Long-range correlations for stock indexes

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Abstract

We apply several tests to analyze the existence of long-term dependence in 10 European stock indexes. After a filtering process, results point to the absence of linear autocorrelation. However, with other tests, we found non-linear serial dependences that affect return rates. Results of mutual information and global correlation confirm these results and Lyapunov point to the existence of deterministic behavior in all time series. With DFA, we found that most return rate series have long-range dependence, more pronounced in Spain, Greece and Portugal. These results could constitute an indicator of the efficiency level of the stock markets under analysis.

1. Introduction

The study of dependence of time series is usually analyzed in economics, for example to study financial markets, because the existence of dependences in series or with another series could conduct to prediction and violate the efficient market hypothesis.

A financial market is considered to be efficient when is no possible to identify any deterministic pattern in time series' behavior which means that does not exist capacity to obtain systematic abnormal profits with arbitrage, using past information. With other words is the same to say that time series for return rates have no memory. As a consequence, financial markets had been analyzed several times to verify the possibility or not to the existence of profit opportunities windows, considering fluctuations and dynamics f the markets.

Bachelier (1900) made one of the first studies about this, analyzing the probability distribution of stock prices, and concluding that price movements follows Gaussian distribution. Later, Kendall (1953) concludes that stock prices are randomly determined, which implies that return rates are independent and identically distributed (i.i.d), assumption that is used, for example, in the Black-Scholes model.

After this, some other studies continue to analyze dependence in financial time series. Some of these studies, namely the works of Osborne (1964),