

A Study on the Accuracy of Heterogeneous Input-Output Models Based on Monte Carlo Simulation

Topic: Input-Output Theory and Methodology - VI

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Abstract: The heterogeneous input-output model has found widespread application in research on trade value-added, energy, and environment in recent years. However, due to the lack of data on trade flows between various types of enterprises when compiling heterogeneous input-output tables, scholars have had to rely on assumptions of proportionality and optimization methods to construct intermediate flow matrices. Based on a thorough study of existing methods for compiling heterogeneous input-output tables, this study proposes a novel method based on Monte Carlo simulation for generating initial values for intermediate flow matrices, which are then adjusted using the TRAS method to ensure conformity with the structural characteristics of the heterogeneous input-output model. The study then measures the accuracy of the Leontief inverse matrix, output multipliers, and export value-added. By simulating the intermediate flow matrix elements 10,000 times under two scenarios, i.e., normal distribution and lognormal distribution, and varying the mechanism for forming the standard deviation of the intermediate flow matrix elements during the simulation, the study shows that the uncertainty of the intermediate flow matrix, Leontief inverse matrix, output multipliers, and export value-added of the Chinese non-competitive input-output model adapted from ICIO-DF(2016) exhibits a decreasing trend. The results of the study indicate that in the process of establishing a heterogeneous input-output model, as long as the total matrix, such as output, value-added, final demand, imports, and exports, are accurately estimated, even if the intermediate flow matrix obtained from proportionality assumptions and optimization methods is biased, the accuracy of the Leontief inverse matrix, output multipliers, and export value-added can still be maintained and improved in order, and the empirical research results obtained from the model can still maintain a high overall accuracy.

Key works: Heterogeneous input-output model; Distinguish between domestic and foreign investment; Monte Carlo simulation; TRAS; Accuracy