK) ...	149
General references'list for Econophysics EDEN I & II.....	156
Some examples of Econophysics programs at various universities ..	181

**A BRIEF PRESENTATION OF
THE EXPLORATORY WORKSHOPS
- EDEN I & EDEN II -**

**2008, 20th March, 2009, 20th March,
University of Pitești**



EDEN I & II

The objectives of the workshops are: first, to provide a brief presentation of the history of Econophysics and the remarkable evolution of research in this inter-, multi-, and trans-disciplinary field, then an applicative detail presentation emphasizing its impact on the sphere of the issues relevant for the education, research, banking, finance and administrative institutions, as well as an inventory-drawing of the resources, authors, links, institutes and forms of actively and permanently promoting the new domain in Romanian banking, financial, academic and higher education institutions; the final round tables will make a thematic repertory new exploratory domains to be applied in Romanian banks and universities, as well as scientific research in Romania, some possible alliances of the Romanian economists and physicists within the new domains in Econophysics, and the necessity of the workshop as a good collaborative work by economists, engineers, physicists, information experts, statisticians, econometricians, and mathematicians

The themes of the workshops are defined by the prospective exploration of the Romanian and European academic potential and the inventorying of other exploratory domains of applicative research through Econophysics. The detail presentation of the extraordinary evolution of the researches carried out within the inter-, multi- and trans-disciplinary science of Econophysics is followed by the results of two researches on financing and accreditation of a number of academic and research institutions, the drawing of the resource repertory, and the nucleus of the first national association of econophysicists. EDEN I & II's main aim is to draw the repertory of some new fields of

using Econophysics, which can be reordered along the classical coordinates of Econophysics, also intending to detail the evolution of the econophysical models already turned classical. The detailed presentation of the applied researches of Econophysics on modelling uncertainty in economy, on decision in today's specific uncertainty context, of interest conflicts, in international academic mobilities, or in the didactic processes specific to this new discipline, continues with drawing a repertory of the resources, and, concretely, by founding the first association of the econophysicists in Romania, as well as the papers' presentation of the new RCAM & Econophysics Journal (on – line).

Detailed presentation of workshops research themes:

The neologizing of the term Econophysics by Rosario Mantegna and H. Eugene Stanley at the second Statphys-Kolkata Conference in 1995, represents the official document of Econophysics, born as a new, interdisciplinary, multidisciplinary and transdisciplinary science. Physics has probably had a dominating effect on the development of formal economic theory; however, the historical interdisciplinarity between physics and economics, established through Econophysics, seems very likely to be a model for the future of the multidisciplinary sciences. Transdisciplinarity suggests a deeper synthesis of approaches and ideas from the two main disciplines involved in the Econophysics, during a short or medium period of time. The same importance must be given to all interactions between economics and physics as well as between the two types of scientific researchers and demographers, sociologists, mathematicians, linguistics, etc. The periodical getting together of such a multidisciplinary group capable, at first, to constitute the initial nucleus of a potential association of the Romanian econophysicists will be done in the coming ears as well, more extensively during the annual workshops (EDEN III, IV), to which will be added, starting with 2011, a national conference with international participation, which would be able to develop both the academic scientific research, and the curricula of a number of multidisciplinary MA programmes, primarily oriented towards the graduating physicists and economists. All these aspects represent a necessary detailing of the initial thematic presentation, as well as a welcome prologue before the presentation of the historical evolution of contemporary Econophysics. The contemporary stages of development, and more especially the dynamics of Econophysics, are really exceptional. Some historical opinions about it maintain that statistical mechanics or physics was developed in the second half of the 19th century by James Clerk Maxwell, Ludwig Boltzmann, and Josiah Willard Gibbs, but others reveal the role of physics models as the foundations for the standard neoclassical model that current econophysicists seek to displace is much older than two centuries, the best arguments being N.F. Canard's work, since 1801, where supply and demand were ontologically like contradicting physical forces, or central concept of general equilibrium theory in economics, where its author Léon Walras' was deeply influenced by the physicist Louis Poinsot, and mostly because the father of American mathematical economics, the well-known statistician Irving Fisher, was a student of the father of statistical mechanics, no other than Josiah Willard Gibbs. But all of these historical opinions agree unanimously that the primordial roots in statistical mechanics approach date back to 1936, when Majorana wrote a pioneering paper, published in 1942 and entitled *Il valore delle leggi statistiche nella fisica e nelle scienze sociali*. First of all, the application of concepts such as power-law distributions, correlations, scaling, unpredictable time series and random processes to financial markets was possible only after physicists had achieved important results in statistical mechanics, due to other significant statistical investigations and mathematical formalizations. The oldest example of an adequate law or mathematical distribution to the wealth of individuals in a stable economy belongs to an Italian economist and statistician, named Vilfredo Pareto. Secondly, the progress of the financial mathematics realised by Louis Bachelier in his doctoral thesis entitled *Théorie de la spéculation*, since 1900, that quantifies the probability of price changes, and the differences of the logarithms of prices that are distributed in a Gaussian

manner, and thus it is an anticipation of Albert Einstein's or Norbert Wiener's researches. Three major events underline the evolution of Econophysics, first in 1973, with the appearance of a rational option-pricing formula, like Black & Scholes' formula, than after 1980, the huge amount of electronically stored financial data readily available, and finally since the 1990s, a growing number of physicists have attempted to analyze and model financial markets and, more generally, economic systems, new interdisciplinary journals have been published, new conferences have been organized, and a lot of new potentially scientific fields, areas, themes and applications have been identified by this new trans-disciplinary science. The researches of Econophysics deal with the distributions of returns in financial markets, the time correlation of a financial series, the analogies and differences between price dynamics in a financial market and physical processes such as turbulence or ecological systems, the distribution of economic stocks and growth rate variations, the distribution of firm sizes and growth rates, the distribution of city sizes, the distribution of scientific discoveries, the presence of a higher-order correlation in price changes motivated by the reconsideration of some beliefs, the distribution of income and wealth, the studies of the income distribution of firms and studies of the statistical properties of their growth rates.

The statistical properties of the economic performances of complex organizations such as universities, regions or countries have also been investigated in Econophysics. The new real characteristics of Econophysics in a medium and long term will be a result of its new research like rural-urban migration, growth of cities, etc. The real criticism of Econophysics is the absence of age variable, because models of Econophysics consider immortal agents who live forever, like atoms, in spite of the evolution of income and wealth as functions of age, that are studied in economics using the so-called overlapping-generations models (Paul Anglin). The first Econophysics models published by physicists in a physics journal were those of Mantegna (1991) and Takayasu (1992), though developed a few years earlier. Even a Monte Carlo simulation of a market was already published in 1964 by Stigler from the Chicago economics school. Nobel laureate of Economics, Markowitz H.M. published too with Kim a model for the year 1987, about the Wall Street crash. After the year 2000, Econophysics has matured enough to allow generalized applications, their field being called sometimes econo-engineering. We believe that the second workshop EDEN II is a welcome resuming of EDEN I, which was conducted felicitously, as well (as can be seen on the site of the centre for research in advanced materials of the University in Pitești (<http://www.upit.ro/ccma/>), from the own resources of the moderators and organizers (Gheorghe Săvoiu and Ion Iorga-Simăn), or supported by the key-speakers, using the academic spaces and equipment of the University in Pitești (the moderators and organizers express their gratitude to the leading staff of the University in Pitești for their accommodation support). EDEN II's main aim is to draw the repertory of some new fields of using Econophysics, but also along the new coordinates of Sociophysics, also intending to detail the evolution of the Econophysics models already turned classical, but also along the new coordinates of index-physics, or the physics of the price indexes (able to measure both inflation, and the specialized stock-exchange evolutions), of Demographysics, or through Econophysics prognosis, a sub-domain that combines a better time projection of phenomena, much better calibrated extrapolations and interpolations in the economic, demographical, crime-related, electoral world. The workshop also materializes in its presentations, through those invited holding the quality of key-speaker, two practical approaches of Econophysics resulting from applying statistical physics, in an original manner and with very interesting results, to the field of financing and accreditation of a number of academic and research institutions. The special potentiality of Econophysics will thus be able to reveal to the rest of the people invited, more especially to those belonging to the academic milieu and the disciplines related to management, statistics and finance-banking, but also to bank managers, mathematicians, physicists, linguists, etc. Its

innovative and applicative character is also evinced by the careful repertory-drawing of the principal applications of Econophysics, substantiated in the papers that are to be published, and presented during the international conferences and symposia, and, moreover, through the investigation, in the latter half of the workshop, of the part played by Econophysics, and its main potential fields of application. In order to manage a good collaborative work by economists and physicists, the workshop presents, in its second part, some of the differences existing at present between economics and physics in their own scientific research work, but also between economists and physicists. Since the time when Econophysics was officially born, Romanian scientific researchers in this multidisciplinary field have published a lot of important papers. Among these pioneers one must necessarily mention Adrian Drăgulescu, Radu Chişleag, Mircea Bulinski, Carmen Costea, Mircea Gligor, Margareta Ignat, etc. From 2003, when the first book entitled Econophysics was published, in Romania, by Mircea Gligor and Margareta Ignat, followed four years later by Investment Econophysics, written by Anca Gheorghiu and Ion Spinulescu, and up to now, a few round tables and satellite workshops have been dedicated to Econophysics, including even summer schools of Econophysics and Complexity – its 3rd edition was held in 2007. The above facts trigger the need for the workshop EDEN II to invite some well known engineers, IT specialists and Econophysicists, at a European and international level, as key speakers (H. Schjær-Jacobsen, Wolfgang Ecker-Lala, Aretina-Magdalena David-Pearson) and to continue a process of repertory-drawing for the internal resources, and making up the nucleus of the first Romanian association of the econophysicists, followed by at least two other workshops, and annual conferences or symposia, which will consolidate the young school of Romanian Econophysics (the first one, EDEN I, and then EDEN II, have already taken place) the third workshop, EDEN III, we hope will take place honoured by the participation of the representatives of the Belgian school led by Professor Marcel Ausloss, hence the invitation addressed to Professor Mircea Gligor from Romania, who has been part of professor Ausloss's team, and the fourth edition, EDEN IV, aims at ensuring the participation of the representatives of the school of econophysics in Boston, including the Romanian Adrian Drăgulescu, whence the invitation to the Romanian researcher Constantin Andronache from Boston. The young econophysicists will grow up within this context of Romanian econophysics, turning to account the relations formed, in the course of time, with schools of international research in the domain, which have already reached scientific prestige). Debating the role and the potential of Econophysics for Romanian scientific research is now not only an opportunity, but also a necessity for normal evolution both of teaching and research in Physics and Economics. Consequently, the objectives of the workshop are a brief presentation of the history of Econophysics' models and the remarkable evolution of research in this inter-, multi-, and trans-disciplinary field, an applicative detail presentation emphasizing its impact on the sphere of the issues relevant for the decision in education, research, banking, finance and administrative institutions, as well as continuing an inventory-drawing of the resources, authors, links, institutes and forms of actively and permanently promoting the new domain in Romanian banking, financial, academic and higher education institutions; the final round table will identify the differences existing at present between Economics and Physics in their own scientific research work, but also between economists, engineers, information experts, statisticians, econometricians, mathematicians, and physicists in the new job of an *econophysicist*.

Estimated outcomes

1. The publication, in a newly created journal having this specific purpose, already named *RCAM & Econophysics Journal*, of the abstracts of the lectures and presentations delivered by the key speakers, as well as the syntheses of the potential domains, and the summarized contents of the debates on the round table topic;
2. The integral publication of the papers and discussions in a book entitled **Exploratory Domains of Econophysics. News (EDEN I & II)**

3. The detailed presentation of an approach to Econophysics and its specific model of analysis of financing and accrediting a number of institutions within the framework of higher education, available of the site of the Research Center for Advanced Materials

4. Delimiting a stable population of researchers, who would represent the first nucleus of a potential association of the econophysicists in Romania and in Europe.

5. The concrete identification of a number of criteria of potential demand as far as research of the Romanian banking market by means of Econophysics is concerned

6. Scheduling and achieving each year for the period (2010–2011), of a special workshop devoted to Econophysics (EDEN III-IV)

7. A site of Econophysics for permanent and malleable dialogues meant to promote the future workshops (<http://www.upit.ro/ccma/>);

List of key speakers:

Professor Hans Schjær-Jacobsen, PhD., Copenhagen University College of Engineering,

Professor Wolfgang Ecker-Lala, PhD., MATH-UP, Viena University

Professor Radu Chişleag, PhD., Polytechnic University, Bucharest,

Professor Carmen Costea, PhD., A.S.E Bucharest,

Professor Ion Iorga-Simăn, PhD., University of Piteşti

Senior lecturer Gheorghe Săvoiu, PhD., University of Piteşti

Lecturer Aretina-Magdalena David-Pearson, Polytechnic University, Bucharest,

Research Associate Constantin Andronache, PhD., Boston College, Information Technology, USA

Associate Professor Mircea Gligor, PhD., National College Roman Voda, Roman,

Projects manager or Workshops organiser in 2008 and 2009

Senior lecturer Gheorghe Săvoiu, PhD, University of Piteşti

ACKNOWLEDGMENT

Project manager and the key speakers and invited colleagues thank the University of Piteşti, for permission of using the university facilities during the two workshops EDEN I & II.