OPTIMAL INVESTMENTS IN THE PRESENCE OF MODEL RISK

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Summary of the PhD thesis

During the last forty years sophisticated methods of the stochastic control theory have been developed in order to determine optimal investment strategies. However, it should be noticed, that the parameters of the model are determined from historical data and depend on the choice of an estimator. Therefore, model uncertainty should be taken into account in investment decisions. Among the various ideas to add model risk into model optimisation, the minimax method is the most popular one. This method involves construction of a family of probability measures, delimiting the scope of an error of the model, and use the worst case criterion (i.e. select a strategy that maximize the expected utility of terminal wealth in the worst possible situation). This dissertation is devoted to minimax strategies when the financial market is modeled by a process of a diffusion type. In addition, the coefficients of the diffusion are dependent on a nontradable factor. It is natural generalisation of the Black-Scholes model and in particular it includes stochastic volatility models, as well as short-term interest rate and energy prices models. The problem is treated here as a stochastic differential zero-sum game problem between the market and an investor. The solution of our minimax problem boils down to finding a saddle point for that game. The method of determining the saddle point is based on partial differential equations of Hamilton-Jacobi-Bellman-Isaacs type. First, the relationship between the value of the game and the corresponding equation is proved. This is a general result, which is applied further to a utility of the HARA (hyperbolic absolute risk aversion), CARA (constant absolute risk aversion) type and quadratic function. The problem of an investor with an infinite investment horizon is also considered. In addition, existence of regular solutions to appropiate nonlinear partial differential equations is proved.

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