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Periodically collapsing bubbles in the US stock market?

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Abstract

The existence of periodically collapsing bubbles in stock markets, applying the Enders–Siklos momentum threshold autoregressive (MTAR) model, is empirically investigated in this paper. Using this nonlinear time series technique, we are now able to analyse bubble-driven run-ups in stock prices followed by a crash in a cointegration framework with asymmetric adjustment. Therefore, applying this technique makes possible a deeper insight into the behavior of stock prices than was previously possible using conventional cointegration tests. Although the results from the subsample 1871–1995 cannot be interpreted in favor of the existence of periodically collapsing bubbles in the US stock market, the findings from the 1871–2001 sample period indicate their presence.

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1. Introduction

Since the 1980s, there has been continuous research interest into the phenomenon of speculative bubbles in share prices, motivated primarily by actual developments in stock markets and the increasing importance of stock markets for investors. The analyses of speculative bubbles are intimately related to time series analysis so that advances in

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econometrics enable an investigation of open questions in this field and their use provide the opportunity to obtain further insights into the characteristics of stock markets. One potential example is the class of periodically collapsing bubbles (Evans, 1991) and the development of econometric techniques designed to capture nonlinear adjustment mechanisms in a cointegration framework (Enders & Granger, 1998; Enders & Siklos, 2001).

Studies investigating the consistency of dividend and stock price data with the market fundamental hypothesis (Blanchard & Watson, 1982; Shiller, 1981; West, 1987) are confronted with the difficulty that the contribution of hypothetical rational bubbles to stock prices are not directly distinguishable from the contribution of unobservable market fundamentals. As an alternative testing strategy, Diba and Grossman (1984, 1988a) proposed the use of standard unit root and cointegration tests (Bhargava, 1986; Dickey & Fuller, 1981; Engle & Granger, 1987) for stock prices and observable fundamentals to obtain evidence for the existence of explosive rational bubbles. This approach relies on the argument that if stock prices are not more explosive compared to dividends, then rational bubbles do not exist because they generate an explosive component into stock price time series. The empirical evidence reported in Diba and Grossman was not conducive to the conclusion that there are explosive bubbles in US stock prices.¹

Evans (1991) argued that the test approaches put forward by Diba and Grossman are unable to detect an important class of rational bubbles, namely periodically collapsing bubbles. The application of standard unit root and cointegration techniques leads, with a high probability, to incorrect conclusions with respect to the presence of bubbles in stock prices. Evans' Monte Carlo simulations show that even in the presence of periodically collapsing bubbles, stock prices are not more explosive than dividends using standard unit root and cointegration tests (see also Charemza & Deadman, 1995). The explanation relies on the logic of standard unit root and cointegration tests; they assume a unit root as the null hypothesis and a linear autoregressive process under the alternative hypothesis. In the case of periodically collapsing bubbles, the bubble component is a nonlinear process, which falls outside the alternative hypothesis. Relying on simulated data with periodically collapsing bubbles present, the findings of standard unit root and cointegration tests reported in Evans' study incorrectly show the absence of bubbles in the majority of cases.

Basing his central argument solely on Monte Carlo simulations and highlighting the power properties of standard unit root and cointegration tests, Evans was not able to provide empirical evidence as to whether periodically collapsing bubbles are actually present in US stock prices due to lack of techniques suitable to deal with nonlinear processes in a cointegration framework. Therefore, the presence of this class of rational bubbles in stock prices remained an open question.

This paper tries to fill this gap using recent advances in the field of time series modelling. Applying the momentum threshold autoregressive (MTAR) model (Enders & Granger, 1998;

¹ As noted many times in the literature, it is virtually impossible to prove the existence of bubbles. This limitation holds for all indirect time series tests as well as for direct approaches relying on a particular structural model.

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