Секция 9. BIGDATA–ТЕХНОЛОГИИ АНАЛИЗА И ПРОГНОЗИРОВАНИЯ

USING R FOR RISK MENEDGMENT

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This research studies two modeling techniques that help seek optimal strategies in financial risk management. Both are based on the stochastic programming methodology. The first technique is concerned with market risk management in portfolio selection problems; the second technique contributes to operational risk management by optimally allocating workforce from a managerial perspective.

The first model involves multiperiod decisions (portfolio rebalancing) for an asset and liability management problem and deals with the usual uncertainty of investment returns and future liabilities. Therefore it is well-suited to a stochastic programming approach. A stochastic dominance concept is applied to control the risk of underfunding. A small numerical example and a backtest are provided to demonstrate advantages of this new model which includes stochastic dominance constraints over the basic model. Adding stochastic dominance constraints comes with a price: it complicates the structure of the underlying stochastic program. Indeed, new constraints create a link between variables associated with different scenarios of the same time stage. This destroys the usual tree-structure of the constraint matrix in the stochastic program and prevents the application of standard stochastic programming approaches such as (nested) Benders decomposition and progressive hedging. A structure-exploiting interior point method is applied to this problem. Computational results on medium scale problems with sizes reaching about one million variables demonstrate the efficiency of the specialized solution technique.

The second model deals with operational risk from human origin. Unlike market risk that can be handled in a financial manner (e.g. insurances, savings, derivatives), the treatment of operational risks calls for a “managerial approach”. Consequently, we propose a new way of dealing with operational risk, which relies on the well known Aggregate Planning Model. To illustrate this idea, we have adapted this model to the case of a back office of a bank specializing in the trading of derivative products. Our contribution corresponds to several improvements applied to stochastic programming modeling. First, the basic model is transformed into a multistage stochastic program in order to take into account the randomness associated with the volume of transaction demand and with the capacity of work provided by qualified and non-qualified employees over the planning horizon. Second, as advocated by Basel II, we calculate the probability distribution based on a Bayesian Network to circumvent the difficulty of obtaining data which characterizes uncertainty in operations. Third, we go a step further by relaxing the traditional assumption in stochastic programming that imposes a strict independence between the decision variables and the random elements. Comparative results show that in general these improved stochastic programming models tend to allocate more human expertise in order to hedge operational risks.