Using geolocation data in spatial-econometric construction of multiregion input-output tables: a Bayesian approach

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Abstract

In my previous two articles (2016; 2021), I demonstrated an approximation method for multiregion input-output (MRIO) tables in Poland at NUTS-3 regional level. While the Moran tests confirmed that the proposed model does not exhibit spatial residual autocorrelation, and hence it captures the desired inter-regional supply chain linkages, and the proposed method outperformed the previous approaches in replicating the seminal Statistics Finland (2006) dataset in terms of most ex-post summary metrics, a few points remained unresolved. In this contribution, I revisit two of them.

First, in the quoted articles, I used a generic distance measure based on the polygon centroids. These might, or might not, be a reasonable region's representation as an economic center of gravity. The problem arises especially for the ring-shaped suburban regions ("bagels") around metropolies, whose centroids are located in the central hole of the ring, and the economic meaning of the distance from the suburban region to the metropolitan region is additionally underplayed by the fact that heavy commuting traffic increases the supply time, and hence the economic cost, related to crossing that (apparently tiny) distance. I tackle this problem here by using a Google-based distance (and driving time) matrix between biggest cities of each NUTS-3 region. Additionally, I incorporate the data on mobile phone traffic to correct the columns and rows of the MRIO matrix related to households to account for the fact that commuters tend to spend their money in a different location from their work location.

Second, the previously proposed method acts as a spatial filter, attempting to interpret all kinds of spatial autocorrelation as supply chain linkages. In fact, this autocorrelation might originate elsewhere, which renders the high-resolution (NUTS-3 level) data relatively noisy. As a remedy, I use additional information from the above-mentioned dataset compiled by Statistics Finland, as one of the few direct data sources on cross-regional intermediate commodity flows. I translate the information content of this data into a prior distribution of the gamma-PDF parameters (scale and shape) on which the spatial decay functions underlying my MRIO table are based. Then, I proceed to obtain a posterior distribution of both parameters for each and every sector, implying a corresponding posterior distribution of the spatial decay function values. As a result, the multiregion I–O simulation can be implemented as a stochastic simulation that yields confidence intervals e.g. for the obtained global output values.

References

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