Consistency of The Manhattan Distance for Model Order Change-Point Detection in Garch Models

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ABSTRACT

Volatility is considered a measure of risk of financial assets. Particularly, modeling of financial returns is vital for prudent financial decision of different stakeholders. GARCH models have been commonly used to capture volatility dynamics of financial time series, particularly in modeling volatility of stock returns, futures and option pricing. A key assumption when specifying the model parameters is that the processes are stationary as this ensures model identifiability. Time series of financial asset returns, however, often exhibit the volatility clustering property indicating that the series deviates from stationarity. This suggests that change-points occur in the series. Various tests for detection of change-points exists. However, a key assumption made in these tests is that change-points are as a result of change in one or more parameters. However, the changes could also be as a result of different orders of the GARCH model. We propose of a change-point estimator based on the Manhattan distance of the auto-correlation structure of squared series. Consistency of the estimator is also proved. The estimator has been extended from single to multiple change-point detection through hierarchical segmentation. The performance of the proposed estimator is evaluated by measuring the degree of similarity between the correct classification and the resultant segmented clusters following identified change-point positions using the Adjusted Rand Index. Empirical applications to exchange rate return series demonstrate that the estimator performs better as the size of change and sample size increases.

Keywords

Autocorrelation function, Change-point, GARCH Models, Manhattan distance, Model order