Derivation of Multi-Asset Black-Scholes Differential Equations

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Abstract: The Black-Scholes differential equations are extensively proposed in multi-asset option prices. Modelling of the Black-Scholes differential equation is generally completed by applying a Δ-hedging method, which could first-rate be accomplished on entire markets. Another technique, which is done in this work, is by first modelling multi-asset option prices in a backward stochastic differential equation. This study starts constructing a multi-asset portfolio which is written in BSDEs. The Feynman-Kac concept offers the relation between BSDEs and the Black-Scholes differential equations. Then we obtain a theorem which explains that the solution of BSDEs of multi-asset portfolios exists and is unique. It is also a solution to the Black-Scholes differential equations. Finally, in the last part of this work, we give some simulations of multi-asset option prices which are executed in a software.

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