An operational, nonlinear input-output system

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ABSTRACT
There is a glaring contrast between the theoretical advances in nonlinear input-output (NIO) theory and the surprisingly scarce list of applications in the empirical literature and this divorce cannot be attributed to the computational requirements for solving nonlinear models. The theory of NIO models has been concerned with establishing theorems that prove existence and uniqueness of solutions for a nonlinear version of the Leontief model. Under quite general conditions, but all of them sharing a modified system productivity assumption, existence of a solution and its uniqueness can be proved. In a NIO model, technical coefficients are not taken as fixed and their variability can be attributed to many different factors (technical innovation, input substitution, productivity changes, non-homogeneity, etc.).
The non-linearities we consider in this paper are of the scale-dependent type, i.e. changes in total output need not be proportional to changes in total inputs but still a unique production mix is all that is available to firms. Isoquants are L-shaped but the isoquant map is not necessarily homothetic. The model is implemented in such a way that it contemplates the possibility of different technological assumptions regarding returns-to-scale and is numerically calibrated in a simple manner that closely resembles the usual technical coefficient calibration procedure in applied general equilibrium.
Multiplier calculations under this nonlinear version offer interval estimates that provide information on the effectiveness and variability of demand-driven induced changes in equilibrium magnitudes. In addition, and unlike the linear model, the nonlinear model allows us to distinguish between physical and cost effects, the reason being that the traditional dichotomy between the price and quantity equations no longer holds in the nonlinear model version. They both have to be determined at the same time. Preliminary analysis uses archetype interindustry data for US, China and Brazil. The implementation shows that this approach may well turn out to be a practical alternative and companion to the standard linear counterpart model.