

TECHNO-ECONOPHYSICS' FRACTAL INVOLVING OF "HELIUM NAT GAS" EXERGY

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Abstract. *Inclusively new to econophysics studies, herewith proposed techno-econophysics as part of techno-economy, econophysics & sociophysics to interparts description between probability and hypothesis evidently found between fractal realms and econophysics of markets, physics markets or stock markets any chaotic evidence [exergy destructive] could present if effective & efficient criterion doesn't complied. More precise iterative study ought to be held to configure how fractal dimension involved in techno-econophysics study of Helium Nat Gas Project which are not integer, but also proofed numerically & analytically.*

Keywords: *techno-econophysics, fractals, nat gas, sociophysics, helium, econophysics.*

1. Introduction

Some physicists claim their modeling & data-analysis can change the way we view stock markets but mainstream economists have yet to be convinced [1].

Ever concluded this week's lottery numbers can be predicted by identifying hidden patterns of previous draws, standard economic theory similarly pours cold water on the idea that the behavior of stock markets affected by past market movements. Future behavior of a market depends only on events in the real worlds, such as profits & losses made by individual companies. Further, some economists argued that past trading does seem to have subtle effects on future fluctuations. Others in the new field of 'behavioral economics' suggest that the irrational psychology of investors lies behind these trends followed with some surprising allies: physicist intent on revealing hidden patterns in market behavior in the field known as econophysics.

For much of the 20th century, economist believed that the probability of a given change in the value of most markets – such as stock or foreign-currency exchange – followed a pattern known as a bell-curve. This curve

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has two important properties: averaged over time, the most likely change is zero, and, because the curve tails off rapidly in extreme values, the probability of large fluctuations occurring is very low. Average stock prices may increase or decrease over the long-term, but day-to-day fluctuations seem to follow the bell curve.

Analysis of the data, however, shows that market behavior is subtly different. In the 1960s, Mandelbrot & Fama showed that markets are better described by power-law distributions (Mandelbrot, 1963 & Fama, 1965).

On behalf “Helium Nat Gas Project” beheld as Astranomics [completes carbon-based economy, hydrogen economy, thermoeconomics etc.] affiliated of helium, propylene extraction & processing from natural gas accompanying KG-Media as Associate-Company, we also quote Kuznetsov & Mandel (2005) of Mediaphysics: “part of sociophysics, studying processes of mass communications in social & sociobiological systems”, in terms of econophysics of the project.

2. Fractal involving econophysics of markets

One of the great innovations in finance coming from econophysics is the fractal market hypothesis, which contradicts the traditional efficient market hypothesis [2]. It is commonly accepted to second law thermodynamics states that all systems left to the natural conditions in the universe will evolve toward entropy, disorganization and disruption over time [3]. It is evident that the transition from a regular, organized and planned structure of a social system to an irregular, disorganized and unplanned state will increase its *entropy*, and the increase in the irregularity of a system will lead to the increase in the entropy of that system at the same rate.

In macro-sociophysics, communities in society were considered as elements. Later, in the micro-sociophysics dimensions, the association of individuals in the relevant communities and then behavior of the laws of physics began to emerge.

Here described a mathematic (or statistical physics) technique to analyze population distribution between two or many alternatives [4]. In Blenkinsop (2004) the number of squares $N(r)$ of side r necessary to cover all the deposits (alternatively the number of squares containing one or more deposits) is measured as a function of r . In fractal geometry

$$N(r) \sim r^{-Db} \quad (1)$$

where Db is the box-counting fractal dimensions [5]. To correlate it to expression in Green function [in Mediaphysics/sociophysics description], we introduce

$$N(r) \sim 1/r^{Db} \text{ especially if } Db = 1, N(r) \sim 1/r. \quad (2)$$

Taking into account of r as a single variable, its differentiation respect to r , $dN(r)/dr$ can be seen as multiplication with $[1/r]$ so $\nabla_r = 1/r$.

Further, in the relationship between *Feigenbaum's constant* a & power spectra [6], the normalized variance $[1/a^{2n}]$ represent the statistical probability density of the n^{th} step growth whereas

$$[Prob]_n = [1/a^{2n}] = \tau^{-4n} \text{ or } [Prob]_n = \tau^{-4t} \quad (3)$$

where t is normalized standard deviation and

$$\tau^2 = a = 2.62 \text{ whereas } \tau = \sqrt{2.62} = 1.61864140562.$$

Now in application of fractals in Mediaphysics we compare to transfer operator [Kuznetsov & Mandel]:

$$Q = \exp[-W_{t+1}(q)] \cdot g$$

where we know: $d/dx [e^x] = e^x$ and further $\nabla_x [e^x] = e^x$.

3. Enhancement of Helium Nat Gas Project

Ever concluded whereas helium recovery & extraction at least fulfill cost-effective calculation, prices of sales gas and helium can be cumulated/summed up without depreciate the energy content of natural gas.

Further, the economic threshold of 0.05 % helium containing in nat gas can benefit a four times adding factor through 0.05-0.2 percentage to 80 times through 0.05-4.0 cost enhancement, which then analyzed by discrete Gaussian kernel curve.

That cost-effective reasons ought to be followed by cost-efficient analysis that firstly taking

into account through techno-economic analysis where equipment cost estimation is calculated by historical cost method or using information from previous projects with similar specification, which after listing each equipment cost, Guthrie method is used to calculate the total cost for an installation [7].

In general, we can adopt Gauge Theory of Arbitrage[8] in which the consideration maps the capital market into QED [Quantum Electro Dynamics] i.e. quantum system of particles with positive (securities) and negative ("debts") charge which interact with each other through electromagnetic field(gauge field of the arbitrage).

Toward the techno-econophysics study, herewith adopted the exergy of available energy concept description in optimization study of LNG boil-off gas [9] to follow exergy analysis developed by Kamran Taheri [2014].

Economic process from cost-effective & cost-efficient criteria discussed here a little [exergy is a concept of energy **efficiency** optimized processes] whereas to that process it could be any fractal involved in techno-econophysics study as compared by Guang Liu [10].

According to the theory of Mandelbrot (1970, 1971), for any fractal Brownian motion $B_H(t)$, the correlation CN between the yields of securities can be expressed by

$$CN = 2^{2H-1} - 1 \quad (4)$$

where H denotes the Hurst exponent.

(a) If $H = 1/2$, then $CN = 0$ and $B_H(t)$ is equal to the standard Brownian motion which indicates that the yields of securities are random & unrelated.

(b) If $1/2 < H < 1$ and $0 < H < 1/2$ then $CN > 0$ & $CN < 0$ and $B_H(t)$ is equal to fractal Brownian motion.

Comparing equation (3) & (4) of course correlation coefficient are not the same as probability. R-squared measures the amount of variation in one variable that can be expressed by other variable whereas probability is a measure of the likelihood of an event occurring.

Configurative compared to description from histogram to application of econophysics in Figure 1, study about Efficient Market Hypothesis & Fractal Market Hypothesis for example followed by its relation to two power-laws [11] as continuation of study of fractals & scaling in finance [12] further predicted any chaotic evidence (exergy destructive) would occur if cost-effective & cost-efficient criterion doesn't complied.

Cost-efficient criteria above considered in *exergy* analysis as a developed concept of energy efficiency optimized processes [13] which optimization measures such as making efficient use of energy or somethings. Given the global economic growth and the rapid manufacturing development, the energy and resource efficiency will become an increasingly competitive factor and scope for the companies in the road of sustainability. Among energy efficiency optimization approaches, thermodynamic methodologies contribute toward the improvement of energy efficiency in manufacturing processes. Beside energy balance, exergy has been recently considered as a practical thermodynamic method for system's energy evaluation and used to manage hedge fund assets appraised by Eshraghi & Taffler, 2012 who studied until June 2008 followed by subsequent dramatic collapse quoted through [14] underlying all financial innovations.

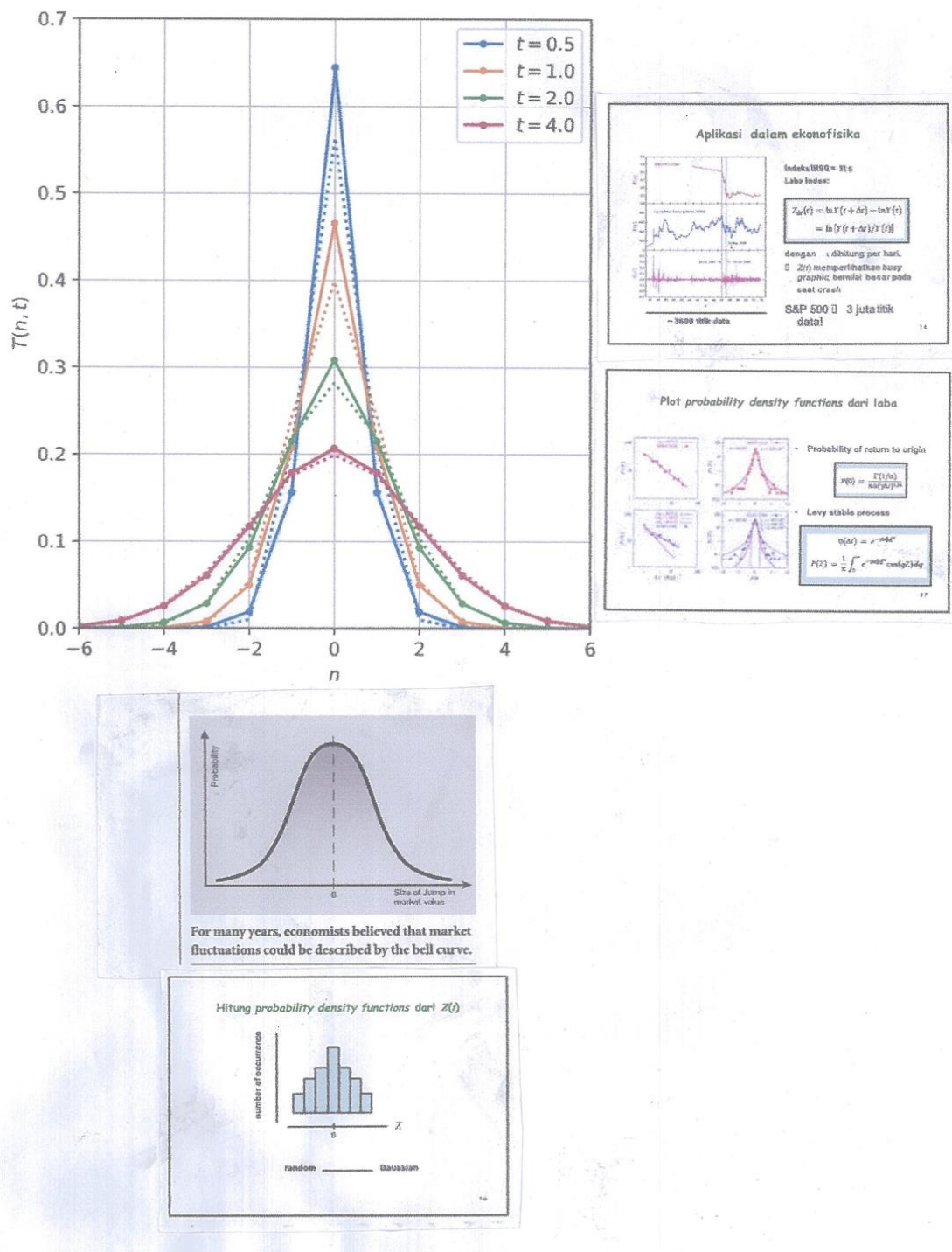


Figure 1. Clockwise illustration shows how bell-curved of log-normal can be approximated through histogram and through exponential include in fractal realm.

Referring to Maria Lopez Garcia & Jose Pedro Ramos Requena (2019) about fractal market hypothesis, we found the case for Helium Nat Gas Project is in relation between probability & hypothesis. Also from the Figure 1, the evolution from histogram between ‘number of occurrence’ to Z, instead to bell-curve between Probability & ‘Size of Jump in market value’ as well as to ‘probability density function’ $\leftrightarrow$ profit, we found for Levy stable process.

4. Conclusion

Have been in completion of reasons & descriptions of hypothesis whereas fractal properties coincidence with econophysics of market, especially about helium extraction project from natural gas. To conclude exergy conception also can be applied, we must make specific & as a whole study of calculations and assumptions to follow have been determined limit of economic value of helium extraction from nat gas (0.05 % helium containing per gas well) before establishes the project.

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