Recurrence quantification analysis of wavelet pre-filtered index returns

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Abstract

We investigate the issue of deterministic vs. stochastic dynamics in financial time series. We demonstrate a way to to reveal nonstochastic dynamical structures in daily stock market index returns, combining Recurrence Quantification Analysis (RQA) and wavelet filtering. Assuming a dynamical system generating the returns sequences, we reproduce its dynamics from the data with minimum assumptions. We reconstruct the phase-space dynamics by time-delay embedding of the wavelet denoised returns, in order to apply the RQA. The results indicate that through wavelet pre-filtering we can obtain very "clean" sequences and reveal nonstochastic dynamics. Our results also suggest the existence of chaos. We provide both quantitative and qualitative evidence supporting our findings.

Key words: Recurrence plots, Recurrence Quantification Analysis; Wavelets; Financial time-series analysis; Chaos.
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