Original article

Spurious Granger causality between a broken-trend stationary process and a stochastic trend process

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Abstract

This paper examines spurious Granger causality between a trend stationary process with structural breaks and a stochastic trend process. Monte Carlo simulations show that whether or not there are deterministic variables in the testing models, the sample size and the parameter values of the data generation process can affect the empirical frequencies of spurious Granger causality relations in different degrees. The analysis also points out that an alternative rank-based causality test method can avoid the risk of spurious causality to some extent by adopting an intercept and deterministic trend term in the testing regressions.
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Keywords: Granger causality; Spurious rejection; Structural break; Stochastic trend

1. Introduction

Many economic time series are dominated by trend. Since the 1970s, econometricians have made extensive and in-depth research on the trend mechanisms of data generation processes (DGPs), which led to further developments in the field of econometrics. Although econometricians generally agree that most macroeconomic variables exhibit trend characteristics, there are still existing differences and disputes on the inherent mechanism of this trend. The debates focus on whether the time trend presented by economic variables is deterministic or stochastic. In particular, the introduction of the structural break concept even catapulted this debate into its peak. Nelson and Plosser [10] adopted the ADF test to make unit root tests for 14 macroeconomic variables in the US. The results showed that there are 13 variables that cannot reject the unit root null hypothesis and that most trend properties of US macroeconomic variables are stochastic. Meanwhile, Perron [11] adopted unit root tests with structural break to show that most US macroeconomic variables have deterministic time trend properties. Since then, there have been a number of studies on structural break issues (see, *inter alia*, [1,2,9,12,13]). Some econometricians, such as Hansen [5], believed that the "structural break" has dramatically altered the face of applied time series econometrics. Many structural breaks and stochastic trend processes exist in macroeconomic time series in a wide range. Therefore, this paper examines spurious Granger causality between a broken-trend stationary process and a stochastic trend process. He and Maekawa [6] examined spurious Granger causality relationships between two independent variables wherein either both or one of the two independent series examined was an I(1) process. Cook [3] further analyzed He and Maekawa's [6] study by