Modelling Inter-Regional Trade Flows: A new method based on Generalized Radiation Model and Multi-Regional GRAS Technique

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IMPLAN has used the gravity model to estimate inter-regional trade flows among different regions in the U.S. Even though the gravity model has been considered the best option to model human commuting patterns, it requires data to estimate parameters. For many international regions, there are no data available to estimate any parameters; therefore, we explored a parameter-free method to model the inter-regional trade flows. This new methodology applied the generalized radiation model and the multiregional generalized RAS (MRGRAS) techniques, which could estimate inter-regional trade flows consistent with a system of regional and national supply and use tables.
This paper describes in detail the method applied in the regionalization process, which includes two steps. The first step is to calculate initial estimates of inter-regional trade flows by applying the generalized radiation model proposed by Masucci et al. (2013). The second step is to balance inter-regional trade flows by applying the MRGRAS technique proposed by Temursho et al. (2018). Trade flows are estimated by distributing the trade over the regions, given the amount produced and consumed in each region. We use supply and use tables and national accounts data from Eurostat, combined with trade estimates from WIOD and European Commission Joint Research Centre's experimental Figaro dataset.
The radiation model was first proposed by Simini et al. in 2012. It became prevalent on the grounds of its simple form and parameter-free property. In 2013, Masucci et al. introduced a generalized radiation model, which overcame some limits of the original model while maintaining its nature of universality. The radiation model was introduced to track human movements in mobility systems. In our project, we apply the model to track goods and services movements, which are the commodity trade flows among regions.
The MRGRAS technique is an extension of the GRAS method. Besides the substitution effects and fabrication effects in the original GRAS technique, this extension added a third dimension of â€œtechnology effectsâ€•, which indicates the general rise or fall in importance of product i for sector j. In our project, instead of adding the â€œtechnology effectsâ€•, we add â€œregional effectsâ€• as the third dimension, which captures trade flows between regions, and also control the aggregated trade flows to the total regional supply and use. In effect, we adjust regional trade estimated at NUTS3 level to national trade controls.