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Financial Investment

Option market

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Options: Definition

- Contract who stablishes the right to buy/sell an underlying asset at some pre-especified dates (maturity) and at some pre-determined price (strike).

- The option writter receives the option premium (cost of the option) upfront and takes the short position in the contract.

- The option holder pays the premium upfront and takes the long position in the contract.

Options: Terminology

- Call: Holder has the right to purchase.
- Put: Holder has the right to sell.
- Exercise or strike price: Specified price set in option contract.
- Maturity: Duration (tenor) of the contract.

Options: Terminology

- European option: Option can be exercised at maturity.
- American option: Option can be exercised at any time along the contract life.
- Bermudan option: Option can be exercised in some specified dates from inception time up to maturity.

Options: Terminology

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Options: Terminology

- Option over standard assets where the payoff depends on the price of the stock/bond/index are called vanilla.

- Payoff: profit obtained by the option holder.
  - Vanilla Call option: Difference between spot and exercise price.
  - Vanilla Put option: Difference between exercise and spot price.

- Options with more structured payoffs are called exotic.

Market and Exercise Price Relationships

In the Money - exercise of the option would be profitable.

Call: market price>exercise price

Put: exercise price>market price

Out of the Money - exercise of the option would not be profitable.

Call: market price<exercise price

Put: exercise price<market price

At the Money - exercise price and asset price are equal.

Payoffs and Profits at Expiration – Vanilla Calls

Recall that a call option gives the right to purchase a security at

exercise price

Exercise price $100, now sellin $110

Notation

Stock Price = ST Exercise Price = X

Payoff to Call Holder

(ST - X) if ST >X

0 if ST ≤ X

Profit to Call Holder

Payoff - Purchase Price

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Payoffs and Profits at Expiration – Vanilla Calls

Payoff to Call Writer

$-(S_T - X)$ if $S_T > X$

0 if $S_T \leq X$

Profit to Call Writer

Payoff + Premium

Figure 20.3 Payoff and Profit to Vanilla Call Option at Expiration

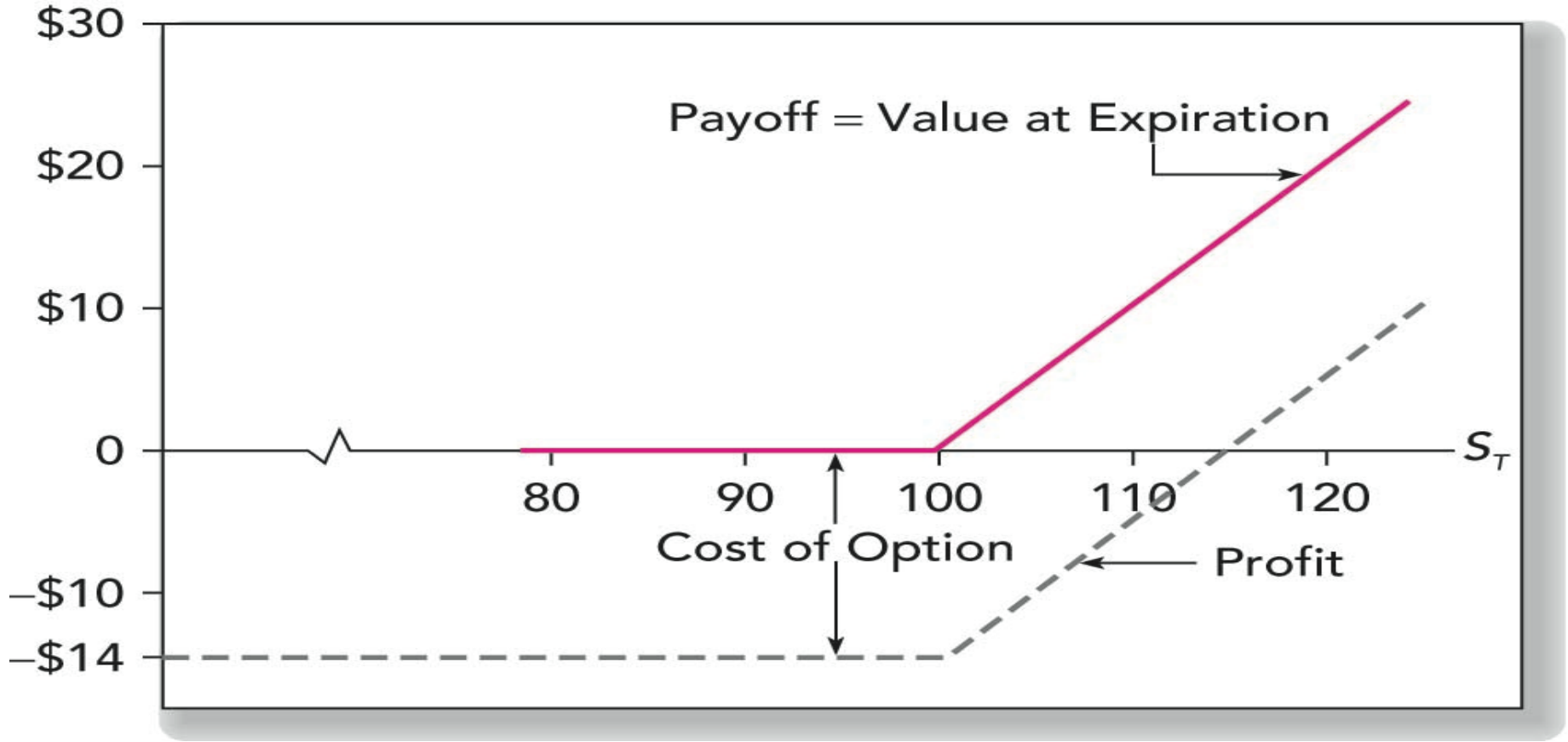

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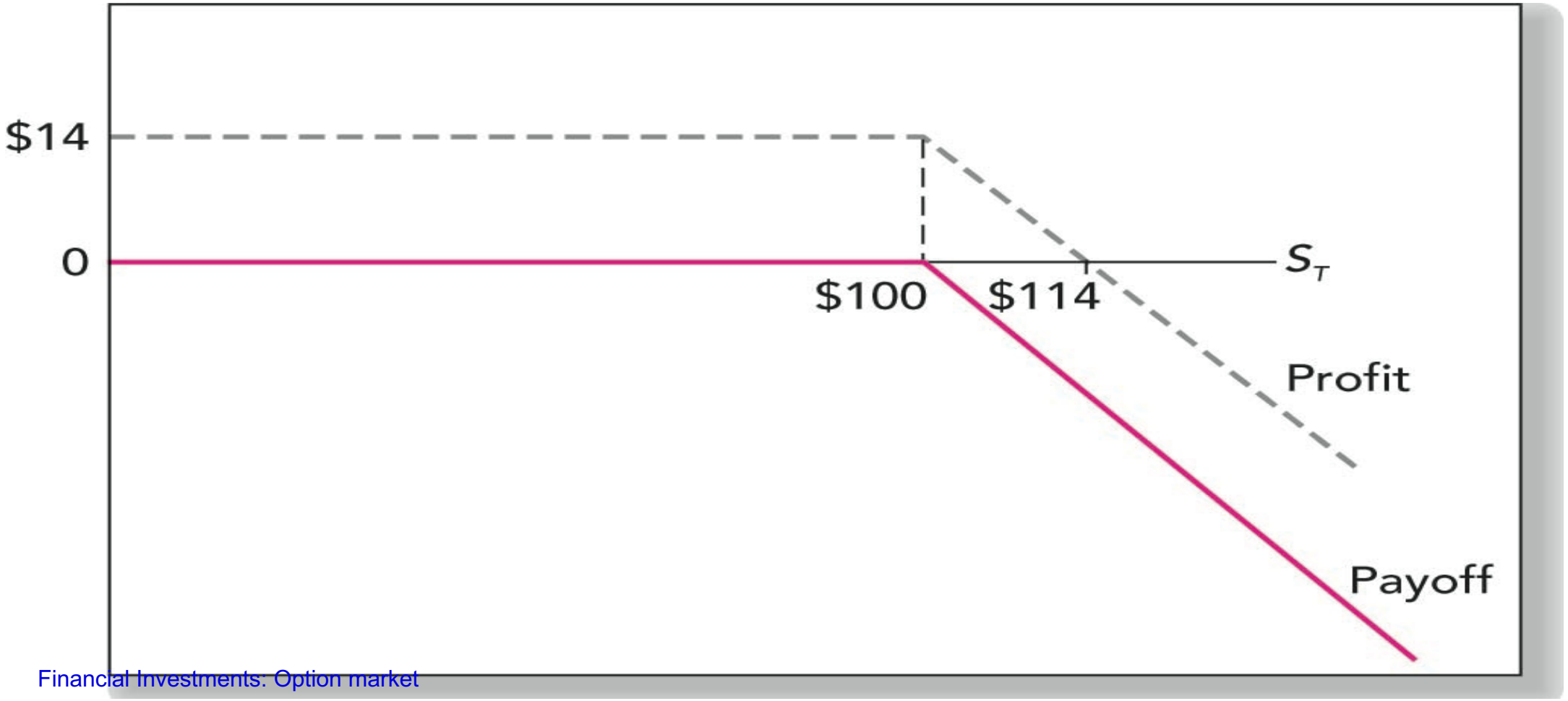
Figure 20.4 Payoff and Profit to Vanilla Call Writers at Expiration



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Payoffs and Profits at Expiration – Vanilla Puts

A put options is the right to sell an asset
at the exercise price

The holder will not exercise the option unless the asset
is worth less than the exercise price

Payoffs to Put Holder

0	if $S_T \geq X$
$(X - S_T)$	if $S_T < X$

Profit to Put Holder

Payoff - Premium

Payoffs and Profits at Expiration – Vanilla Puts

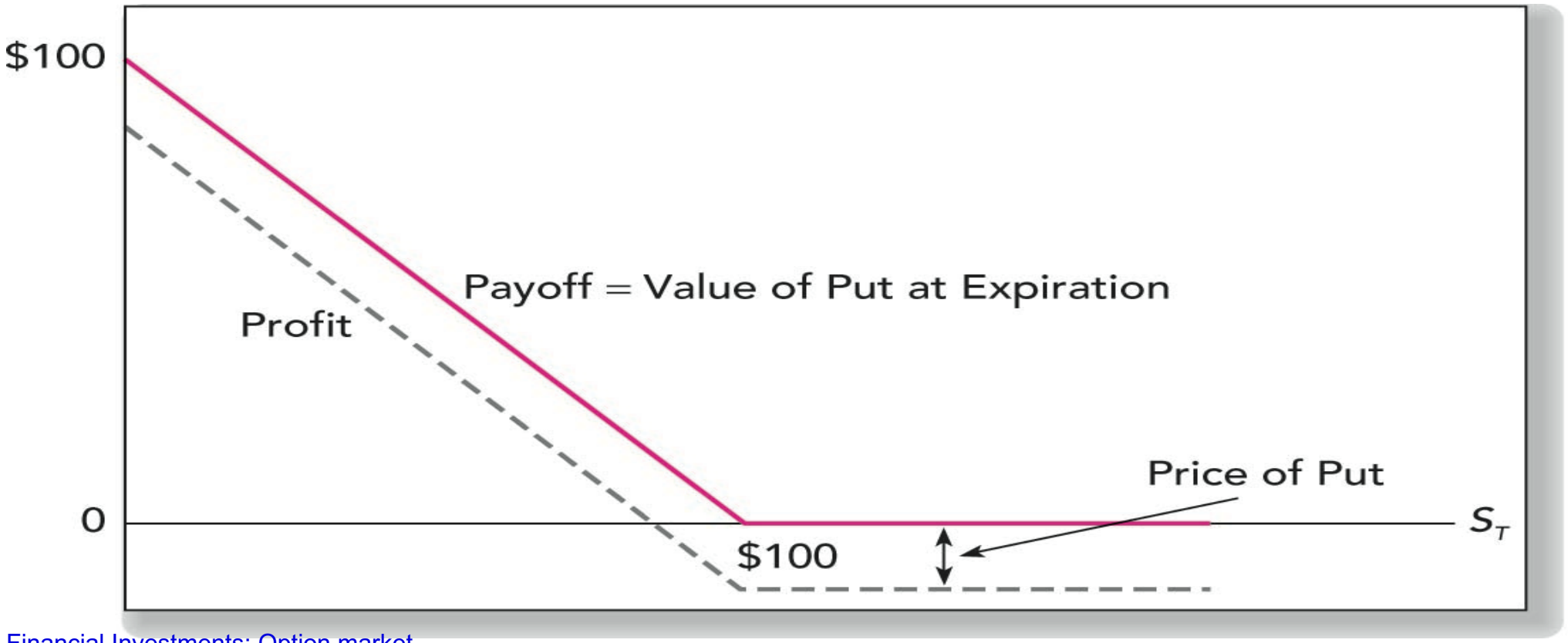
Payoffs to Put Writer

$$\begin{array}{ll} 0 & \text{if } S_T \geq X \\ -(X - S_T) & \text{if } S_T < X \end{array}$$

Profits to Put Writer

Payoff + Premium

Figure 20.5 Payoff and Profit to Vanilla Put Option at Expiration



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Options Trading

- OTC markets
  - Terms tailor to the needs of traders
  - Costs higher
- Exchange
  - Standardized
    - 100 shares of stock
    - Limited and uniform set of securities
  - Two benefits
    - Ease of trading
    - Liquid secondary market

OTC vs Listed derivatives

Type	Listed (Exchange Traded	OTC
Features	Standardised contracts •Strikes •Maturities •Contract size •Exercise type •Delivery •Pay outs	Terms are flexible and negotiable •Strikes at any level •Any maturity date •Varying contract size •American/ European •Physical/ cash •Payouts are flexible
Trading	Exchange Traded Highly liquid	Private agreement Limited liquidity
Guatrantee	Clearing Corporation of the Exchange	Issuer or writer

Equity, Options & Leveraged Equity

- Purchasing call option
  - Bullish strategy
  - Profit when stock prices are increasing
- Writing call option
  - Bearish strategy
  - Profit when stock prices are decreasing
- Purchasing put option
  - Bearish strategy
  - Profit when stock prices are decreasing
- Writing put option
  - Bullish strategy
  - Profit when stock prices are increasing
- Because option values depend on the price of the underlying stock, purchase of options may be viewed as a substitute to direct purchase or sale of a stock

Equity, Options & Leveraged Equity

Investment	Strategy		Investment
Equity only	Buy stock @ 100	100 shares	$10,000
Options only	Buy calls @ 10	1000 options	$10,000
Leveraged equity	Buy calls @ 10 Buy T-bills @ 3% Yield	100 options	$1,000 $9,000

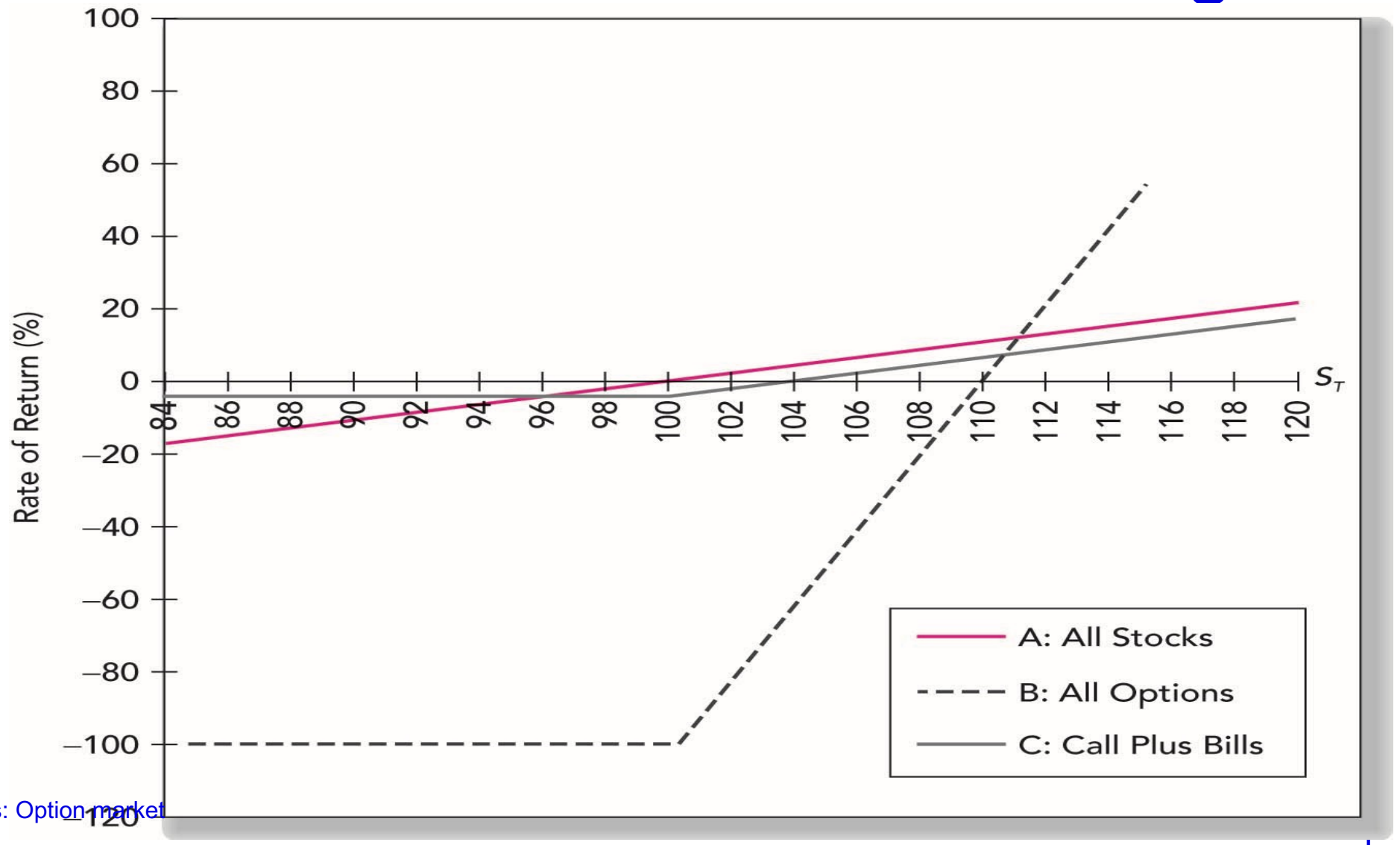
Equity, Options Leveraged Equity - Payoffs

	IBM Stock Price		
	$95	$105	$115
All Stock	$9,500	$10,500	$11,500
All Options	$0	$5,000	$15,000
Lev Equity	$9,270	$9,770	$10,770

Rates of Return

	IBM Stock Price		
	$95	$105	$115
All Stock	-5.0%	5.0%	15%
All Options	-100%	-50%	50%
Lev Equity	-7.3%	-2.3%	7.7%

Figure 20.6 Rate of Return to Three Strategies



Option strategies: Protective Put
Put option + stock

Protective Put

Imagine you would like to invest in a stock, but you are unwilling to bear potential losses beyond some given level. Investing in the stock alone seems risky to you because in principle you could lose all the money you invest.

	$S_T \leq X$	$S_T > X$
Stock	S_T	S_T
+ Put	$X - S_T$	0
= *TOTAL*	X	S_T

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Option strategies: Covered Calls
Stock + sell call option (writter)

Covered Calls

A **covered call** position is the purchase of a share of stock with a simultaneous sale of a call on that stock. The call is "covered" because the potential obligation to deliver the stock is covered by the stock held in the portfolio.

	$S_T \leq X$	$S_T > X$
Payoff of stock	S_T	S_T
+ Payoff of written call	-0	$-(S_T - X)$
= TOTAL	S_T	X

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Option strategies: Straddle

Straddle

A long **straddle** is established by buying both a call and a put on a stock, each with the same exercise price, X, and the same expiration date, T. Straddles are useful strategies for investors who believe a stock will move a lot in price but are uncertain about the direction of the move.

	$S_T < X$	$S_T \geq X$
Payoff of call	0	$S_T - X$
+ Payoff of put	$X - S_T$	0
= TOTAL	$X - S_T$	$S_T - X$

Option strategies: Strips and Straps

- Strip:
  - Buy 1 Call
  - Buy 2 Put
- Strap:
  - Buy 2 Call
  - Buy 1 Put

Option strategies: Spread

Spreads

A **spread** is a combination of two or more call options (or two or more puts) on the same stock with differing exercise prices or times to maturity. Some options are bought, whereas others are sold, or written. A *money spread* involves the purchase of one option and the simultaneous sale of another with a different exercise price. A *time spread* refers to the sale and purchase of options with differing expiration dates.

	$S_T \leq X_1$	$X_1 < S_T \leq X_2$	$S_T \geq X_2$
Payoff of purchased call, exercise price = X_1	0	$S_T - X_1$	$S_T - X_1$
+ Payoff of written call, exercise price = X_2	− 0	− 0	− $(S_T - X_2)$
= *TOTAL*	0	$S_T - X_1$	$X_2 - X_1$

Option strategies: Example 1

a. A butterfly spread is the purchase of one call at exercise price X_1, the sale of two calls at exercise price X_2, and the purchase of one call at exercise price X_3. X_1 is less than X_2, and X_2 is less than X_3 by equal amounts, and all calls have the same expiration date. Graph the payoff diagram to this strategy.

b. A vertical combination is the purchase of a call with exercise price X_2 and a put with exercise price X_1, with X_2 greater than X_1. Graph the payoff to this strategy.

Option strategies: Example 2

A bearish spread is the purchase of a call with exercise price X_2 and the sale of a call with exercise price X_1, with X_2 greater than X_1. Graph the payoff to this strategy

Option strategies: Example 3

You write a put option with $X = 100$ and buy a put with $X = 110$. The puts are on the same stock and have the same expiration date.

a. Draw the payoff graph for this strategy.
b. Draw the profit graph for this strategy.

Option strategies: Example 4

You write a call option with $X = 50$ and buy a call with $X = 60$. The options are on the same stock and have the same expiration date. One of the calls sells for \$3; the other sells for \$9.

a. Draw the payoff graph for this strategy at the option expiration date.
b. Draw the profit graph for this strategy.
c. What is the break-even point for this strategy? Is the investor bullish or bearish on the stock?

Option strategies: Example 5

Consider the following portfolio. You write a put option with exercise price 90 and buy a put option on the same stock with the same expiration date with exercise price 95.

a. Plot the value of the portfolio at the expiration date of the options.
b. On the same graph, plot the profit of the portfolio. Which option must cost more?