

State Space Model Representation of Integrated Time Series and Trend Cycle Decomposition

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Abstract

It has been a common practice to decompose an integrated time series into a random walk trend and a stationary cycle using the state space model. Application on state space trend-cycle decomposition, however, often misleads the interpretation of the model, especially when the basic concepts of the state space model are not properly considered. In this paper, we have found that the spurious trend-cycle decomposition, questioned by Nelson (1988), is related to an unobservable state space model, and the usual assumption of independent noises in the state space model results in parameter redundancy. In addition, the equivalent relationship between ARIMA(1,1,1) process and the state space model with a random walk trend and an AR(1) cycle, where the noises of trend and cycle are generally correlated, is closely analyzed with an example of US real GNP.

Keyword

ARIMA, Redundancy, Spuriousness, State Space Model, Trend-Cycle Decomposition