Options

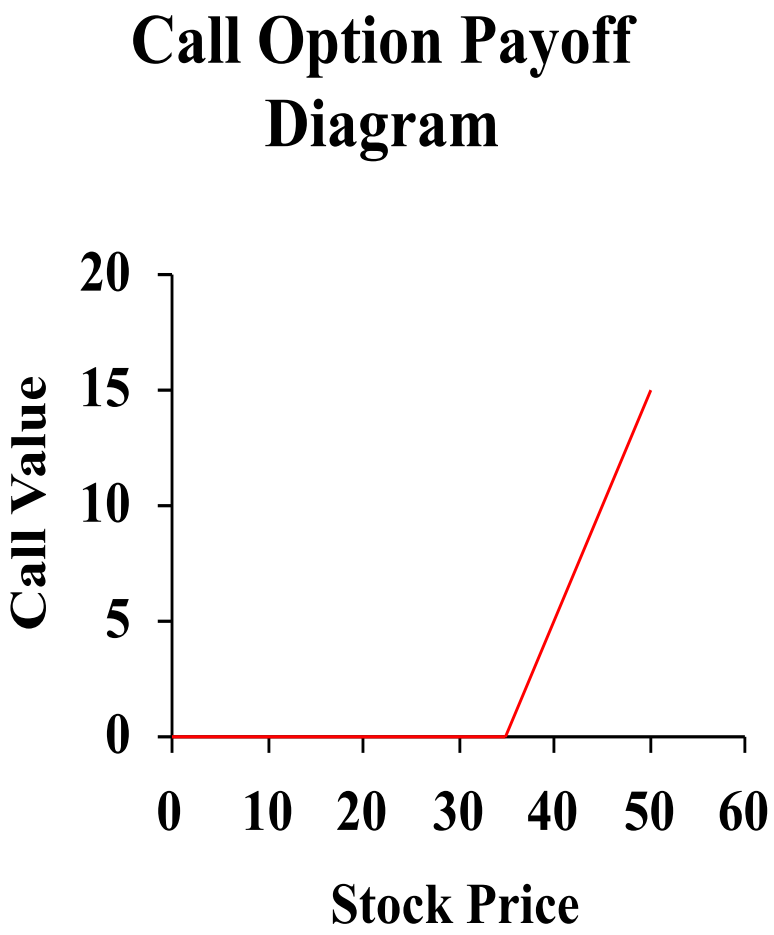
MBA 614

Option Terminology 25.1

- Call
- Put
- Strike or Exercise price
- Expiration date
- Option premium
- Option writer
- American Option
- European Option

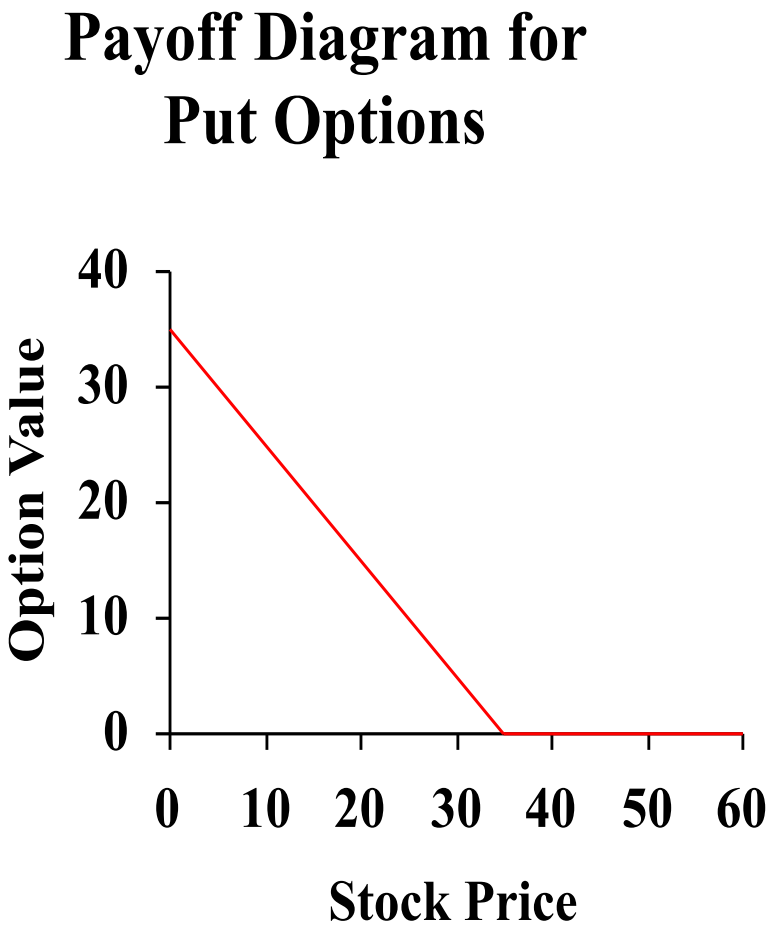
Option Payoffs – Calls

- The value of the call at expiration is the intrinsic value
  - $C_1 = \text{Max}(0, S_1 - E)$
  - If $S_1 < E$, then the payoff is 0
  - If $S_1 > E$, then the payoff is $S_1 - E$
- Assume that the exercise price is $35



Option Payoffs - Puts

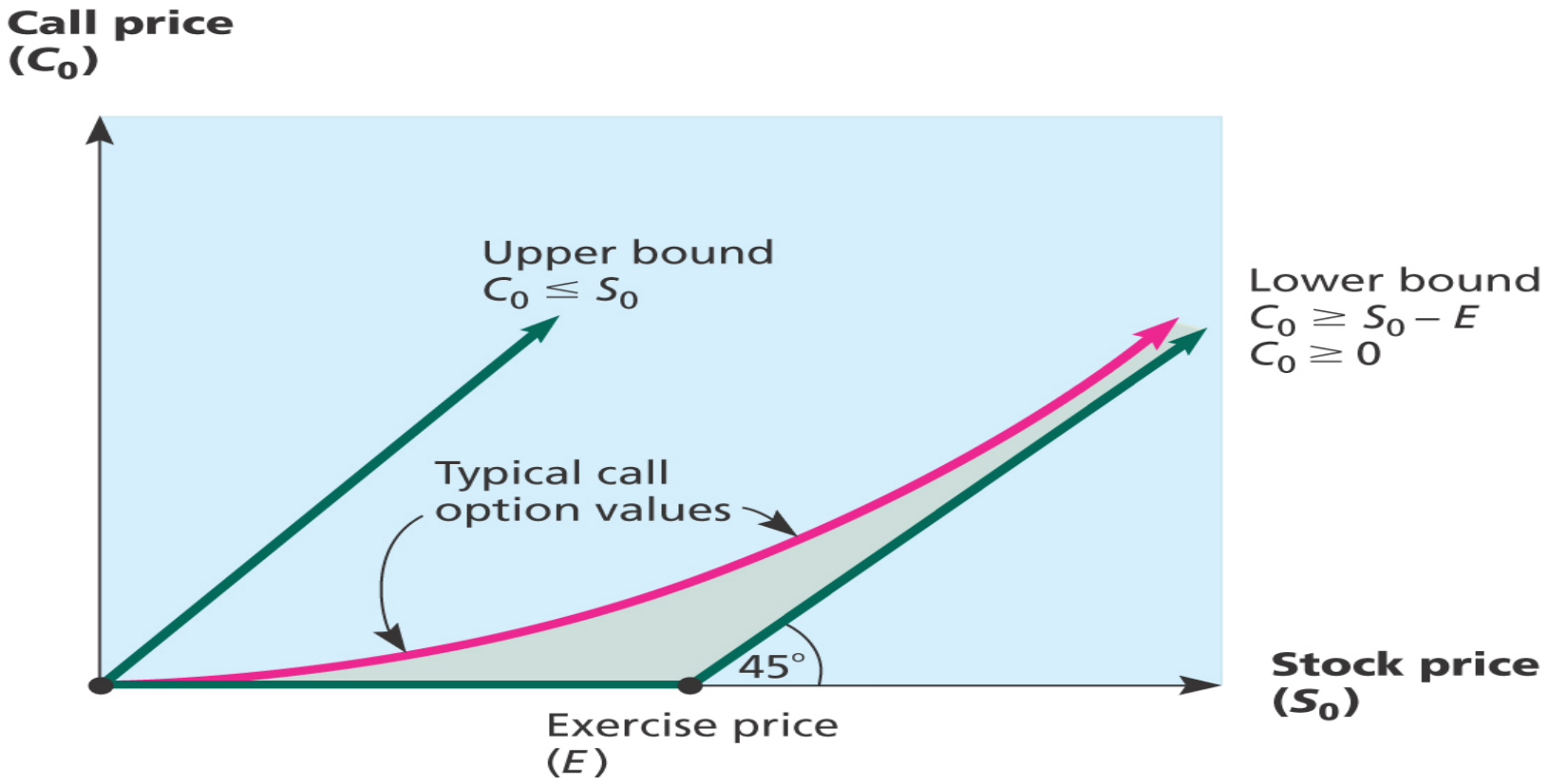
- The value of a put at expiration is the intrinsic value
  - $P_1 = \text{Max}(0, E - S_1)$
  - If $S_1 < E$, then the payoff is $E - S_1$
  - If $S_1 > E$, then the payoff is 0
- Assume that the exercise price is $35



Call Option Bounds

- Upper bound
  - Call price must be less than or equal to the stock price
- Lower bound
  - Call price must be greater than or equal to the stock price minus the exercise price or zero, whichever is greater
- If either of these bounds are violated, there is an arbitrage opportunity

Figure 25.3 – Value of a call option before expiration



As shown, the upper bound on a call's value is given by the value of the stock ($C_0 \leq S_0$). The lower bound is either $S_0 - E$ or zero, whichever is larger. The highlighted curve illustrates the value of a call option prior to maturity for different stock prices.

A Simple Model

- An option is "in-the-money" if the payoff is greater than zero
- If a call option is sure to finish in-the-money, the option value would be
  - $C_0 = S_0 - PV(E)$
- If the call is worth something other than this, then there is an arbitrage opportunity

What Determines Option Values?

- Stock price
  - As the stock price increases, the call price increases and the put price decreases
- Exercise price
  - As the exercise price increases, the call price decreases and the put price increases
- Time to expiration
  - Generally, as the time to expiration increases both the call and the put prices increase
- Risk-free rate
  - As the risk-free rate increases, the call price increases and the put price decreases

What about Variance? 25.3

- When an option may finish out-of-the-money (expire without being exercised), there is another factor that helps determine price
- The variance in underlying asset returns is a less obvious, but important, determinant of option values
- The greater the variance, the more the call and the put are worth
  - If an option finishes out-of-the-money, the most you can lose is your premium, no matter how far out it is
  - The more an option is in-the-money, the greater the gain
  - You gain from volatility on the upside, but don't lose anymore from volatility on the downside

Table 25.1 – Five factors that determine option values

Factor	Direction of Influence	
	Calls	Puts
Current value of the underlying asset	(+)	(–)
Exercise price on the option	(–)	(+)
Time to expiration on the option	(+)	(+)
Risk-free rate	(+)	(–)
Variance of return on the underlying asset	(+)	(+)