Structure and Stability Results for a Risk Averse Linear Bilevel Problem under Stochastic Uncertainty

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Abstract: Bilevel problems arise from the interplay between two decision makers on different levels of a hierarchy. In stochastic bilevel problems, the lower level problem is entered by the realization of some random vector whose distribution does not depend on the upper level decision as an additional parameter. It is assumed that the leader has to make his or her decision without knowing the realization of the randomness, while the follower decides under full information.

In contrast to classical two-stage stochastic programming, the arising random variable in optimistic stochastic bilevel programming depends on the optimal value of a problem, where only optimal solutions to the lower level problem are feasible and the decision is made by a different actor. This is a crucial difference that results in weaker analytical properties, since the upper level objective function gives rise to a random variable defined by the optimal value function of the recourse problem in two-stage stochastic programming.

We examine linear bilevel programming problems, where the right-hand side of the lower level problem subject to stochastic uncertainty, and present a risk averse formulation based on special risk measures. In particular, structural properties and qualitative stability of the optimal value function of this model under perturbation of the underlying Borel probability measure will be investigated for special risk measures with respect to weak convergence of probability measures.

Focussing on the case of an underlying random vector with a finite number of realizations, the equivalences of the risk averse stochastic bilevel problems and single-level problems conclude the talk.

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