

Precise—Then Even More Precise: Revisiting Discrete Option Pricing

Hsin-Chieh Wong¹ (翁新傑)

¹Department of Statistics & Fintech and Green Finance Center,
National Taipei University, New Taipei City, Taiwan

Abstract

The continuity correction approximation developed by Broadie, Glasserman, and Kou (1997, 1999) (BGK) for discretely monitored barrier and lookback options remains one of the most widely used analytical results. However, despite a generation of subsequent research, no sharper or higher-order refinement of the continuity correction has been established for these options. This paper presents a refined asymptotic expansion of the BGK approximation for path-dependent option prices, using the smooth-fit principle. The resulting higher-order correction continues to shift the barrier level, but the adjustment factors are no longer determined solely by the underlying volatility. Instead, the new formula incorporates the drift and introduces interpretable economic terms that shed further light on the structure of the correction. Numerical examples are also provided to illustrate and validate the theoretical improvements.

Keyword: Overshoot, first-passage time, Laplace transform, boundary crossing.