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Original article

Voter interacting systems applied to Chinese stock markets

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Abstract

Applying the theory of statistical physics systems – the voter model, a random stock price model is modeled and studied in this paper, where the voter model is a continuous time Markov process. In this price model, for the different parameters values of the intensity λ, the lattice dimension d, the initial density θ, and the multivariate set (θ, λ), we discuss and analyze the statistical behaviors of the price model. Moreover, we investigate the power-law distributions, the long-term memory of returns and the volatility clustering phenomena for the Chinese stock indices. The database is from the indices of Shanghai and Shenzhen in the 6-year period from July 2002 to June 2008. Further, the comparisons of the empirical research and the simulation data are given.
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Keywords: Stock price model; Voter model; Probability distribution; Return; Computer simulation

1. Introduction

As the governments deregulate the stock markets, it is becoming an important problem to model the dynamics of the forwards prices in the risk management, derivatives pricing and physical assets valuation. And the research work on the statistical properties of fluctuations of stock prices in globalized securities markets is also significant. Recently, some research work has been done, by applying the interacting particle systems, to investigate the statistical behaviors of fluctuations of stock prices, and to study the corresponding valuation and hedging of contingent claims, for instance see [11,12,17,21,22]. Stauffer and Penna [21] and Tanaka [22] have been apply the percolation model to study the market fluctuation, see [8]. In [21,22], they construct the local interaction or influence among investors in a stock market and define the cluster of investors with the same opinion about the market as a cluster of percolation. In their financial models, they suppose that the stock price fluctuation is influenced by the information in the stock market, and the investors follow the effect of sheep flock. That means that the investors decide the investment opinions by other investors' attitudes, so the investors' investment attitudes of the stock market lead to the stock price fluctuation. In the present paper, we apply a statistical physics model – the voter model (see [3,15]) to study the fluctuation behaviors of the return processes. Through the computer simulation on this financial model, we discuss the statistical behavior, the tail behavior, long term memory of fluctuation and the volatility clustering phenomena for the return processes.

In recent years, the empirical research in financial market fluctuations has been made. Some statistical properties for market fluctuations uncovered by the high frequency financial time series, such as fat tails distribution of price changes, the power-law of logarithmic returns and volume, volatility clustering which is described as on-off intermittency in

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