Utility maximization problem and related backward stochastic PDEs

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We study utility maximization problem for general utility functions in an incomplete financial market model, where the dynamics of asset prices are described by an R^d-valued continuous semimartingale. Under some regularity assumptions on the utility function we prove that the value function is a regular family of semimartingales satisfying a backward stochastic partial differential equation. We show that the strategy is optimal if and only if the corresponding wealth process satisfies a certain forward-SDE. As examples the cases of power, exponential and logarithmic utilities are considered.