Computational tractability of chance constrained data envelopment analysis

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Abstract

Chance constrained data envelopment analysis (DEA) is proposed in the literature for its merits of concerning data uncertainty and being robust in contrast to deterministic DEA. According to Charnes & Cooper (1963), chance constrained DEA include E-model, P-model and other variants. Although chance constrained DEA have been built carefully to model the randomness of inputs and outputs of a set of decision making units (DMUs), optimization methods for solving these models lack a formulation to correspond them to tractable optimization problems. The current study examines the nonlinearity of these stochastic programming models where intractable optimization problems are differentiated from tractable ones. We reformulate tractable models into conic optimization and quasi-convex optimization. We relax the uncorrelation assumption which is usually adopted in existing chance constrained DEA models and extend chance constrained DEA from Gaussian model to distributionally robust model in order to deal with datasets where distributions of random inputs and outputs are only partially known in advance. Example is provided to demonstrate the validity of the reformulated forms of chance constrained DEA.

Keywords: data envelopment analysis; chance constrained; stochastic programming; computational tractability; conic optimization