Full probability density model for IOT and national accounts

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The paper discusses a theoretical framework for deriving marginal probability density functions for input-output coefficients (IOC) and the joint probability model for input-output tables. The idea that IOC can be considered as a distribution rather than a point estimate has been discussed by Jackson (1986) where he tried to link the problem of aggregation of micro-data and uncertainties from the survey data with IOT framework. The paper advances this idea by deriving full probability density functional form directly from the input-output model, which is consistent with proposed by Jackson (1986) framework for individual io-coefficients. Modeling the exact probability density provides several benefits over evaluation of uncertainties around a particular state of the matrix, and admittedly over the point estimates. First, the marginal and conditional distribution of io-coefficients is theoretically grounded, i.e. has known functional form, and can be directly used in analyses such as studying of uncertainties in data, Bayesian updating or disaggregation of IOTs, optimization problems, and many other. Second, stochastic sampling techniques (like MCMC) can be avoided or dramatically improved for generation of random matrices. This feature significantly reduces computational barriers of the probabilistic/stochastic analyses of IOTs and extends the application of the proposed methodology for very large matrices. However, even if the marginal PDFs for individual io-coefficients derived from the exponential family of distributions, it is not straightforward to generate a random sample for the full matrix because of the constraints imposed by the input-output model. Therefore, we consider several techniques to generate random matrices, which satisfy all the constraints on the io-coefficients. The techniques with the best results allow sample very large matrices (10 thousand rows and columns) within minutes, and will be presented at the conference for a discussion. Finally, the proposed probabilistic framework can be adopted for other national accounts, as well as for probabilistic macroeconomic modeling.