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A POSSIBLE CONNECTION BETWEEN SOME STATISTICAL MODELS IN ECONOPHYSICS AND THE BVB (BUCHAREST STOCK EXCHANGE) EVOLUTION

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Abstract
The existence of stylized facts in real stock market data (volatility, clustering, stock properties, etc.) was at the origin of the introduction of the statistical description of some spin-like models in econophysics. In a previous article [4] we connected these results with real BVB and SP&P data for the time series in the 2001-2003 time period. In this work, the statistical analysis is extended for the BVB over the 01.01.2005 - 11.11.2005 time period.
Keywords: econophysics, Ising models, stock markets

1. Introduction

Theoretical econophysics for financial markets uses the basic concepts of statistical physics and thermodynamics for determining the properties and evolution of the financial markets. The main problems are introduced by means of Boltzmann entropy formalism and of statistical models, especially percolation, Minority Game, Levy Solomon and Ising – like models.

2. Method

The statistical models for stock markets deal with the interactions between trades in terms of statistical physics, realizing the connection between financial discontinuities (herd behavior, bubbles, crashes) and "critical points" in phase transitions due to the cooperative effects. In our point of view, the Ising-like spin 1 statistical model, which involves two order parameters, may be used for the same purposes. There is a non-analytical behavior of these order parameters around the critical point, but at the same time, there is interdependence between them, which, in our opinion, becomes significant in studying market evolution. In terms of market parameters, this means that there are related parameters such as volatility or volume of the market, which are put in evidence in the time series market data.

Daily price return of an asset is defined as:

$$R_i(t) = \frac{Y_i(t) - Y_i(t-1)}{Y_i(t-1)}$$ with $Y_i(t)$ the asset price at the t moment

and the **daily logreturn** as

$$r(t) = \ln \frac{Y(t)}{Y(t-1)}$$

The **mean value** and **standard deviation** are

$$\mu(t) = \frac{1}{n} \sum_{i=1}^{n} R_i(t)$$

$$\sigma(t) = \sqrt{\frac{1}{n}\left(\sum_{i=1}^{n} \left(R_i(t) - \mu(t)\right)^2 \right)}$$

Mean value of the price returns, $\mu(t)$, quantifies the general trend of the market at day t, and the standard deviation $\sigma(t)$ (i.e. **variety**) measures the width of the market.

The market evolution is also characterized by market index $i(t)$ closely related to $\mu(t)$ and its statistical characteristics

$$\Delta i = i(t) - i(t-1)$$
$$< i >_T$$
$$v_i = \sqrt{< i^2 >_T - < i >_T^{\;2}}$$

We consider the following interesting parameters for measuring market evolution

$$M(t) = \frac{i(t)}{< i >_T} \qquad i = i(t)$$
$$DifBET = \frac{\Delta i}{< i >_T}$$
$$Q(t) = \frac{i^2(t) - < i >_T^{\;2}}{< i >_T} \qquad Q = Q(M)$$

where M and Q correspond to the first and second Ising-1 order parameters so that $Q = Q(M)$.

3. Results and discussions

Taking into consideration the observation that two Ising – 1 order parameters are interdependent one another, we consider that there is interesting to put into evidence these kinds of correlations for these financial market parameters which may be associated with the statistical model parameters.

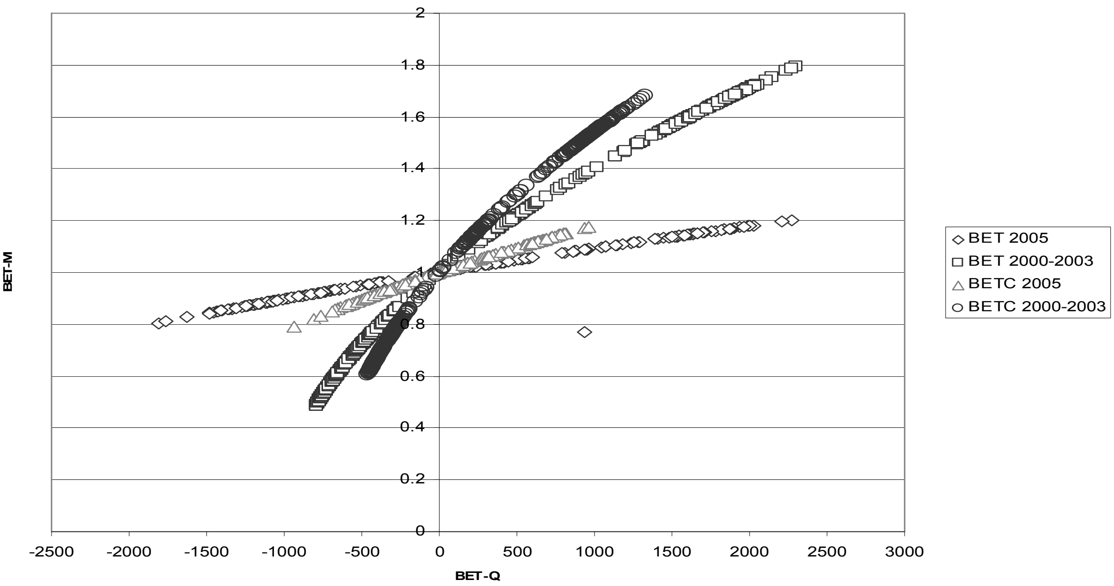

Fig 1 – BET M – BET Q dependency comparison

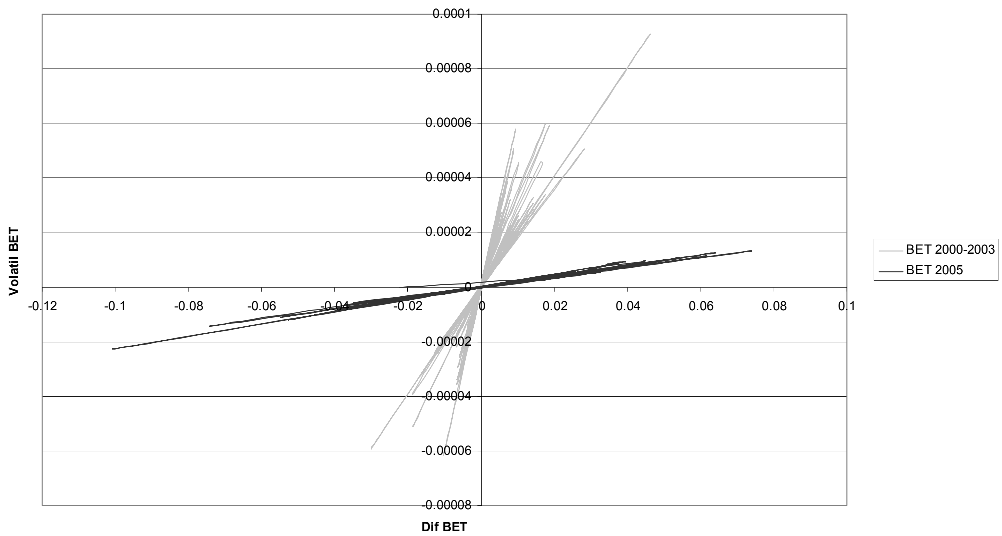

Fig 2 – BET Volatility – BET Dif dependency comparison

Two possible situations are presented in figures 1 and 2, the first case being a comparison between the BET M – BET Q dependence for the two time periods considered, while in the second another comparison is given based on the Volatility – BET Dif dependences.

Based on the figures we can observe the following:

1. The BET M – BET Q dependence curve is very similar with the Ising 1 M – Ising 1 Q dependence for the system evolution far from critical point [3] (this means that the financial market is far from destructive phenomena like bubbles or crashes).
2. For the pair volatility - BET Dif there is a linear dependence, the slopes being distributed in a small angle, around a specified direction in each time series.
3. The comparison of the curves for the selected two time periods reveals that in both situations the curve inclination is smaller in 2005, in which period market analysts consider that the BVB is in a state of maturity, compared to the previous periods.

4. Conclusions

Taking into consideration the Ising 1 order parameters properties, the possibility of introducing some financial market quantities, in correlation with the definition of the Ising 1 order parameters, is revealed, in such a mode, that significant information can be obtained, about the market evolution, from the analysis of their interdependence for different time periods. As a consequence, the statistical Ising - like models in financial econophysics are useful not only for predicting catastrophic events like bubbles or crashes, but also by the possibility of having time series diagnosis of the normal market evolution.

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