

## **Simplifying gravity equations to embed regions within world input-output models**

Topic: Input-Output Theory and Methodology - V

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Multiregional input-output (MRIO) models provide better maps of economic structure. They yield detailed mappings of structural relationships among different industries and economies than do single-region models. If models can be considered a sort of mapping of reality, then it follows that we should be able to attain better findings as our models better reflect actual human and environmental interaction across space and sectors (our maps become more accurate).

But a lack of viable trade data within nations deters the inclusion of subnational regional economies in global MRIO models. This inconvenience has encouraged scholars and practitioners to produce clever solutions ameliorating the usual problem of data scarcity. We identify in literature three main tools that deal with this problem. Import/export weights appear as the more meticulous approach, yet the more data demanding too. It relies on detailed information on regional imports/exports by sector and country origin/destination, which is seldom available. Gravity models are one way to estimate trade flows when information on trade is minimally available (if at all) and distance (or travel time) is an important consideration. However, their accuracy is improvable and relies on parameters that cannot be set a priori. Finally biproportional balancing techniques (e.g.: RAS) are useful ensuring MRIO coherency but cannot compensate for badly posed initial estimates.

To facilitate more-ready development of such multiscale MRIO models, in this paper we identify a gravity model simplification with minimal data requirements that generates reasonable estimates of region-to-abroad trade. We illustrate the approach by spatially disaggregating two hypothetically constructed countries: one built upon small and open economies (Belgium, Luxembourg and the Netherlands); other combining big and less trade-oriented economies (France, Germany and Italy). We embed these regions within FIGARO global MRIO model and contrast estimates against true published data. Our results suggest that it is possible to reduce information requirements and still produce relatively accurate multiscale MRIO models. Feedback effects and spillovers are also well captured.