

## Pricing Discrete Barrier Options with an Adaptive Mesh Model

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### Abstract

Many exotic derivatives do not have closed-form valuation equations, and must be priced using approximation methods. Where they can be applied, standard lattice techniques based on binomial and trinomial trees will achieve correct valuations asymptotically. They can also generally handle American exercise. But for many problems, including pricing barrier options, convergence may be slow and erratic, producing large errors even with thousands of time steps and millions of node calculations. Options with price barriers that are only monitored at discrete points in time present additional difficulty for lattice models. Standard tree methods increase accuracy by shrinking the time and price step size throughout the lattice, but this increases the number of calculations sharply and much of the additional computation is in regions of the tree where it makes little difference to accuracy. A previous paper, Figlewski and Gao [1999], introduced the Adaptive Mesh Model (AMM), a very flexible approach that greatly increases efficiency in trinomial lattices. Coarse time and price steps are used in most of the tree, but small sections of finer mesh are constructed to improve resolution in specific critical areas. This paper presents an especially effective AMM structure for pricing options with discrete barriers. In a basic example, an AMM with 60 time steps is ten times more accurate than a 5000-step trinomial, but runs more than 1000 times faster.

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