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论文

待遇预定制养老基金资产组合与缴费计划最优决策——基于随机波动率Heston模型及Legendre对偶变换法

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The Optimal Portfolio Decision and Contribution Plan of Defined Benefit Pension Funds Based on a Heston Stochastic Volatility Model and Legendre Dual Transform Method

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摘要 待遇预定制养老金制度在中国应用非常广泛,缴费制定和资产配置是此类养老金管理的两大核心问题。由此,面对随机波动的现实市场,文章针对待遇预定制养老基金的资产组合管理问题,应用最优控制理论,选用对数效用函数,建立Heston随机波动率模型;在难以求解随机微分Bellman方程的情况下,应用Legendre变换,将原来问题转化为对偶问题,从而求得原问题的解析解。在理论上,进一步丰富了资产组合问题的随机最优控制模型的构建和随机微分方程的求解理论。在实践上,确定了养老金管理风险资产配置比例和缴费水平,给出了最优决策与总资产、发放待遇、净资产与风险溢价之间的数量关系,从而实现养老基金管理的最优资产配置和最低缴费水平的效用目标。

关键词： 待遇预定制养老金 资产组合 随机波动率 Heston模型 Legendre变换

Abstract： The defined benefit pension system applies widely in China. The portfolio and the contribution plan are the two core issues in this system. Thus, a Heston stochastic volatility control model with the logarithm utility function for the portfolio of the defined benefit pension funds is created in this paper, and a stochastic differential Bellman equation by applying optimal control theory is obtained. But this equation is very difficult to solve, so it transfers the primal problem to the dual problem and provides an analytic solution to the primal optimal problem by applying the Legendre transform and the dual theory. In theory, the paper enriches the methods of the model specification and the model solution for the stochastic volatility control model about the portfolio. In practical level, an optimal asset allocation strategy (between a risky asset and a reckless asset) and the least contribution policy, and expressions of quantity relations between the optimal decisions and the total assets, the pension benefit, the net assets and the risk premium to achieve the utility goal are found in this paper.

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