Chapter 20

UNDERSTANDING OPTIONS

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20-1 CALLS, PUTS, AND SHARES

- Call Option
  - Right to buy an asset at specified price on or before exercise date
- Put Option
  - Right to sell asset at specified price on or before exercise date

20-1 CALLS, PUTS, AND SHARES

- Option Obligations

	Long	Short
Call option	Right to buy asset	Obligation to sell asset
Put option	Right to sell asset	Obligation to buy asset

20-1 CALLS, PUTS, AND SHARES

- Derivatives
  - Financial instrument created from another instrument
- Option Premium
  - Price paid for option, above price of underlying security
- Intrinsic Value
  - Difference between strike price and stock price
- Time Premium
  - Value of option above intrinsic value

20-1 CALLS, PUTS, AND SHARES

- Exercise Price (Strike Price)
  - Price at which security is bought or sold
- Expiration Date
  - Last date on which option can be exercised
- American Call
  - Can be exercised any time up to expiration date
- European Call
  - Can only be exercised on expiration date

TABLE 20.1 OPTIONS ON APPLE STOCK, OCTOBER 2011

Maturity Date	Exercise Price	Price of Call Option	Price of Put Option
December 2011	$340	$ 69.30	$ 3.43
	370	44.30	9.90
	400	24.30	19.00
	430	11.35	36.15
	460	4.55	56.95
April 2012	$340	$ 79.09	$15.20
	370	61.60	23.70
	400	44.05	37.15
	430	30.30	53.10
	460	19.70	68.95
January 2013[a]	$340	$104.00	$34.00
	370	84.66	47.54
	400	70.00	61.50
	430	55.55	77.40
	460	44.36	97.30

20-1 CALLS, PUTS, AND SHARES

- Option Value
  - Value at expiration is a function of stock price and exercise price
    - Example
      - Option values given exercise price of $80

Stock Price	$60	70	80	90	100	110
Call value	0	0	0	10	20	30
Put value	20	10	0	0	0	0

FIGURE 20.1A APPLE POSITION DIAGRAM, CALL

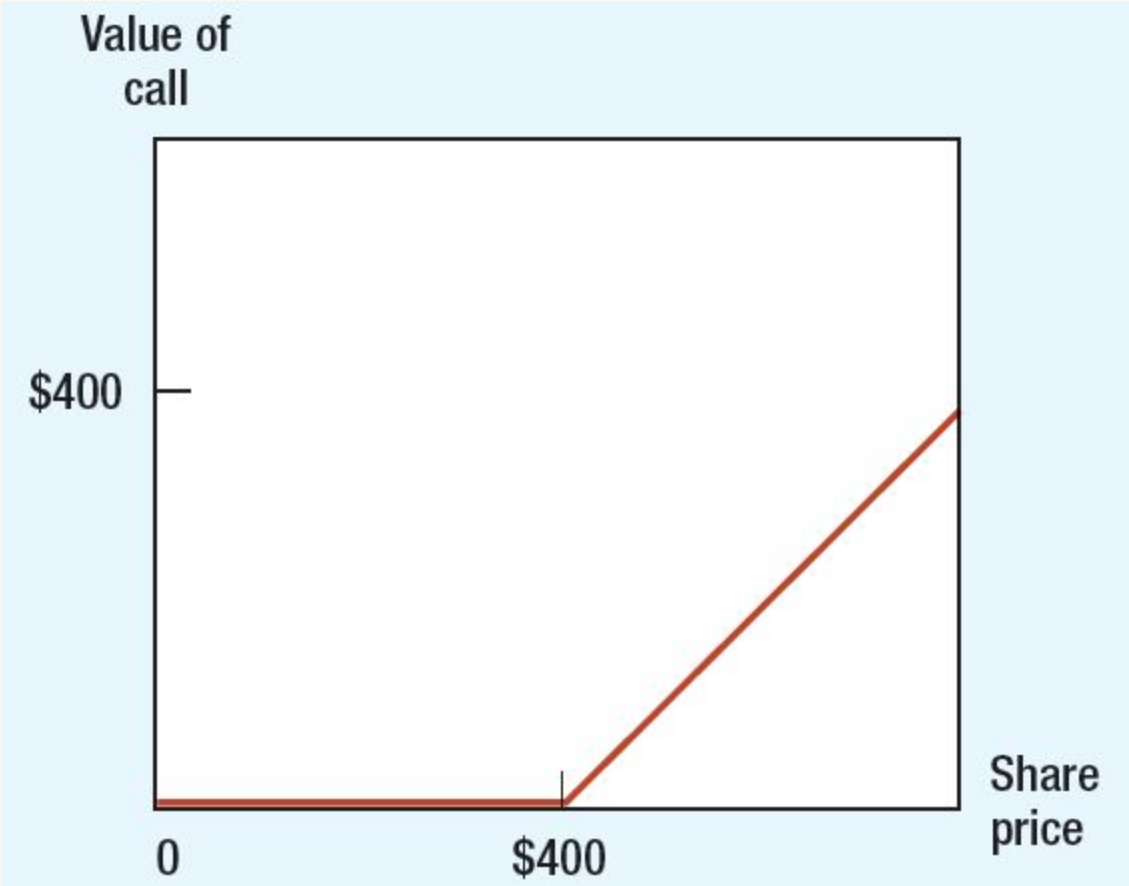


FIGURE 20.1B APPLE POSITION DIAGRAM, PUT

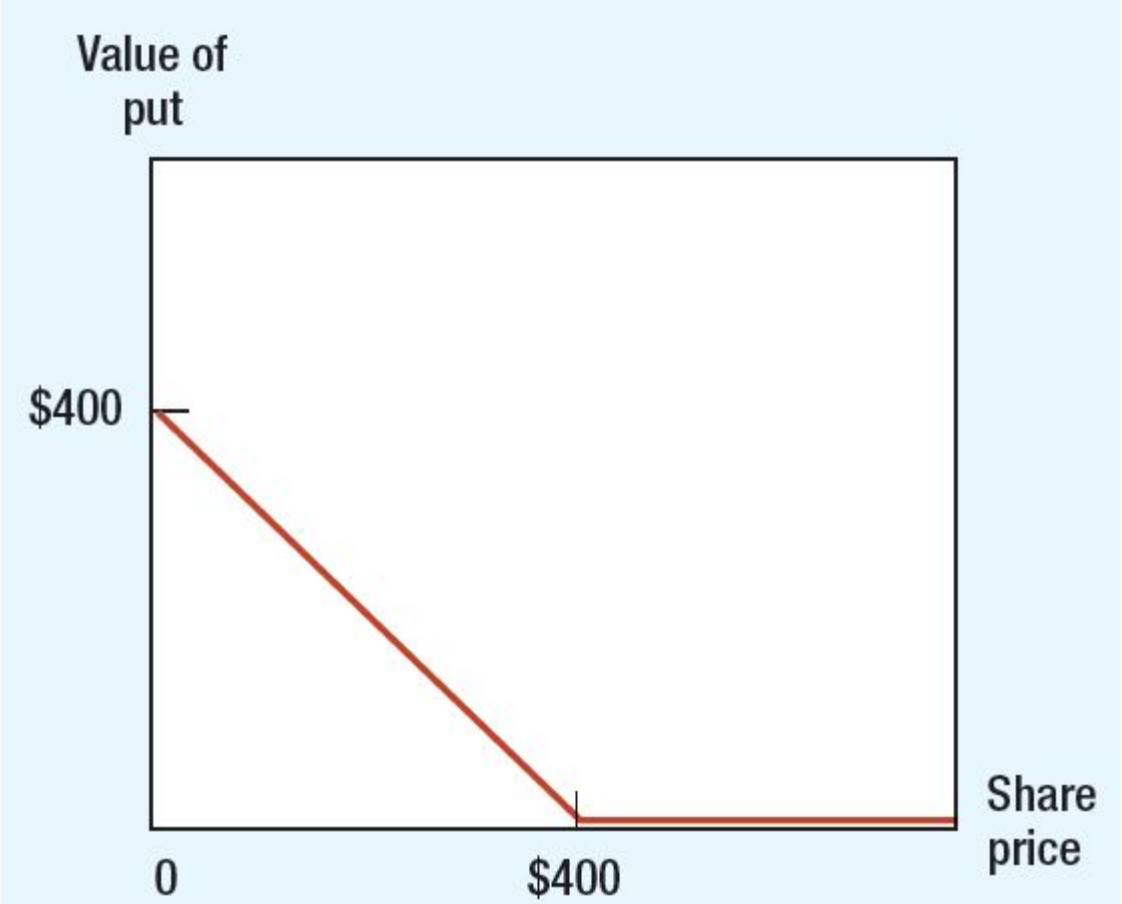


FIGURE 20.2A PAYOFF TO SELLER OF APPLE CALL

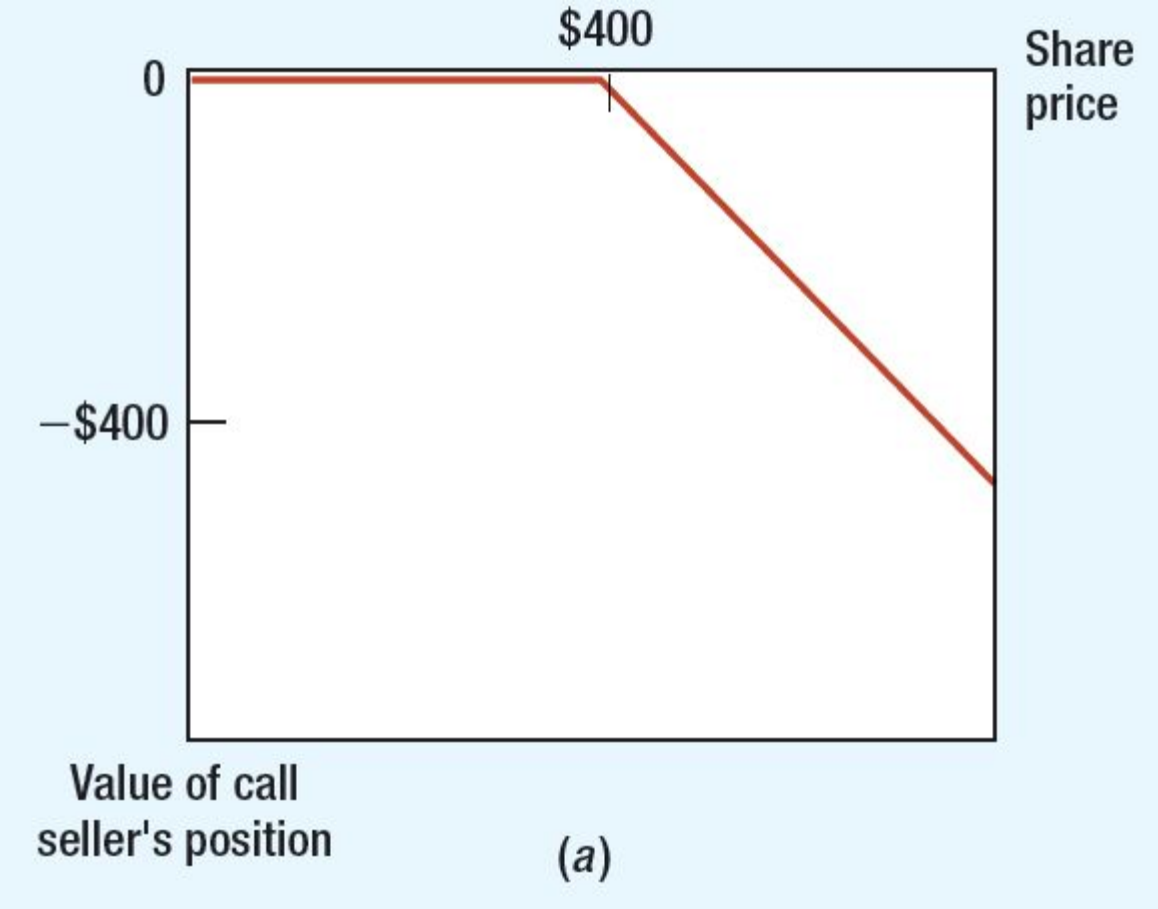


FIGURE 20.2B PAYOFF TO SELLER OF APPLE PUT

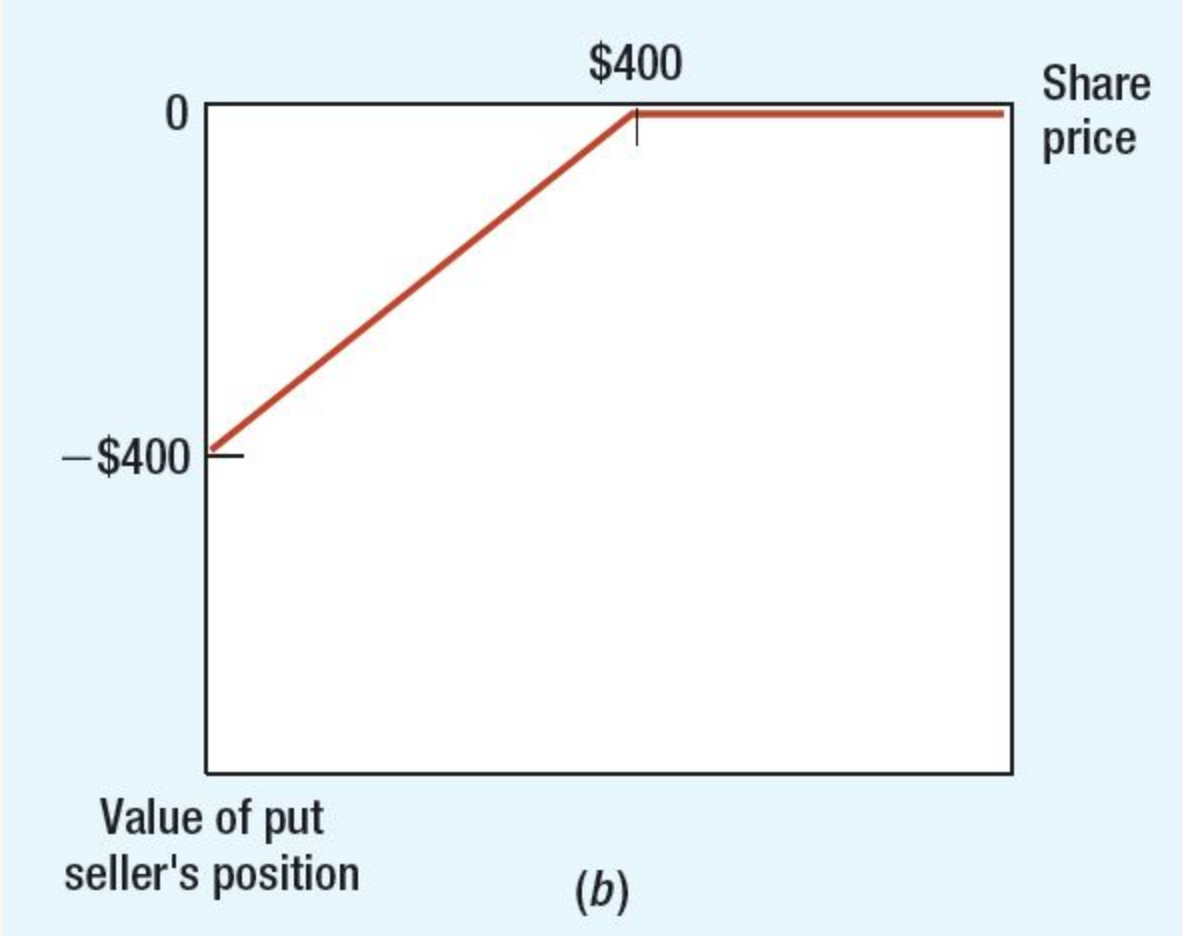


FIGURE 20.3A PROFIT DIAGRAM FOR APPLE

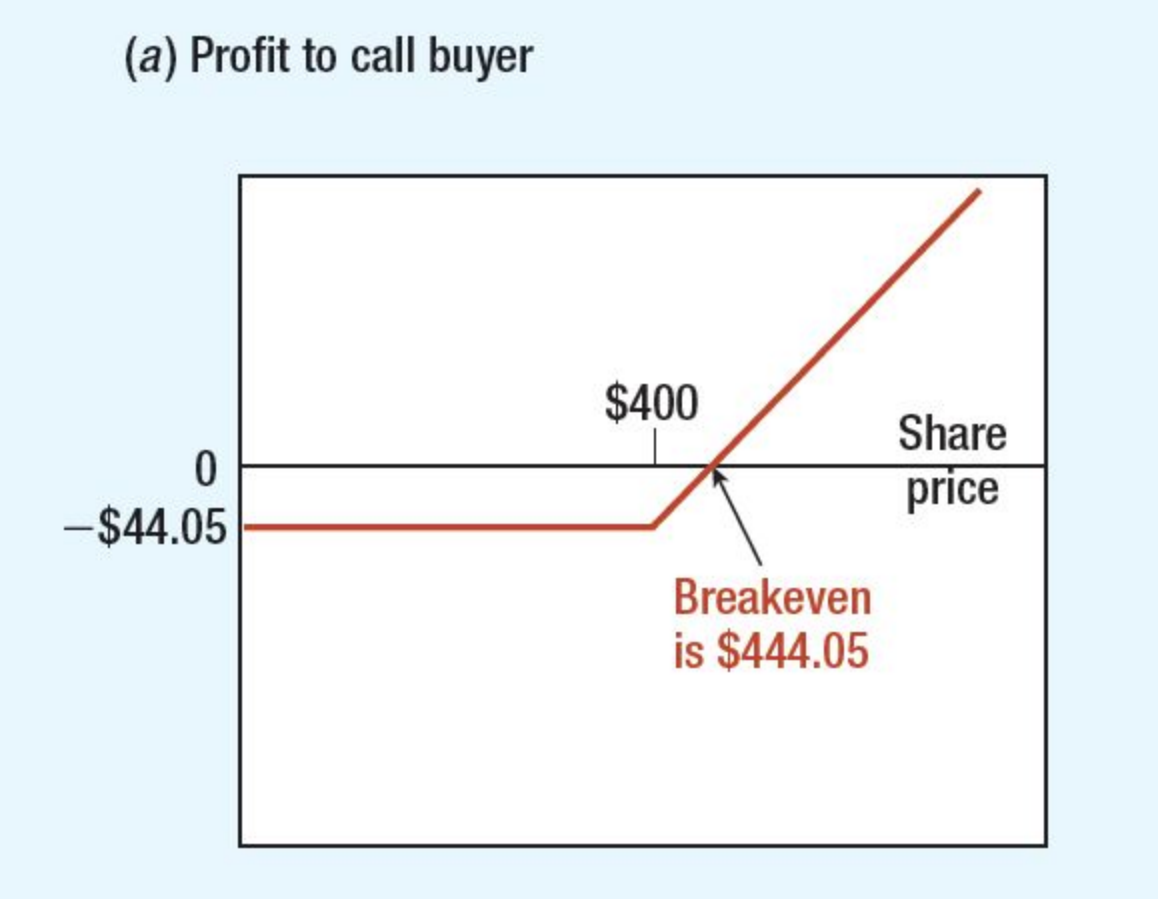
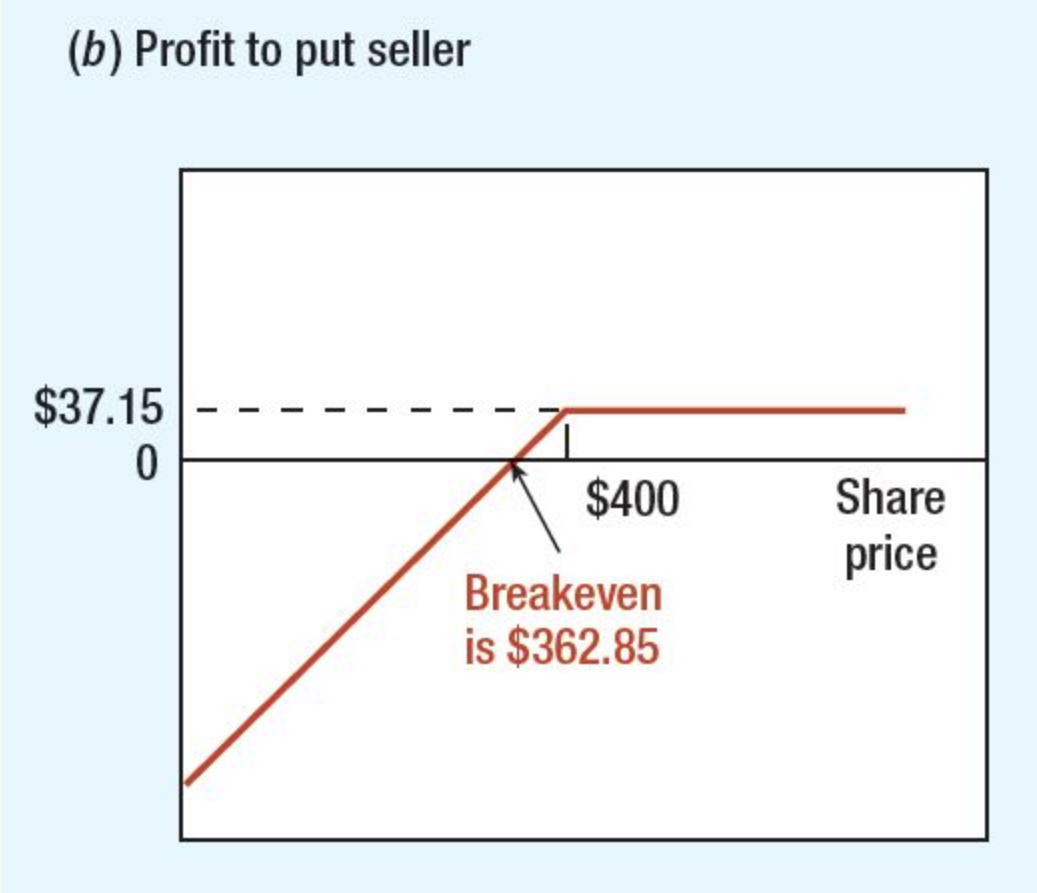
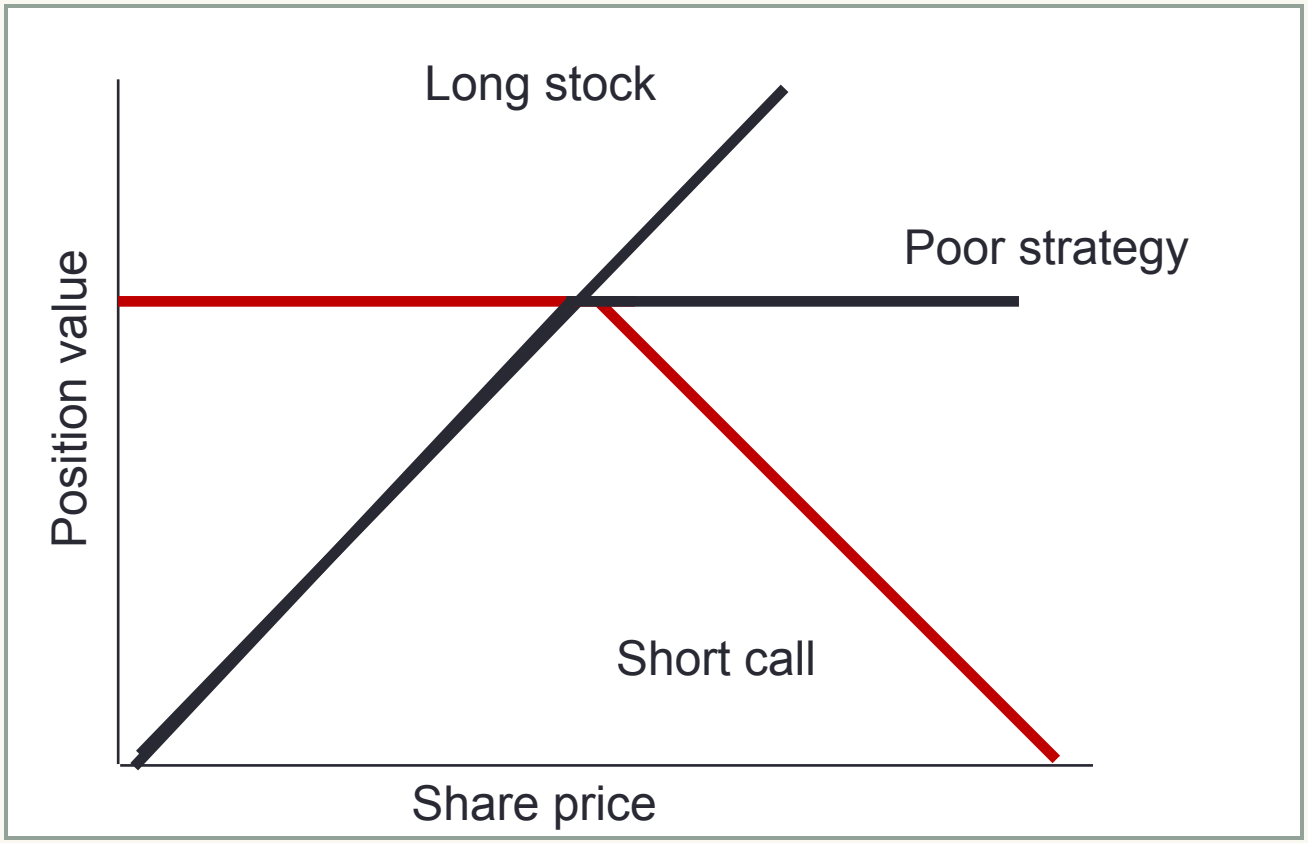


FIGURE 20.3B PROFIT DIAGRAM FOR APPLE



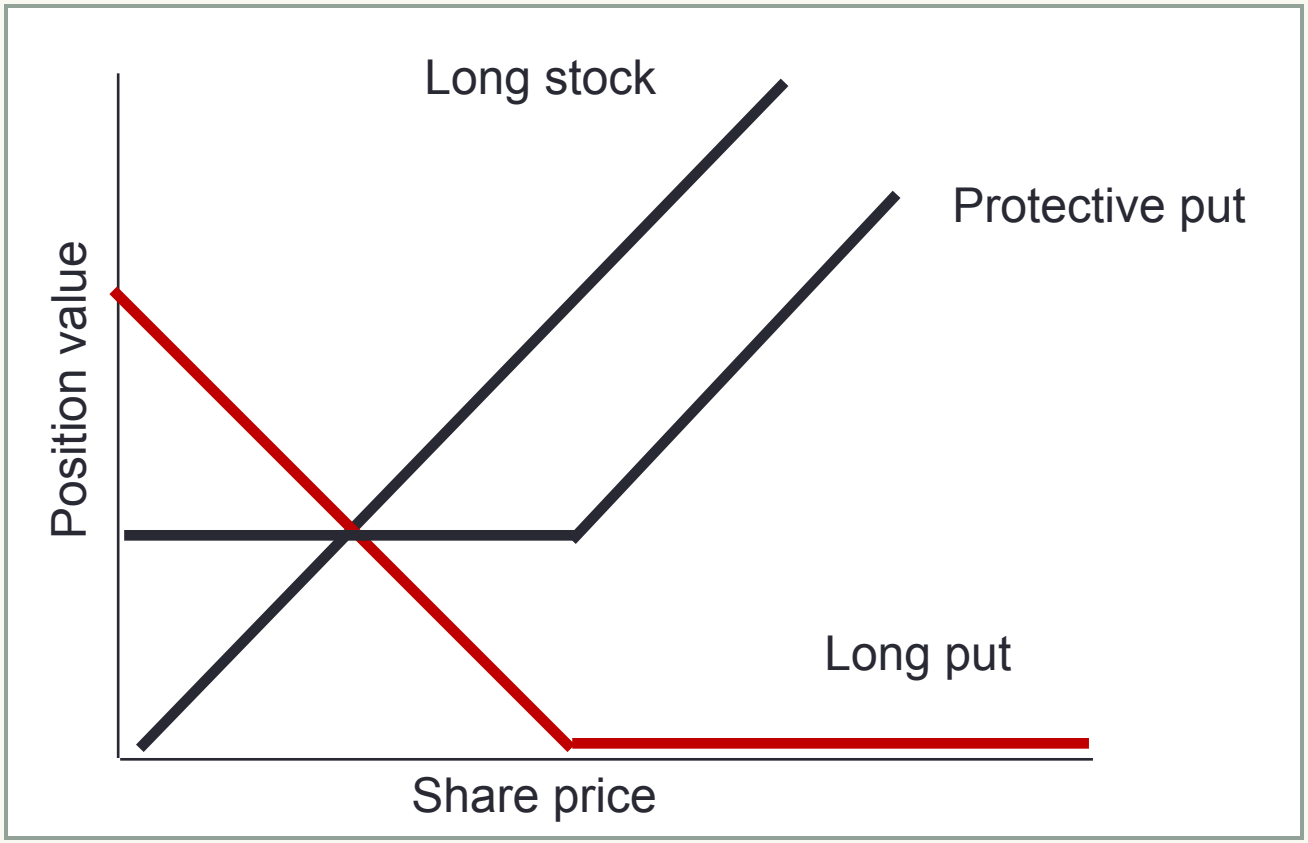
20-1 CALLS, PUTS, AND SHARES

- Position Diagram
  - Long stock and short call



20-1 CALLS, PUTS, AND SHARES

- Position Diagram
  - Protective put: long stock and long put



20-1 CALLS, PUTS, AND SHARES

- Position Diagram
  - Straddle: long call and long put

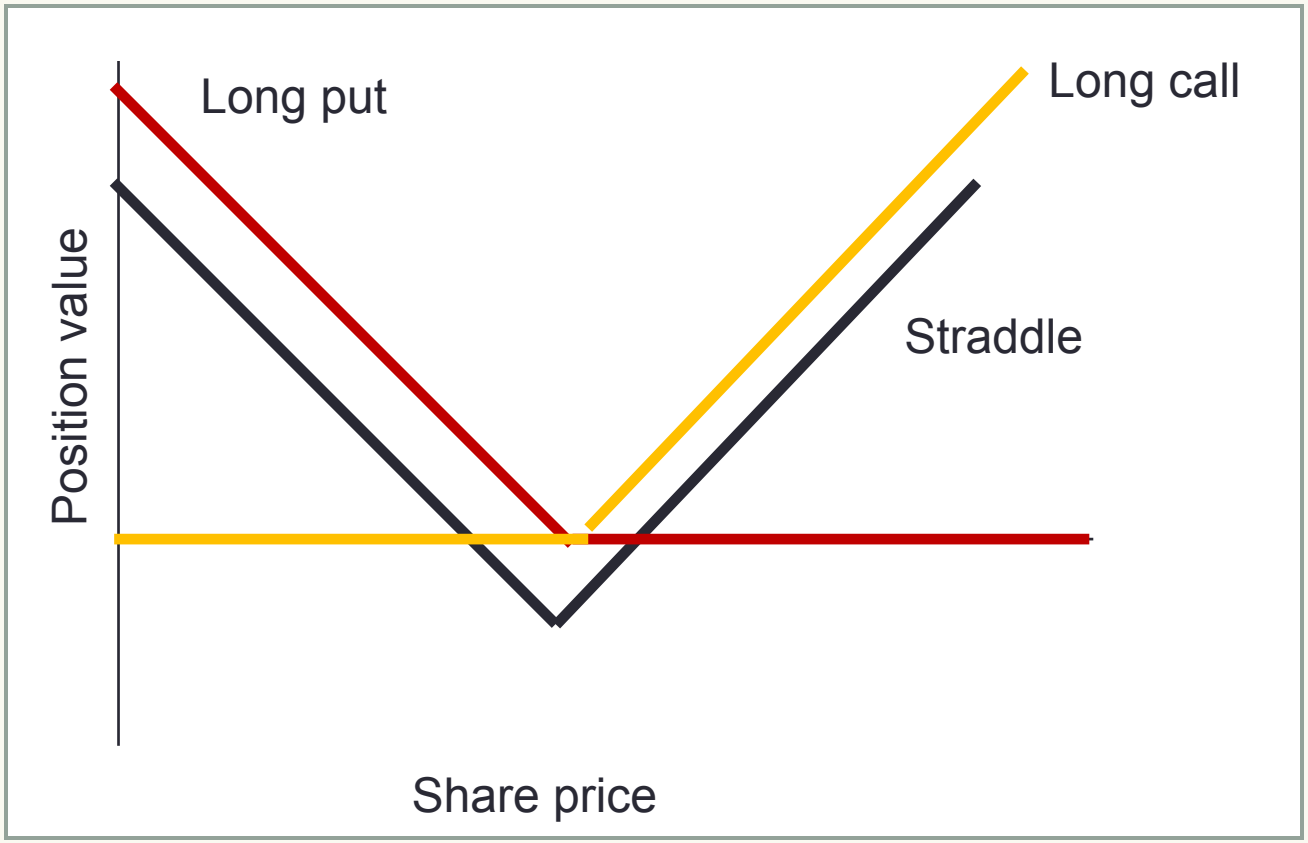


FIGURE 20.4 SIX-MONTH PAYOFF OPTIONS, APPLE

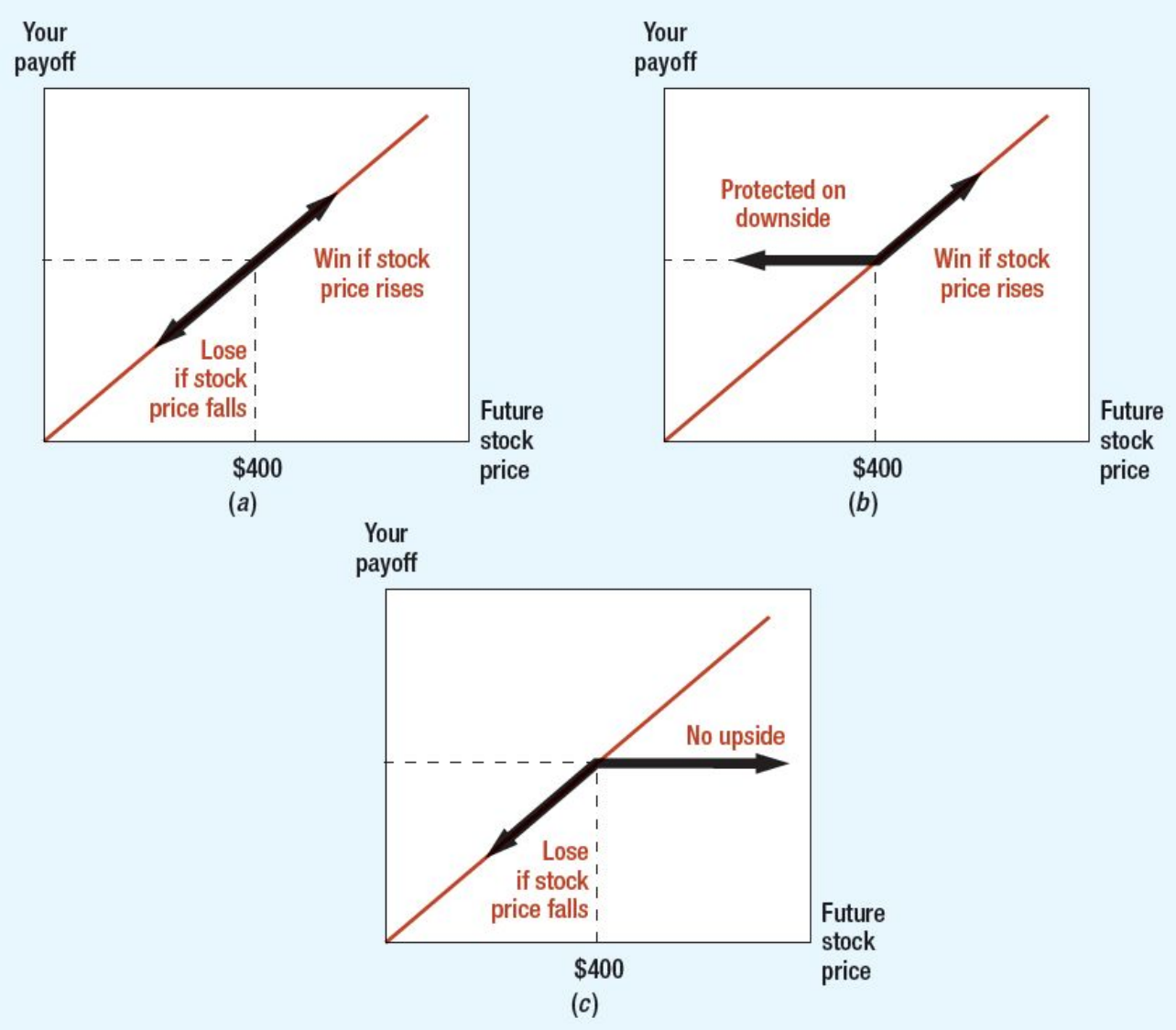


FIGURE 20.5 OPTIONS

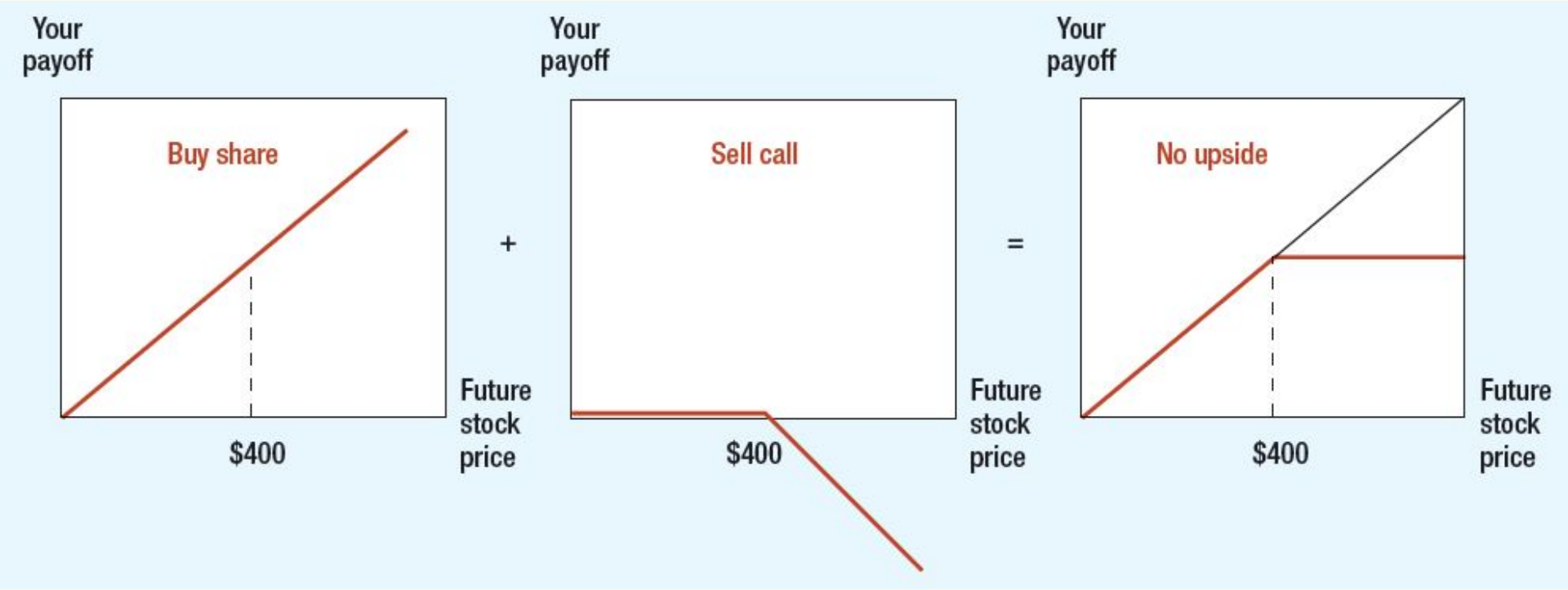


FIGURE 20.6 PROTECTION STRATEGIES

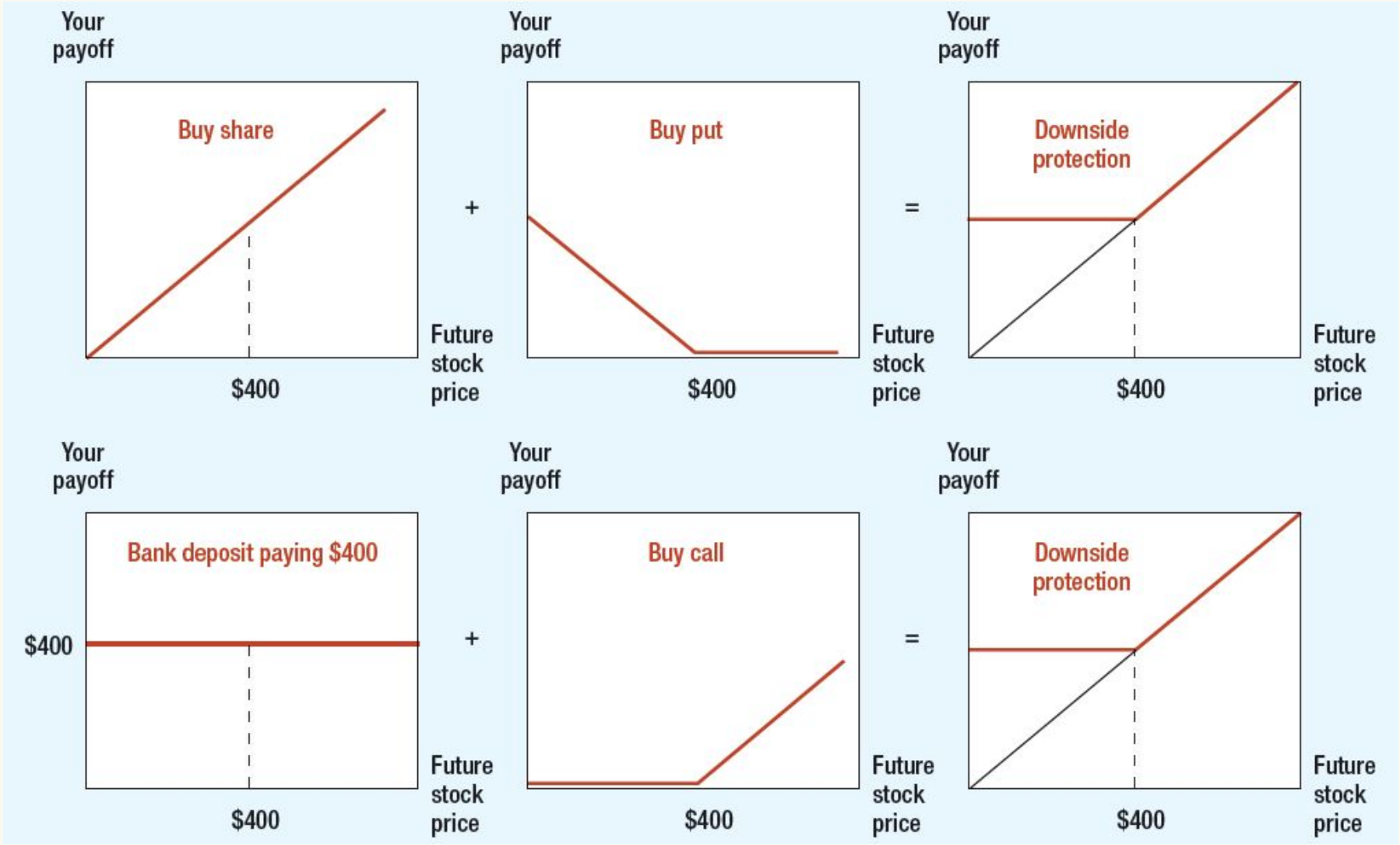


FIGURE 20.7 CALL TO PUT

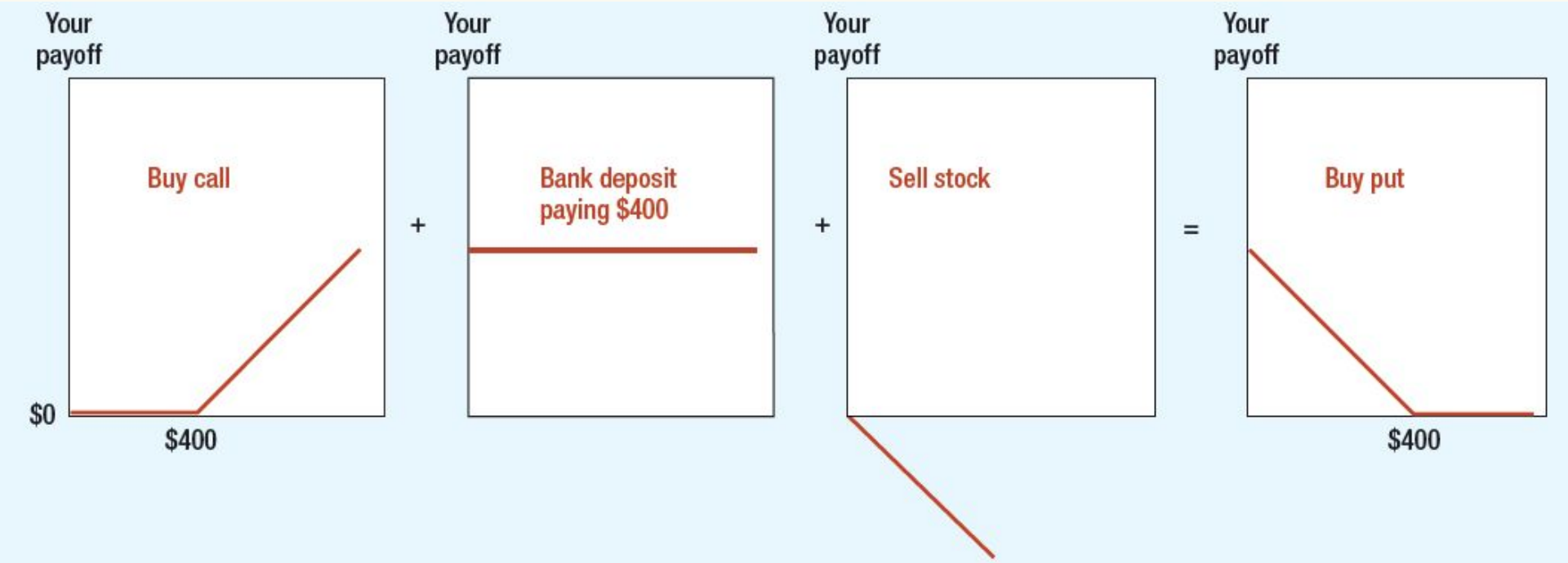


FIGURE 20.8 TICKET PAYOFF

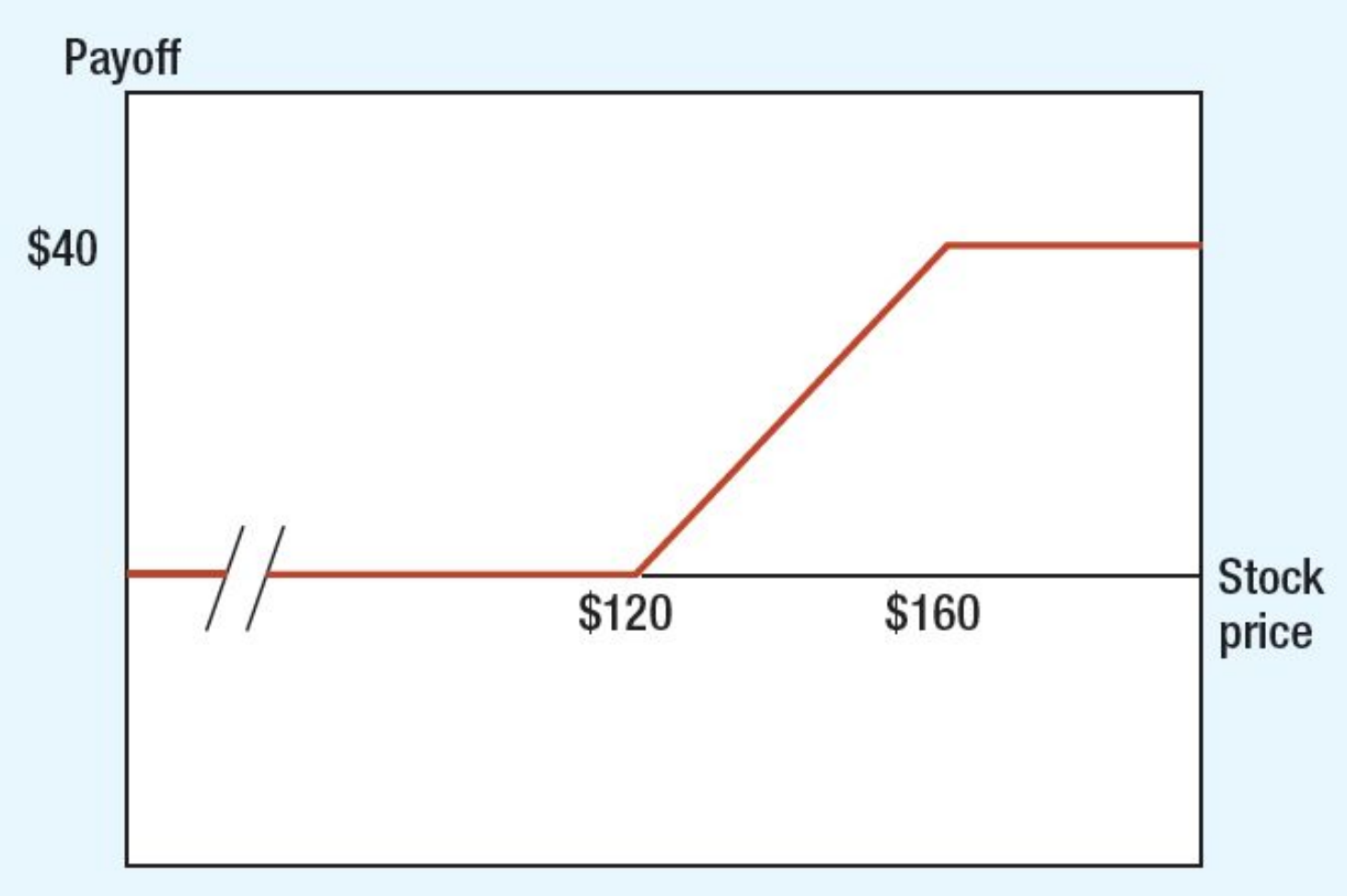
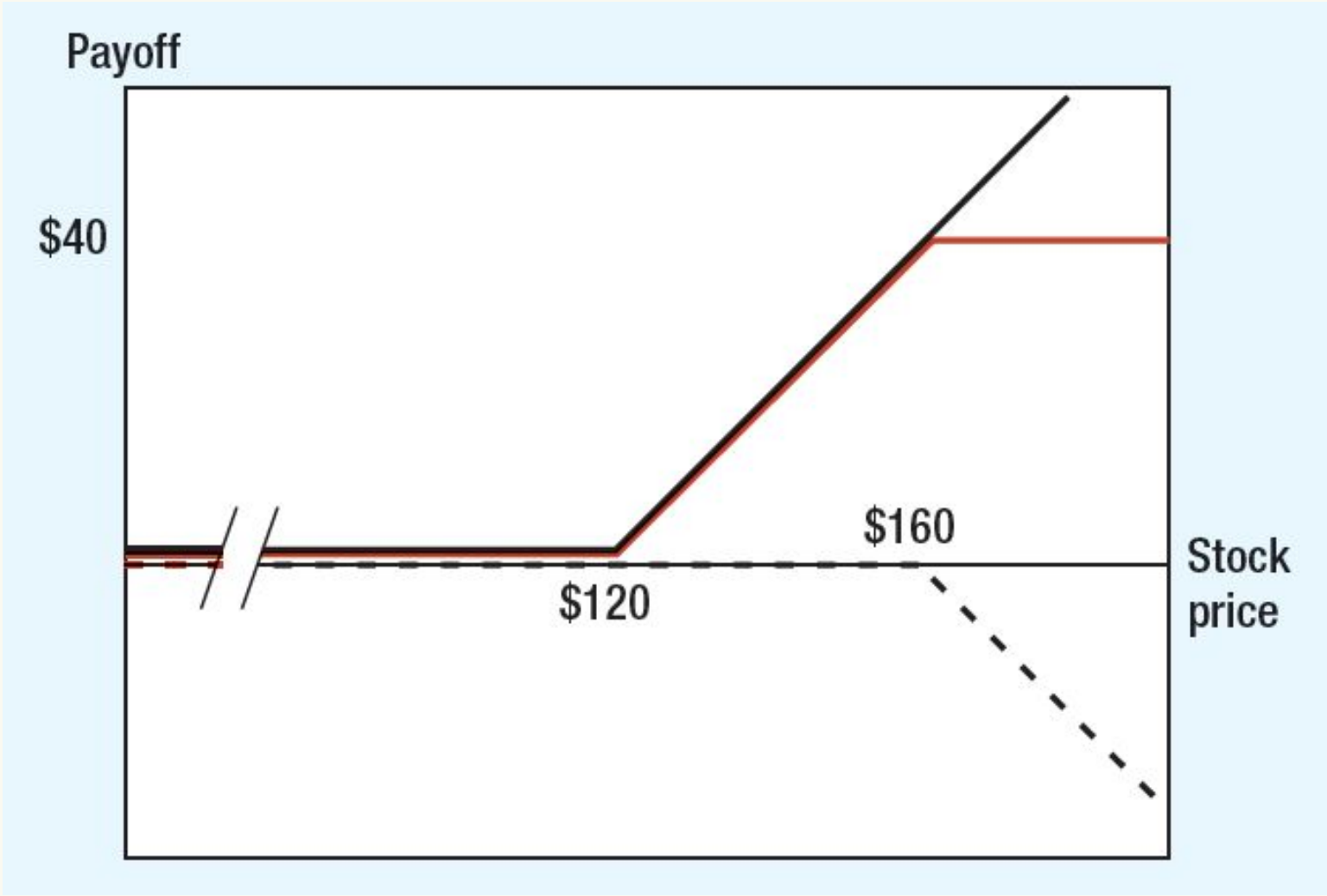


FIGURE 20.9 CALL PURCHASE AND SALE

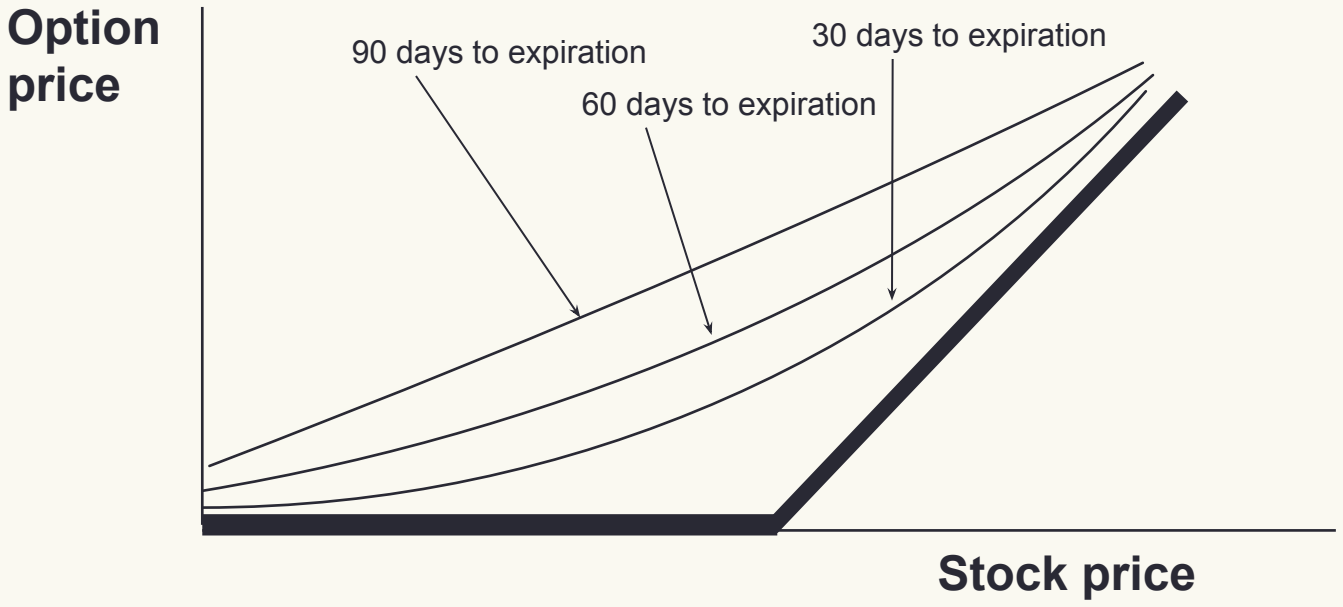


20-3 WHAT DETERMINES OPTION VALUES?

- Components of Option Price
  - Underlying stock price = P_s
  - Striking or exercise price = S
  - Volatility of stock returns (standard deviation of annual returns) = v
  - Time to option expiration = t = days/365
  - Time value of money (discount rate) = r
  - PV of dividends = D = (div)e^{-rt}

TIME DECAY CHART

- Option price decreases, all other things equal, as time to expiration decreases



20-3 WHAT DETERMINES OPTION VALUES?

Stock price

Upper limit

Lower limit

(Stock price - exercise price) or 0, whichever is higher

FIGURE 20.10 VALUE OF CALL BEFORE EXPIRATION DATE

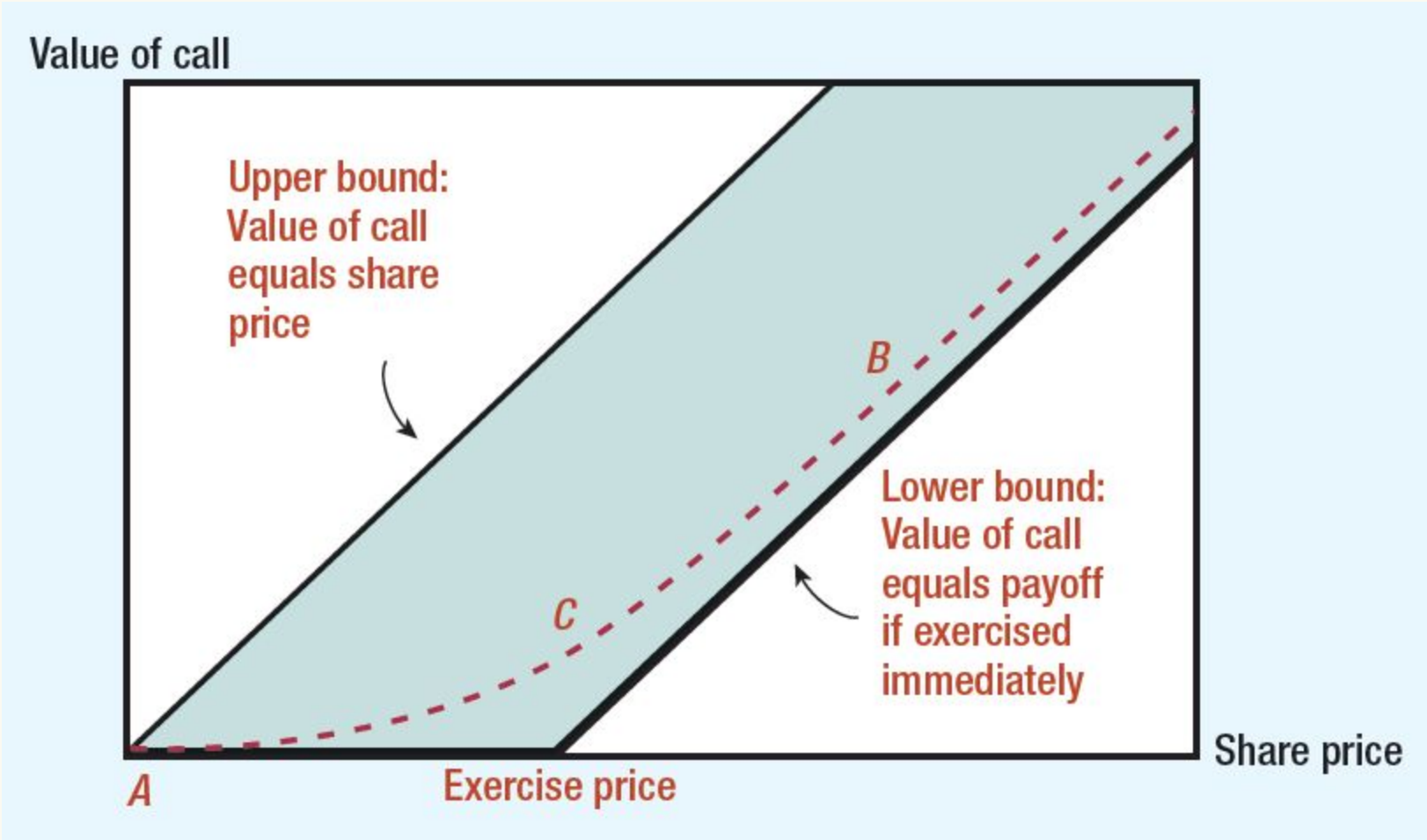


FIGURE 20.11 CALL OPTIONS, FIRMS X AND Y

- In each case, current share price equals exercise price; each option has 50% chance of success or failure
- Firm Y has greater chance of large payoff because it is more volatile

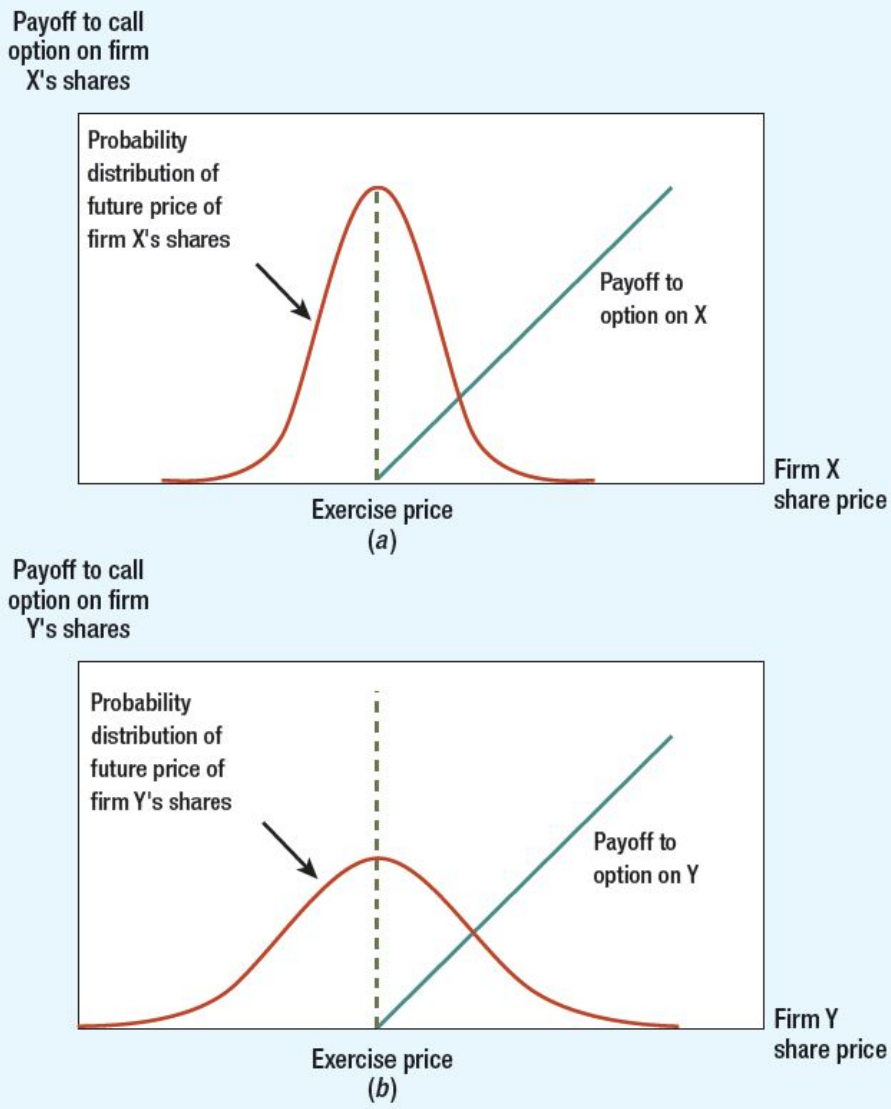


FIGURE 20.12 APPLE CALL OPTION VALUE VERSUS STOCK PRICE

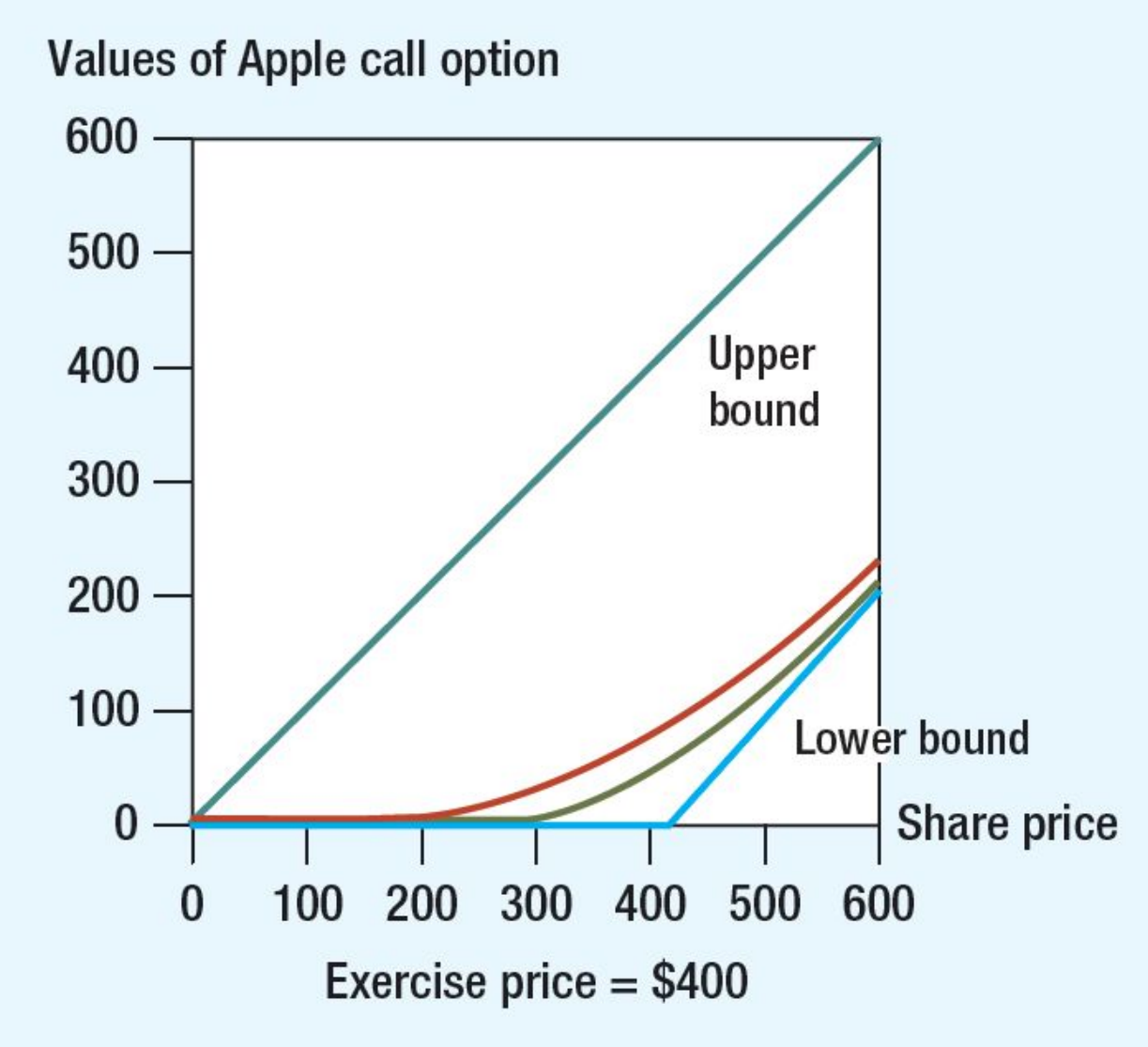


TABLE 20.2 DETERMINANTS OF CALL PRICE

1. If there is an *increase* in:	The change in the call option price is:
Stock price (P)	Positive
Exercise price (EX)	Negative
Interest rate (r_f)	Positive*
Time to expiration (t)	Positive
Volatility of stock price (σ)	Positive*
2. Other properties of call options:	
a. *Upper bound.* The option price is always less than the stock price.	
b. *Lower bound.* The call price never falls below the payoff to immediate exercise ($P - EX$ or zero, whichever is larger).	
c. If the stock is worthless, the call is worthless.	
d. As the stock price becomes very large, the call price approaches the stock price less the present value of the exercise price.	

TABLE 20.3 EXECUTIVE STOCK OPTIONS

	Establishment Industries	Digital Organics
Number of options	100,000	100,000
Exercise price	$25	$25
Maturity	5 years	5 years
Current stock price	$22	$22
Stock price volatility (standard deviation of return)	24%	36%