Spatial Stochastic Frontier Models

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A wide variety of spatial stochastic frontier models, which merge stochastic frontier models and spatial econometric models, have been proposed. However, these models have not been clarified in a systematic way. Thus, we introduce (non-spatial) stochastic frontier models and basic models of spatial econometrics, systematically categorize the spatial stochastic frontier models, and then clarify the characteristics and problems of each.
Concretely, we start with the (non-spatial) stochastic frontier models and review the basic models of spatial econometricsâ€”the spatial lag of X model (SLX), the spatial autoregressive model (SAR), and the spatial error models (SEM). Subsequently, we categorize these three basic models of spatial econometrics in order to review the following examples of the spatial stochastic frontier modelsâ€”the spatial lag of X stochastic frontier models (SLXSF), the spatial autoregressive stochastic frontier models (SARSF), and the spatial inefficiency stochastic frontier models (SIESF).
Then, we develop a new spatial inefficiency stochastic frontier model. Our spatial inefficiency stochastic frontier model meets the following conditions: (a) It can detect not only positive, but also negative spatial autocorrelation of inefficiency; (b)The inefficiency follows a truncated normal distribution; and (c) It can distinguish whether the detected spatial autocorrelation is caused by an influence from oneâ€™s own inefficiency on the surrounding inefficiency (true spatial spillovers) or by a lack of spatially dependent determinants of inefficiency (spurious spatial spillovers). Finally, we introduce some application examples of these models, such as Japanese manufacturing and local governments. We also discuss the applicability of input-output table data to spatial stochastic frontier models.