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**Pricing two-asset alternating barrier options with icicles and their variations.** (English)

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**Summary:** This paper introduces a new class of barrier options and its variations. We call the new class of options as two-asset alternating barrier options, since we consider alternating barrier levels for two underlying assets. The alternating barrier levels are placed in the sub-periods of the option's lifetime; each being applied to one of the two underlying assets. We also consider vertical branches of the barrier, which are termed as icicles. The alternating barrier with icicles can be often seen as an embedded form in various equity-linked financial products. To price such new options, we obtain the joint distribution of two underlying asset prices at an intermediate time point and the maturity, along with their partial maximums under the Black-Scholes model. This joint distribution plays a critical role in the derivation of the pricing formulas for alternating barrier options and their variants. As in ordinary barrier options, we consider eight types of alternating barrier options and derive their explicit option pricing formulas. To our knowledge, the pricing formulas for these options have never been obtained explicitly in the literature even under the Black-Scholes model. We also examine an autocallable equity-linked investment product to derive its explicit pricing formula. Our results are illustrated with numerical examples, showing the effect of different barrier levels and different values of correlation coefficient between two underlying asset prices.

**MSC:**

**62P05** Applications of statistics to actuarial sciences and financial mathematics

**91G20** Derivative securities (option pricing, hedging, etc.)

Cited in 1 Review

**Keywords:**

alternating barrier option; icicled barrier option; equity-linked products; Brownian motion; Esscher transform; factorization formula

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