Financial Mathematics

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Le Chen

lzc0090@auburn.edu

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Auburn University
Auburn AL

[1] Based on Robert L. McDonald's *Derivatives Markets*, 3rd Ed, Pearson, 2013.

Chapter 14. Exotic Options: I

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The barrier option has the payoff
that depends on whether over the option life the underlying price
reaches a specified level.

- Path-dependent
- Since barrier puts and calls never pay more than standard puts and calls, they are no more expensive than standard puts and calls
- Widely used in practice

Types of Barrier Options

1. **Knock-out options**: Go out of existence

   down-and-out: if the asset price falls to reach the barrier

   up-and-out: if the asset price rises to reach the barrier

2. **Knock-in options**: Come into existence

   down-and-in: if the asset price falls to reach the barrier

   up-and-in: if the asset price rises to reach the barrier

3. **Rebate options**: make a fixed payment if the asset price reaches the barrier

   down rebates: if the asset price falls to reach the barrier

   up rebates: if the asset price rises to reach the barrier

$$\underbrace{\{\text{down}, \text{up}\}}_{\text{Knock}} \times \{\text{in}, \text{out}\} \times \{\text{call}, \text{put}\}$$

Knock-in option + Knock-out option = Normal option

Down-and-in call + Down-and-out call = Standard call

Down-and-in put + Down-and-out put = Standard put

Up-and-in call + Up-and-out call = Standard call

Up-and-in put + Up-and-out put = Standard put