Stochastic resonance as a model for financial market crashes and bubbles

A. Krawiecki, and J. A. Hołyst
Faculty of Physics, Warsaw University of Technology,
Koszykowa 75, PL-00-662 Warsaw, Poland;
Institute for Economics and Traffic, Dresden University of Technology,
D-01062 Dresden, Germany.

September 20, 2003

Abstract

A bistable model of a financial market is considered, aimed at modeling financial crashes and bubbles, based on the Ising model with thermal-bath dynamics and long-range interactions, subject to a weak external information-carrying signal and noise. In the ordered phase, opposite stable orientations of magnetization correspond to the growing and declining market before and after the crash or bubble, and jumps of magnetization direction correspond to crashes and bubbles. It is shown that the influence of an information-carrying signal, assumed to be too weak to induce magnetization jumps, can be enhanced by the external noise via the effect of stochastic resonance. It is argued that in real stock markets the arrival of a piece of information, considered *a posteriori* to be the cause for a crash or bubble, can be enhanced in a similar way, thus leading to price return whose value is unexpectetly large in comparison with relatively weak importance of this piece of information.