Calibrating Mathematical Programming Spatial Models

Quirino Paris (University of California, Davis), **Sophie Drogué** (INRA-AgroParisTech), and **Giovanni Anania** (University of Calabria)

Abstract

In the area of trade, modelers have a wide variety of tools at their disposal, including spatial and non spatial partial equilibrium models and computable equilibrium models. The paper deals with mathematical programming spatial partial equilibrium models, e.g. with partial equilibrium models which are "naturally" able to reproduce bilateral trade flows without having to resort to the Armington assumption. These models are particularly useful when the markets considered are relatively small with respect to the countries' overall economy and relevant trade policies include discriminatory ones, i.e. policies which discriminate by country of origin (destination) of imports (exports), such as preferential tariffs, country specific tariff rate quotas or embargos. Empirical models of international trade are subject to a common pitfall that is represented by the discrepancy between actual and optimal trade flows, that is, between realized commodity flows in a given year and the import-export pattern generated by the model solution for the same year. In fact, mathematical programming models often suffer from an "overspecialization" of the optimal solution with respect to observed trade. The main reason for this discrepancy originates in the transaction costs per unit of commodity bilaterally traded between two countries. Generally, this piece of crucial information is measured with gross imprecision. When this is the case, a calibration of the trade model for the given base year allows for more effective policy simulations. Different approaches have been used in the past to calibrate mathematical programming models, mostly based on including in the model additional constraints limiting the space of feasible solutions. The paper proposes an original calibration procedure which follows the approach used in Positive Mathematical Programming. The first part of the paper discusses the proposed calibration procedure with reference to a variety of mathematical programming spatial transportation and trade models: the classical transportation model; the Samuelson-Takayama-Judge model; and the "equilibrium problem". The second part of the paper provides numerical examples of the implementation of the calibration procedure proposed for the models discussed in the first part.