Value-at-risk constrained portfolios in incomplete markets: a dynamic programming approach to Heston's model

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This talk is centered on dynamic portfolio optimization with terminal-wealth constraints. We start with a brief overview of the seminal paper H. Kraft and M. Steffensen (2013), in which the authors generalize the dynamic programming approach to optimal-investment problems with terminal-wealth constraints in a complete Black-Scholes market. Building on that, we extend the dynamic programming approach to constrained portfolio optimization problems in an incomplete financial market, where the stock price follows the Heston stochastic volatility model. We demonstrate that the value function in the constrained problem can be represented as an expected modified utility of a vega-neutral financial derivative on the optimal wealth in the unconstrained problem. Furthermore, we show how the optimal wealth and the optimal investment strategy in the constrained problem are linked to the optimal wealth and the optimal investment strategy in the unconstrained problem. We show the details using the example of a power-utility maximizing investor with a Value-at-Risk constraint on terminal wealth. At the end of the talk, we show the results of our numerical studies and highlight the potential of our methodology for solving other utility-maximization problems with terminal-wealth constraints in incomplete markets.