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CHAOTIC BEHAVIOUR AT MICRO AND MACROECONOMIC LEVEL

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Abstract: *It is well known in the related literature that the fractal theory supports the idea that any existing element or phenomenon represents or may be represented as a fractal. Hence, fractals should be regarded as simple processes generating complex results as, by its intervention, chaos cerates a unique output, with a chaotic dimension directly proportional to the complexity of the analysed phenomenon. Also, any component or characteristic of a system may be regarded as a fractal. It is needless to mention that the fractal theory can be approached at microeconomic level, therefore characterising the aggregate behaviour, seen as an extension of the individual ones. The analysis of the capital market, component of the economic cybernetic system, is one of the most interesting applications of fractals at macroeconomic level.*

Keywords: *capital market, chaos theory, fractal, dynamic system, management*

1. INTRODUCTION

According to the specialty literature, any existing element or phenomenon represents or may be represented as a fractal.
Fractals should be regarded as simple processes generating complex results, as chaos creates a unique output, with a chaotic dimension directly proportional to the complexity of the analysed phenomenon.
The fractal theory can be approached at microeconomic level, therefore characterising the aggregate behaviour, seen as an extension of the individual ones.
The study of the capital market, component of the economic cybernetic system, is one of the most interesting applications of fractals at macroeconomic level.
Economy, being a cybernetic system, meaning a self-adaptive one, cannot be fully controlled as, by its dependency on the initial, basic conditions, serious changes may occur, affecting it.
The macroeconomic system presents a high degree of instability as regards the evolution, both at individual level, meaning at the level of components, and at aggregate level. The macroeconomic system is therefore a chaotic system.

2. FUNDAMENTALS OF FRACTALS AND OF CHAOTIC DYNAMIC SYSTEMS

According to J. Yorke1, the theory of chaos is based on the self-similarity of fractal geometry shapes.

In compliance with the literature in the matter, the chaos theory is a concept equivalent to the stochastic process, as it considers the dependency on the initial conditions.

Small changes in the initial conditions of a dynamic system can cause different final results, for such reason this issue being conceptualised in the theory of fractals. The experiment of Lorenz reveals that the complex system considered reacts otherwise than the initial one.

The related literature defines chaos as a characteristic of a complex system, the analysis of the latter not being able to encompass all of the system variables.

The consequence of the analysed system complexity resides in the fact that, starting from the final state of the system parameters, the initial conditions cannot be estimated or deduced.

3. PRESENCE OF CHAOS AT MICROECONOMIC AND MACROECONOMIC LEVEL

3.1. Presence of chaos at microeconomic level

The behaviour analysis at microeconomic level is equivalent to the study of the economic agents' behaviour and of the system structure, under conditions of risk and incertitude.

J. Gleick succeeded in outlining the chaotic characteristics of the administrative management. Thus, management is a new science that should to be approached from a chaotic perspective.

At present, the emerging idea is that the theory of chaos represents the fundamentals for the theory of complexity of business management.

Considering the Lorenz attractor example, we could state that a complex system reacts in a different manner to each process. So, the same inputs can generate different outputs.

Within a complex system, the context is unique as the system continuously adapts itself to the environment, meaning to the influence of the endogenous and exogenous factors. Therefore, the system will always have a different state. At the level of the decisional system, for instance, a decision is never made and a strategy is never conceived within the same context.

Due to the strange attractors, the regular or uniform behaviour of a system becomes, in time, unstable or turbulent.

Nowadays, the researchers' interests focus on the analysis of the characteristics and behaviour at the level of the management system. In this context, the managerial system may be seen as a dynamic, complex system, with a chaotic behaviour, that is not linear, adaptive, with a certain degree of instability.

Thus, the role of a manager is not to control the system, but to exploit its complexity. The scientific researchers, as Stacey, start from the premises that, even if the long-run forecasts are dominated by a high degree of incertitude, it is necessary to optimally analyse each change in order to obtain positive results.

In this way, the organisation, a complex system, deals with attractors favouring the change or the alteration of such system behaviour. This is the result of the mutual interaction of the scientometric, technical, psychological etc. factors that direct the system to a well-defined state.

The sudden changes or shocks in the system results, as a consequence of the modification of at least one state parameter, are known as bifurcations at the system level.

According to the fractal theory, at the level of the organisational or administrative management, we can ascertain that miscellaneous hierarchies present common or even identical characteristics, similar to a fractal.

As well known, an organisation has several departments (administrative department, human resources department, IT department operational department etc.) where there are hierarchies (department management, operational management etc.).

[1] Universitatea din Maryland

Within each type of management, the following processes are carried out: planning, execution, acquirement of new knowledge, monitoring, analysis, reporting.

Therefore, at the management system level, the fractal specific characteristic is revealed: the macroeconomic processes, meaning the organisational management (the most advanced type of management) processes will be also reflected at microeconomic level (operational management). Thus, the planning, execution, acquirement of new knowledge, monitoring, analysis and reporting processes will be found at each managerial level.

Figure 1 outlines the fractal concept, meaning the identification of the macroeconomic level characteristics reflected at micro-managerial level.:

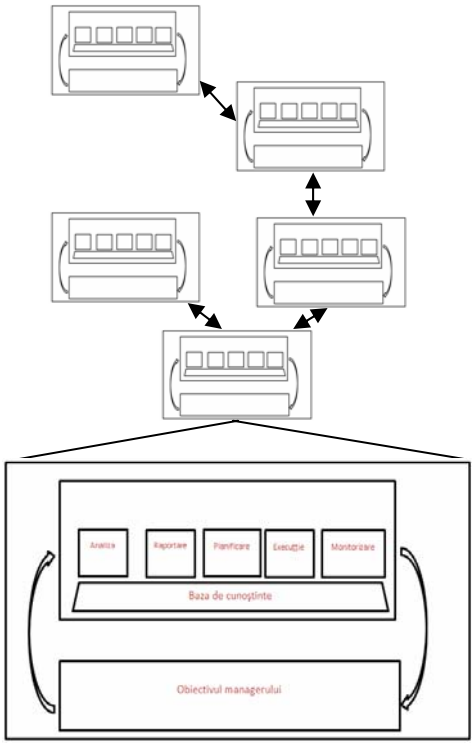

Figure 1.

3.2. Presence of chaos at macroeconomic level

The capital market, a dynamic component, is a system characterised by parameters with a chaotic evolution, dominated by an ever increasing instability level.

On the capital market, the evolution of individual transactions is highly dependent on the initial conditions, as there is a very tight correlation between past, present and future, in the sense that prices, as a decision parameter, influence evolution both at the society and at the capital market level.

The individual behaviour tends to the transactional market behaviour and vice versa, the capital market behaviour tends to the individual behaviour of the companies listed at BVB (Bucharest Stock Exchange). Therefore, we can state that the capital market and its components are fractals, as the characteristics of one of them can be observed to the other one.

Figures 2, 3, 4 and 5 reveal the monthly, daily or annual evolutions, both at a company level, for BANCA TRANSILVANIA S.A., and at the capital market level, characterised by the BET stock exchange index.

4. CONCLUSIONS

The analysis of what is known as fractal is necessary to outline the behaviour of the studied object or phenomenon. Therefore, most phenomena may be characterised by resorting to the fractal geometry.

As concerns fields such as: mathematics, physics, artificial intelligence etc., fractals are nothing else but elements connecting the mirco level to the macro one.

Any complex system may pass the test of the theory according to which each system has imprinted an unpredictable behaviour, dominated by incertitude, which can suffer from significant changes at aggregate level, caused by infinite decimal changes at the state parameter level.

The economic system may be regarded as a chaotic system, the behaviour of which is strongly dependent on the changes occurring inside or outside the same.

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Figure 2. Monthly evolution, between 01.04.2012-03.03.2013, of the transactions carried out by BANCA TRANSILVANIA S.A.
(http://www.bvb.ro/ListedCcompanies/SecurityDetail.aspx?s=TLV)

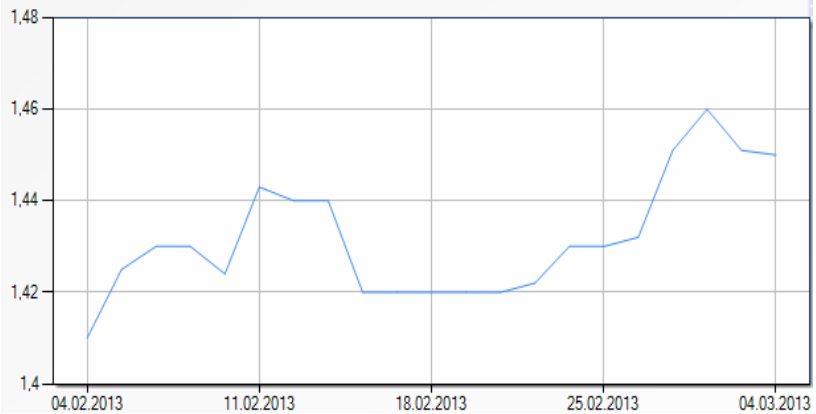

Figure 3. Daily evolution, during February 2013, of the transactions carried out by BANCA TRANSILVANIA S.A.
(http://www.bvb.ro/ListedCompanies/EmitGrafic.aspx?s=TLV)

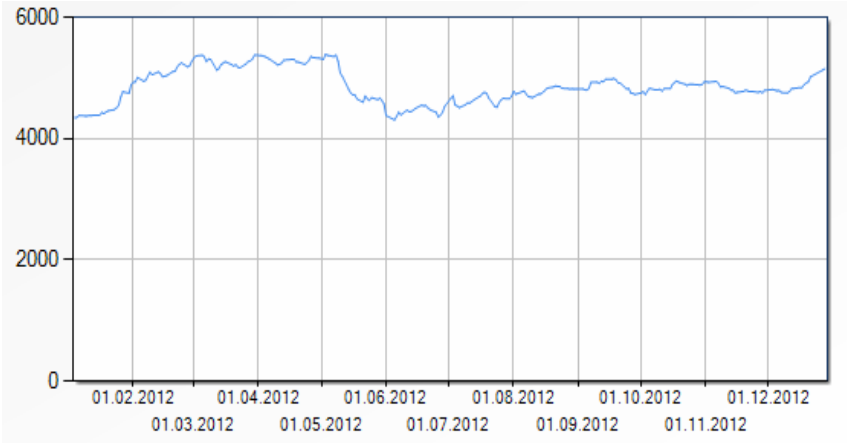

Figure 4. Monthly evolution of BET stock exchange index, between 01.0.2.2012-01.02.2013 (http://www.bvb.ro/IndicesAndIndicators/indices.aspx?t=4&p=BSE&i=BET&m=&d=3%2f4%2f2013)

Figure 5. Annual evolution of BET stock exchange index, between 1998-2013 (http://www.bvb.ro/IndicesAndIndicators/indices.aspx?t=4&p=BSE&i=BET&m=&d=3/4/2013)