

Online 2: Option Pricing of Debt Contracts

Charles B. Moss ¹

¹University of Florida

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1 Using the Random Draw Subroutine

2 Payoff Function

Using the Random Draw Subroutine

As a starting point, let's simply use the subroutine to generate a sample of 100 observations of normal random variables with a mean of 5 and a standard deviation of 3.

Payoff Function

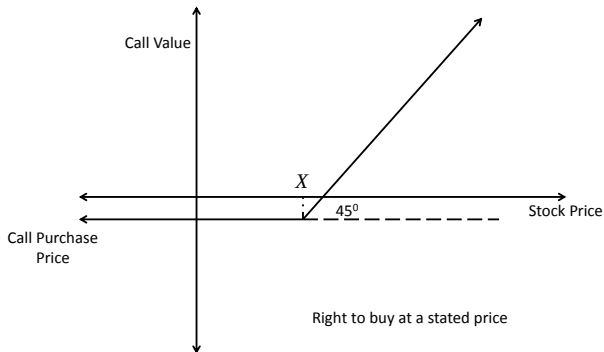
Let's turn this into an option.

- A (single-period) *call option* represents the right, but not the obligation to **purchase** at the end of the period a set number of units (shares) of a particular primitive asset at a price specified at the beginning of the period.
 - This price is known as the *strike price* or *exercise price* X .

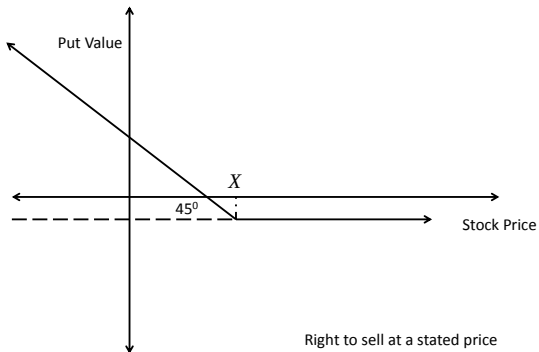
$$\hat{y}_c = \max(\hat{y} - X, 0) \quad (1)$$

- A *put option* is like a call option, but it represents the right to sell.

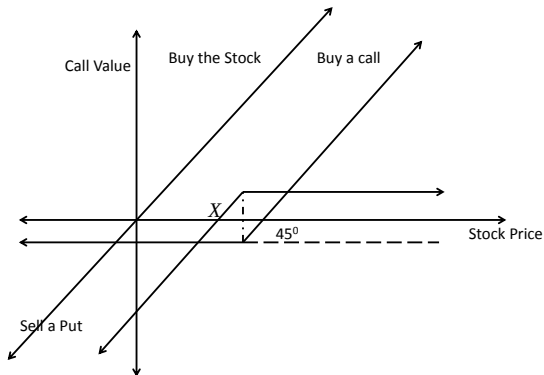
Call Option



Put Option



Option Equilibrium



Suppose that you purchase a call option of the asset for \$ 4.00. If the market price is greater than \$ 4.00, you will exercise the option, purchase the asset at \$ 4.00 and sell it at say \$ 6.50 and make \$ 2.50 per unit.

Next, think about valuing debt as a put option. Let the rate of return on the underlying asset be normally distributed with a mean of 0.05 and a variance of 0.03. Given a stated interest rate of 0.03, the investor earns a negative rate of return as long as the return is less than 0.03. If that happens, we assume that the investor walks away from the investment – defaults. The return on the loans is then

$$y_P = \min(r - 0.03, 0.03) \quad (2)$$

where r is the rate of return on the underlying asset.