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Original article

Modified tests for variance changes in autoregressive regression

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Abstract

In this paper, we consider the problem of testing for variance changes in the linear autoregressive processes including AR(p) processes meanwhile autoregressive parameters shifts occur. In performing a test, we employ the conventional residual CUSUM of squares test (RCUSQ) statistic. The RCUSQ test is based on the bootstrap method introduced to eliminate the influence caused by the autoregressive parameters shifts. It is shown that under regularity conditions, the test statistic behaves asymptotically the function of a standard Brownian bridge. Simulation results as to AR(1) processes and an example of real data analysis are provided for illustration.

Keywords: Bootstrap; Variance changes; Autoregressive parameters shifts; RCUSQ test

1. Introduction

The problem of testing for change-point in statistical models has been an important issue among both theoreticians and practitioners. Research into this problem originally began with iid sample; for a review of work, see [7,9,18,20,21,24,26]. Subsequently, the issue became very popular in the time series context since series often suffer from structural changes. Particularly, econometric time series exhibit changes in their underlying model because a myriad of political and economic factors can cause the relationships among economic variables to change over time. Detecting structural changes beforehand is an important step, and it can make us better interpret and more accurate forecast the data. Therefore, for correct inference, it is imperative to figure out whether the parameters continue to be constant during the whole series or not. For references, see [2,1,4,5,10,12,15–17,25] and the papers cited therein.

Owing to the works of Perron [22,23] and Hendry Neale [13], it is now well recognized in the literature that unit root tests should be designed to have against the alternative hypothesis that allows for a break in the mean. The conventional unit tests that ignore the break under the alternative can spurious fail to reject the unit root null hypothesis. Therefore, Perron [23] proposed a unit root test that is specifically designed to have power against the alternative that allows for a one time break in the mean occurring at a known break-date.

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