Available online at www.sciencedirect.com
ScienceDirect
Physica A 373 (2007) 569–585
PHYSICA A
www.elsevier.com/locate/physa

Microeconomic co-evolution model for financial technical analysis signals

G. Rotundo[a,*], M. Ausloos[b]

[a]*Faculty of Economics, University of Tuscia, via del Paradiso 47, 01100 Viterbo, Italy*
[b]*SUPRATECS, B5, Sart-Tilman, B-4000 Liege, Euroland*

Received 24 March 2006; received in revised form 19 April 2006
Available online 19 May 2006

Abstract

Technical analysis (TA) has been used for a long time before the availability of more sophisticated instruments for financial forecasting in order to suggest decisions on the basis of the occurrence of data patterns. Many mathematical and statistical tools for quantitative analysis of financial markets have experienced a fast and wide growth and have the power for overcoming classical TA methods. This paper aims to give a measure of the reliability of some information used in TA by exploring the probability of their occurrence within a particular *microeconomic* agent-based model of markets, i.e., the co-evolution Bak–Sneppen model originally invented for describing species population evolutions. After having proved the practical interest of such a model in describing financial index so-called avalanches, in the prebursting bubble time rise, the attention focuses on the occurrence of trend line detection crossing of meaningful barriers, those that give rise to some usual TA strategies. The case of the NASDAQ crash of April 2000 serves as an illustration.

Keywords: SOC model; Technical analysis; Large financial crashes

1. Introduction

Quantitative analysis of financial market data has well assessed several properties like the long term memory in volatility [1–4], returns [5–7], speculative bubbles [8], and the presence of fractals [9] that has been extensively studied since a pioneering paper [10]. Many mathematical and statistical models [11–16] are available nowadays for a phenomenological description of financial data, while rigorous theoretical frameworks have shown to be able to encapsulate some conjectures like the Elliot waves [17].

Alongside the descriptive analysis of macroeconomic quantities, theories derived for complex systems can explain the aggregate behavior of markets through the analysis of its components at the microeconomic level. Microeconomic models of financial markets rank in complexity from the simplest models, typically considering the interaction of two main types of agents—the fundamentalists and the chartists [18–21]—to the most heterogeneous types of agents; an intermediate step considering the presence of noise traders that act

*Corresponding author. Tel.: +39 06 4976 6277; fax: +39 06 4976 6765.
E-mail addresses: giulia.rotundo@uniroma1.it (G. Rotundo), marcel.ausloos@ulg.ac.be (M. Ausloos).

0378-4371/$ - see front matter
doi:10.1016/j.physa.2006.04.062

either without market information or not caring about the fundamentals, thus creating white noise, while mean reversion effects [22] can be accounted due to the activity of fundamentalists. The first question to be raised is whether a microeconomic approach can be found based on insight about the mechanism of the formation of financial quantities. If investigations of micro- or macroeconomic models rely on simulation frameworks whenever more theoretical tools are not available, the evaluation of investment strategies driven by models, even empirical ones, like those leading to technical analysis (TA) is a need. Nevertheless, it is difficult to implement them, even through simulations of multiagent systems, because of the lack of reliability of the parameters. Indeed it is not easy to perform computer simulations of markets with interacting agents that trigger their orders on the basis of TA patterns because TA rules are more complex than those commonly assigned to chartists and fundamentalists in computer simulations. Moreover, to get the best trading decision is still an art, independently from a model sophistication; indeed the interpretation of charts heavily relies on the expertise of the analyst.

Therefore, we study model property and statistics instead of trying to draw results relying on heavy computer simulations of a multiagent system.

On the other hand, a decision based on financial signal TA must take into account the temporary occurrence of several patterns. However, to start the study of the occurrence and of the reliability of the simplest components is a compulsory step towards the comprehension of more complex configurations. This can in turn lead to a systematic assessment of the expertise of such a kind of market analysts.

A cornerstone for TA comes from the expertise of Charles H. Dow that developed the set of methods that are gathered under the name of Dow theory. Dow theory [23] considers major trends as those lasting more than one year. Intermediate trends are those that range from a minimum of three weeks to a maximum of several months, as those which can be useful in futures markets. Short trends can be identified for time intervals shorter than two or three weeks. Thus, it is very important to decide upon a reliable time interval for implementing a strategy, before trying to define any trend. Statistics of trend lines will be exploited on the aggregate of the proposed microeconomic model and compared with the results obtained on raw data. Such analyzes should show their power at their best when performed during periods of high risk exposure. Among them the rising part of speculative bubbles of market indices, due to endogenous causes, has been chosen below because of the availability of already well assessed theories [24–28]. It is worth remarking that stock market indices actually are a weighted mean of stock prices. To perform buy/sell strategies on stock market indices (eventually triggered by TA signals) has the meaning to buy/sell a previous selected financial product replica of the index (Exchange Traded Funds, ETF, certificates).

Therefore, the aim of this paper is twofold. The first task is to set up a microeconomic approach based on insight about the mechanism of the formation of financial quantities; the second target is to show how to use the property of the aggregate rising from the model structure in order to evaluate the reliability of already often used methods like those found by chartists in so-called TA [29]. In particular, the analysis will focus on the probability estimate of the occurrence of trend lines slopes and on the estimate the probability of trend lines crossing.

The paper is organized as follows. The next section shortly gives an overview of the main properties of the NASDAQ July 2000 crash, of its statistical properties, and shows the bases of the models that we are going to apply and how to combine them for data modeling. Section 3 introduces TA signals of interest, in particular so-called barriers. Section 4 shows how to use the model information in order to set up a tool in order to estimate both the occurrence of barrier crossing and the formation of a trend line.

Section 5 serves as a conclusion and suggestions for going beyond the present work. It will appear that the numerical values used to build the agent-based model describing the financial index are those of the two-dimensional square lattice Bak–Sneppen (BS) co-evolution model [30]. For completeness the one-dimensional case is treated in the Appendix.

2. Microeconomic model

This section aims to set up a model for the rising part of speculative bubbles due to endogenous causes in order to capture data features as the property of long term memory, the distribution of the size of fluctuations around at the mean, and the main trend. The modelization tasks can be accomplished through several models,