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Physica A 341 (2004) 526–532
PHYSICA A
www.elsevier.com/locate/physa

Herd behaviors in the stock and foreign exchange markets

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Received 20 August 2003; received in revised form 16 April 2004

Abstract

The herd behavior of returns for the won–dollar exchange rate and the Korean stock price index (KOSPI) is analyzed in Korean financial markets. It is reported that the probability distribution $P(R)$ of returns R for three types of herding parameter satisfies the power-law behavior $P(R) \simeq R^{-\beta}$ with the exponents $\beta = 2.2$ (the won–dollar exchange rate) and 2.4 (the KOSPI). When the herding parameter h satisfies $h \geqslant 2.33$, the crash regime in which $P(R)$ increases with the increasing R appears. The active state of the transaction exists to decrease for $h > 2.33$. Especially, we find that the distribution of normalized returns shows a crossover to a Gaussian distribution when the time step $\Delta t = 252$ is used. Our results will also be compared to the other well-known analyses.

PACS: 02.50.−r; 02.60.−x; 02.70.−c

Keywords: Herd behavior; Returns; Won–dollar exchange rate; KOSPI

1. Introduction

There has been considerable interest [1–3] in the microscopic models of financial markets. Such models, which are based on the self-organized phenomena, are: the herding multiagent model [4,5] and the related percolation models [6,7]; the democracy and dictatorship model [8]; the self-organized dynamical model [9], the cut and

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0378-4371/$ - see front matter
doi:10.1016/j.physa.2004.05.052

paste model; and the fragmentation and coagulation model [10]. One of important microscopic models is the herding model [11,12], in which there exist some degrees of coordination among a group of agents who share the same information or the same rumor and make a common decision in order to create and produce returns. Recently, a theoretical model [5] for this herding behavior has been proposed. In this model, the probability distribution of returns shows a power-law behavior for the herding parameter below a critical value. But the financial crashes yield an increase in which the probability of large returns exists for the herding parameter larger than the critical value. In particular, the distribution of normalized returns has the form of the fat-tailed distributions [13] and a crossover towards the Gaussian distribution can be shown in financial markets.

In the previous work [14], the theoretical models and numerical analyses for the volume of bond futures transacted at the Korean futures exchange market were presented. The number of transactions for two different delivery dates were the principal consideration. In that work, the decay functions for survival probabilities [15,16] were discovered in the analysis of the bond futures. The tick dynamical behaviors of the bond futures price using the range over standard deviation or the R/S analysis treated in the future Korean exchange market [17] were also studied. The recent work [18] on Norwegian and US stock markets has shown that there exist the notable persistence caused by long-memory in the time series. The numerical analyses based on multifractal Hurst exponent and the height–height correlation function have also been used mainly for long-run memory effects. It was demonstrated in particular that the form of the probability distribution of the normalized return leads to the Lorentz distribution rather than the Gaussian distribution [17].

The intention of this paper is to study the dynamical herding behavior for the won–dollar exchange rate and the KOSPI in Korean financial markets. In Section 2, the financial crashes and the distribution of normalized returns for the two different delivery dates are analyzed numerically. The results and conclusions are given in Section 3.

2. Financial crashes and simulations

In our analyses, we introduce the won–dollar exchange rate and the KOSPI in Korean financial markets. However, in this article, we only consider two delivery dates: the tick data for the won–dollar exchange rate shown from the period April 1981 to December 2002, and the tick data of the KOSPI for a 23-year period, commencing April 1981. We show the time series of the won–dollar exchange rate $P(t)$ in Fig. 1, and the price return $R_\tau(t_i)$ is defined as

$$R_\tau(t) = \ln \frac{P(t+\tau)}{P(t)} , \tag{1}$$

where τ denotes the time interval. Our average time τ between ticks is about 1 day in two types of our tick data, as shown in Figs. 1 and 2.

In what follows, in order to describe the averaged distribution of clusters, we consider three return states composed by N agents, i.e., the continuous tick data of the