

<English Version>

Inference based on the pivotal quantity and Monte Carlo simulation for spatial regression models

Young Eun Jeon¹⁾ · Suk-Bok Kang¹⁾ · Joon Jin Song²⁾ · Jung-In Seo³⁾

Summary: This study aims to improve the performance of the interval inference method for model parameters, scale and regression parameters, in the simultaneous and conditional autoregressive models. The maximum likelihood method is the most widely used estimation method, but it has a fatal drawback in that it provides the approximate confidence intervals which often fail to satisfy nominal levels for a small sample size. To overcome this problem, we propose novel interval inference approaches using the pivotal quantity and Monte Carlo simulation, which appropriately treat nuisance parameters. In particular, the inference approach using the pivotal quantity leads to exact intervals.

For illustrative purposes, the simulation study and real data analysis are conducted. The simulations demonstrate the superiority of the proposed methods through a comparison with an interval inference method based on the maximum likelihood estimator in a situation where the sample size is not large enough. The real data analysis examines the applicability of the proposed methods by analyzing the district-level confirmed rates of COVID-19 in Seoul with various explanatory variables.

Keywords: conditional autoregressive model, confidence interval, pivotal quantity, simultaneous autoregressive model

1) Department of Statistics, Yeungnam University, Gyeongsan, Korea

2) Department of Statistical Science, Baylor University, Texas, USA

3) Department of Information Statistics, Andong National University, Andong, Korea