Risk management for tactical supply chain planning

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In this work a modeling framework and a solution approach is presented for a multi-period mixed 0-1 problem arising in tactical supply chain planning under uncertainty. A multistage scenario tree based scheme is used to represent the parameters' uncertainty and developing the related Deterministic Equivalent Model. A cost risk reduction is performed by using a new risk averse measure, so-called expected conditional stochastic dominance (ECSD) measure, included by a set of profiles to be satisfied as a target on given functions for the groups of scenarios with a one-to-one correspondence with the nodes in a modeler-driven subset of periods in the scenario tree. Each profile, related to the functions in whose value risk reduction is to be performed, is included by a 3-tuple given by a threshold, a chance-constrained of its infeasibility (also so-named a bound on the first order SD) and a bound on the corresponding infeasible value (also so-named a bound on the expected second-order SD value). It is proven that ECSD belongs the set of time-consistent Expected Conditional Risk Averse Measures introduced in [3], among others. Given the dimensions of this problem in real-life applications, see [2], a decomposition approach is proposed, so-called SDP-ECSD. It is based on a stageewise non-independent stochastic dynamic programming (SDP methodology introduced in [1]. The main results that are reported in a broad computational experience consist of a comparison between the plain use of a current state-of-the-art mixed integer optimization solver and the proposed SDP decomposition approach, by considering the risk neutral version of the model as the subject for the benchmarking. The add-value of the new risk averse strategy is confirmed by the computational results that are obtained using SDP for both versions of the TSCP model, namely, risk neutral and risk averse.

References

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