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A New Approach to Pricing Double-Barrier Options with Arbitrary Payoffs and Exponential Boundaries

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Abstract

We consider in this article the arbitrage free pricing of double knock-out barrier options with payoffs that are arbitrary functions of the underlying asset, where we allow exponentially time-varying barrier levels in an otherwise standard Black–Scholes model. Our approach, reminiscent of the method of images of electromagnetics, considerably simplifies the derivation of analytical formulae for this class of exotics by reducing the pricing of any double-barrier problem to that of pricing a related European option. We illustrate the method by reproducing the well-known formulae of Kunitomo and Ikeda (1992) for the standard knock-out double-barrier call and put options. We give an explanation for the rapid rate of convergence of the doubly infinite sums for affine payoffs in the stock price, as encountered in the pricing of double-barrier call and put options first observed by Kunitomo and Ikeda (1992).

Key Words:

Exotic options | double-barrier options | method of images | parity relations of double-barrier options

Notes

[1]Where single flat barriers were treated.

[2]Where the flat double-barrier case is treated.