Stochastic Input-Output Analysis and Extensions: A Case Study of the United States

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The input-output (I-O) model's capability to provide macroeconomic policy insights on interdependent economic systems has recently been extended in the field of quantitative risk analysis. As with any quantitative models, estimates of input data and associated parameters are inevitably prone to some kind of error or bias. The same statement can be said about the susceptibility of the I-O technical coefficients to imprecision originating from various sources of uncertainty. Hence, this paper provides a methodology based on stochastic I-O analysis to address these issues and subsequently measure the uncertainty when using the I-O model. The research uses the supply and use tables from the US Bureau of Economic Analysis for a period of 14 years (1998-2011) to estimate the probability distributions of the technical coefficients. The coefficients are assumed to follow the Dirichlet distribution, and their moments are evaluated by using a Monte-Carlos Simulation of 10,000 iterations. The simulation methodology is implemented in MATLAB and the results are used to generate key sector analysis. Probability distributions can be established to measure the backward and forward linkages for each economic sector. In addition, we used the eigenvalue method to determine the key sectors based on their contribution to the economy and to assess the sensitivity of the sectors to economic disruptions. In sum, this research develops a stochastic model based on historical I-O data and the results are envisioned to contribute positively to strategic economic planning and macroeconomic risk analysis.