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عنوان مقاله:

A new quadratic deviation of fuzzy random variable and its application to portfolio optimization

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نویسندگان:

X. Wu - School of Economics and Management, Tianjin Polytechnic University, Tianjin WooWAY, China

D. A. Ralescu - Department of Mathematical Sciences, University of Cincinnati, Cincinnati, OH FAYYI-00YA, USA

Y. Liu - College of Mathematics & Information Science, Hebei University, Baoding ovior, Hebei, China

خلاصه مقاله:

The aim of this paper is to propose a convex risk measure in the framework of fuzzy random theory and verify its advantage over the conventional variance approach. For this purpose, this paper defines the quadratic deviation (QD) of fuzzy random variable as the mathematical expectation of QDs of fuzzy variables. As a result, the new risk criterion essentially describes the variation of a fuzzy random variable around its expected value. For triangular and trapezoidal fuzzy random variables as well as their linear combinations, we establish the analytical expressions of their QDs, and obtain the desirable convexity about the analytical expressions with respect to critical parameters. To explore the practical value of the proposed QD, we apply it to a portfolio selection problem to quantify the investment risk, and develop three mean-QD models to find the optimal allocation of the fund in different risky securities. Due to the convexity of our QD, the original three mean-QD models can be turned into their equivalent convex parametric quadratic programming problems, which can be solved by conventional optimization methods. The computational results clearly demonstrate that our new QD significantly reduces the computational complexity that cannot be avoided when variance is used as a risk criterion. Finally, the numerical comparison between the proposed mean-QD model and mean-variance model is conducted to show the consistency between the optimal results in both techniques. Meanwhile, the comparison between the proposed QD, variance, spread, and second moment is made to summarize the similarities and differences between them, distinguish these four risk criteria and determine their .respective application scopes in decision systems

كلمات كليدى: Risk criterion, hybrid uncertainty, mean-QD model, convexity, computational complexity, portfolio optimization

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