Financial Mathematics

MATH 5870/6870[1]
Fall 2021

Le Chen

lzc0090@auburn.edu

Last updated on

September 2, 2021

Auburn University
Auburn AL

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

Chapter 11. Binomial Option Pricing: Selected Topics

Chapter 11. Binomial Option Pricing: Selected Topics

§ 11.1 Understanding Early Exercise

§ 11.2 Understanding risk-neutral pricing

§ 11.3 The Binomial tree and lognormality

§ 11.4 Problems

Chapter 11. Binomial Option Pricing: Selected Topics

§ 11.1 Understanding Early Exercise

§ 11.2 Understanding risk-neutral pricing

§ 11.3 The Binomial tree and lognormality

§ 11.4 Problems

Options may be rationally exercised prior to expiration

By exercising, the option holder

- Receives the stock and thus receives dividends
- Pays the strike price prior to expiration (this has an interest cost)
- Loses the insurance implicit in the call against the possibility that the stock price will be less than the strike price at expiration

If volatility is zero, the value of insurance is zero. Then, it is optimal to defer exercise as long as interest savings on the strike exceed dividends lost

$$rK > \delta S$$

$$\Downarrow$$

$$\text{It is optimal to exercise} \quad \Longleftrightarrow \quad S > \frac{rK}{\delta}$$

E.g. When $r = \delta$ and $\sigma = 0$, any in-the-money option should be exercised immediately.

When volatility is positive, the implicit insurance has value that varies with time to expiration.

FIGURE 11.1

Early-exercise boundaries for volatilities of 10%, 30%, and 50% for a 5-year American call option. In all cases, $K = \$100$, $r = 5\%$, and $\delta = 5\%$.

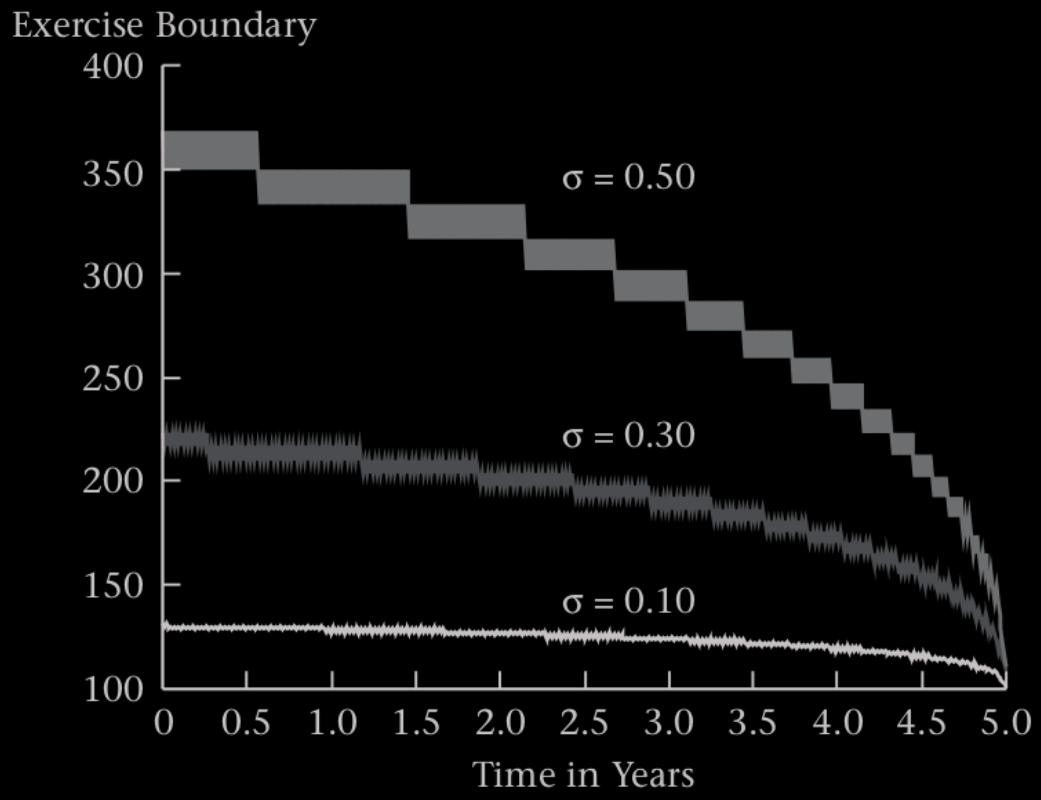

FIGURE 11.2

Early-exercise boundaries for volatilities of 10%, 30%, and 50% for a 5-year American put option. In all cases, $K = \$100$, $r = 5\%$, and $\delta = 5\%$.