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Introduction to Econophysics:
Look Back Into the Future - Tomorrow's Science by the Data of Yesterday

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ABSTRACT

The future contains terms (V) that are valid at all times, and terms (U) that are presently unknown. In economics, (V) and (U) correspond to ex ante and ex post, in physics to conservative and not conservative, in calculus, to exact and not exact differential forms or to Riemann and Stokes integrals, and to linear or non-linear equations, in statistics to real and probable terms. Apparently, the authors may represent the (V) and (U) structure in economics and physics by calculus, probability theory, by non-linearity, and chaos theory. The present paper applies Stokes integrals to double entry accounting. The resulting laws replace neoclassical theory and correspond to the first and second laws of thermodynamics. Economics and physics have the same structure, leading to the name econophysics. Production is a two level cycle with cheap production, expensive sales, corresponding to the Carnot cycle of a motor with cold air and hot exhaust. In a running motor, efficiency, the difference between hot and cold, becomes always higher. In an economy the gap between rich and poor always rises.

KEYWORDS

Capital - Energy, Carnot Production Cycle, Economic Theory, Entropy Production Function, Ex Ante -Ex Post, Exact - Not Exact, Labor - Work, Riemann - Stokes, Wealth - Enthalpy

1. INTRODUCTION

Econophysics is a new field that investigates economic problems with the methods of physics. Eugene Stanley has coined the name in 1993. The book "Introduction to Econophysics" by Mantegna & Stanley (2000) discusses mainly correlations and complexity in finance; this is until today the main application of econophysics. However, in 2001 the German Physical Society founded the group "Physics of socio-economic Systems". This group aims at a far wider scope, at the application of physics to socio-economic problems. This includes macroeconomics, microeconomics, finance, socio-economics, complexity, nonlinear systems, chaos and other topics. In the following time, similar groups have formed worldwide under various names, and a number of books have been published in this new field, Mimkes (2006 a), Aruka & Mimkes (2006), Yakovenko & Rosser (2009), Richmond, Mimkes & Hutzler (2013) & Piketty (2014). The present article discusses a future model explaining the different approaches to econophysics like calculus, statistics, nonlinearity and chaos theory. The main focus is, however, the application of calculus to macroeconomics.

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Mainstream economists for several reasons do not yet accept the new field econophysics. The language and thinking of economists and physicists is quite different, economics is a more philosophical experience, whereas physics relies on mathematical theories. There are many misunderstandings on both sides and so far, economists claim, econophysics has not generated any striking new results. However, physicists point out that the agreement of experience and theory, of social and natural science is already a big success! However, econophysics also shows many errors and weaknesses of mainstream economics. In addition, banks have started to hire physicists for bank services like portfolio management.

2. THE U – V FUTURE MODEL

Why do we send our children to school and teach them the knowledge of yesterday, of our past. Will they be able to make any use of their learning in the future? Well, in learning the past, we hope that some of our knowledge today will still be valid in the near future. Of course, children will encounter many new and unknown things in their future lives. How will these unknown facts interact with the experience of yesterday? This is the starting point of the present U – V future model.

Future contains elements that are always valid (V) and elements (U) that are unknown. These elements interact in the near future by an unknown relationship W (U, V). However, is it possible to find out this relationship today? The answer is "yes", all we have to do is to wait. After due time the near future will flow into the past. The elements (V) remain the same. The elements (U) become measurable in the past and we may now call them (u). If the future is not too far away, the relationship will still be the same and is now W (u, V), Figure 1. Researchers have to distinguish between the measurable elements (u) that will be unknown in the future, and the elements (V) that are always valid, and then they have to determine their relationship, W (u, V). The scientists have to present the relationship W (u, V) in a proper mathematical apparatus that will preserves and transfers the (U,

Figure 1. Researchers cannot look into the future. Scientists use the past like a mirror.