Trading Strategies Involving Options

Reference:
John Hull, Futures, Options and Other Derivatives (global edition, 9ed.) 2019.
Ch. 12

본 강의자료는 수강생의 수업 목적을 위해 제공하는 것으로서,

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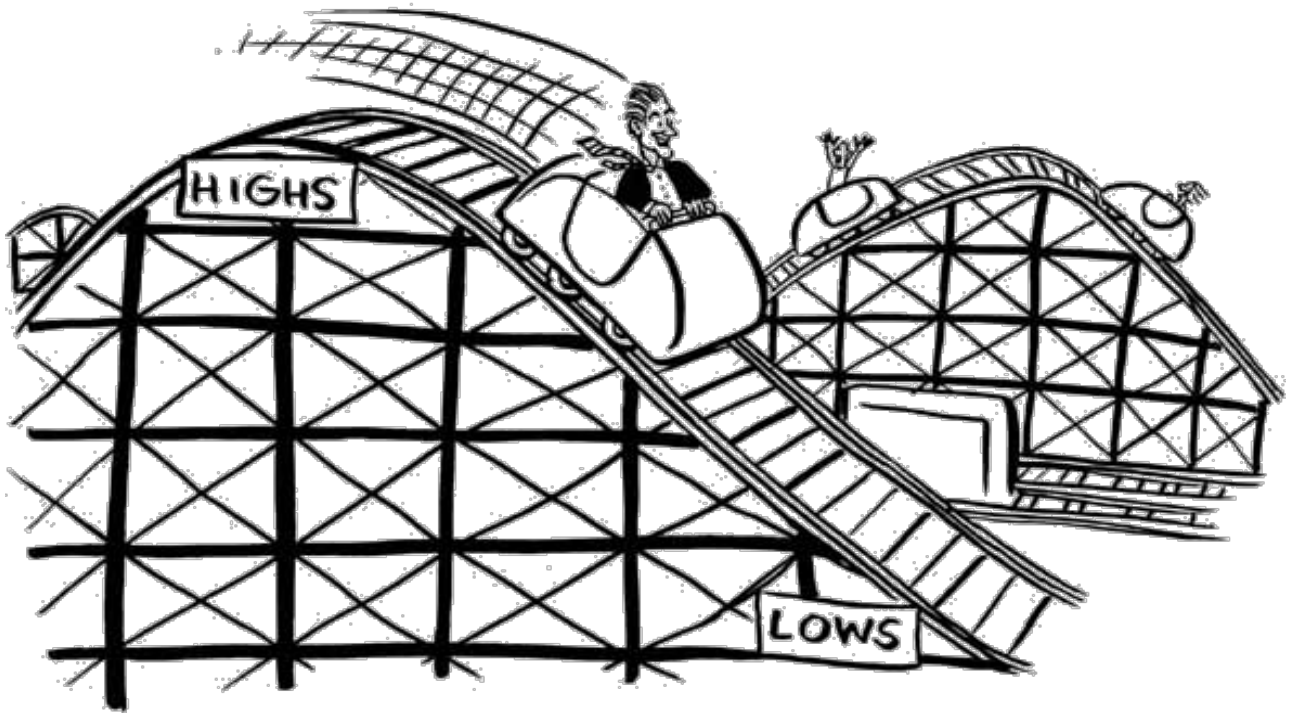
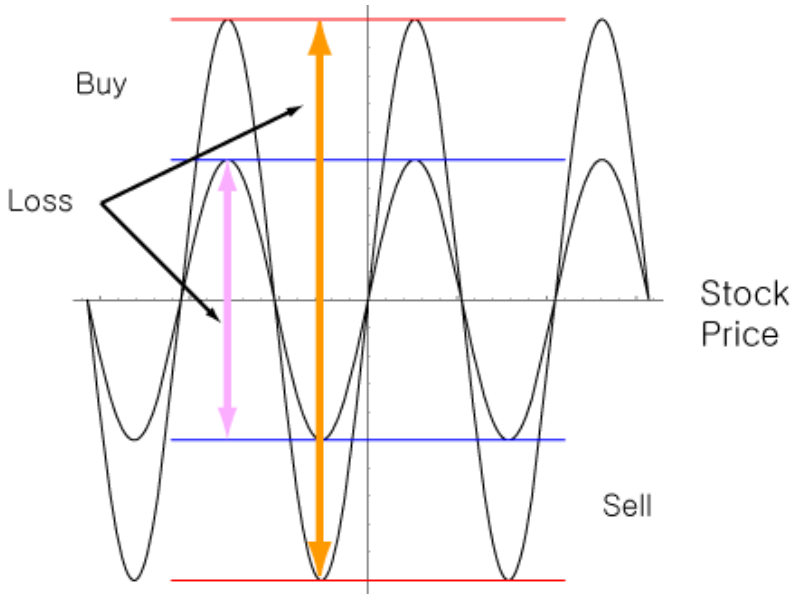
Short Gamma vs Long Gamma

"변동성"을 이용한 수익 창출

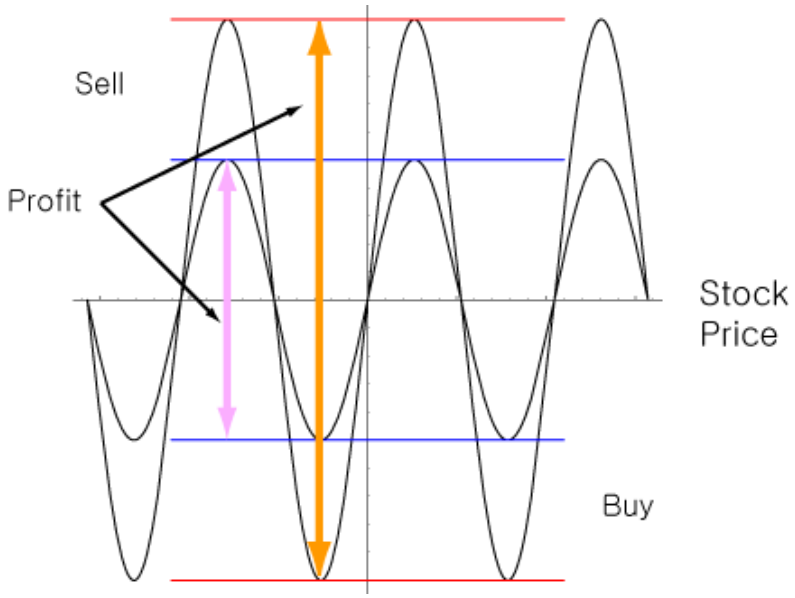


Short Gamma vs Long Gamma

"변동성"을 이용한 수익 창출



Short gamma Position

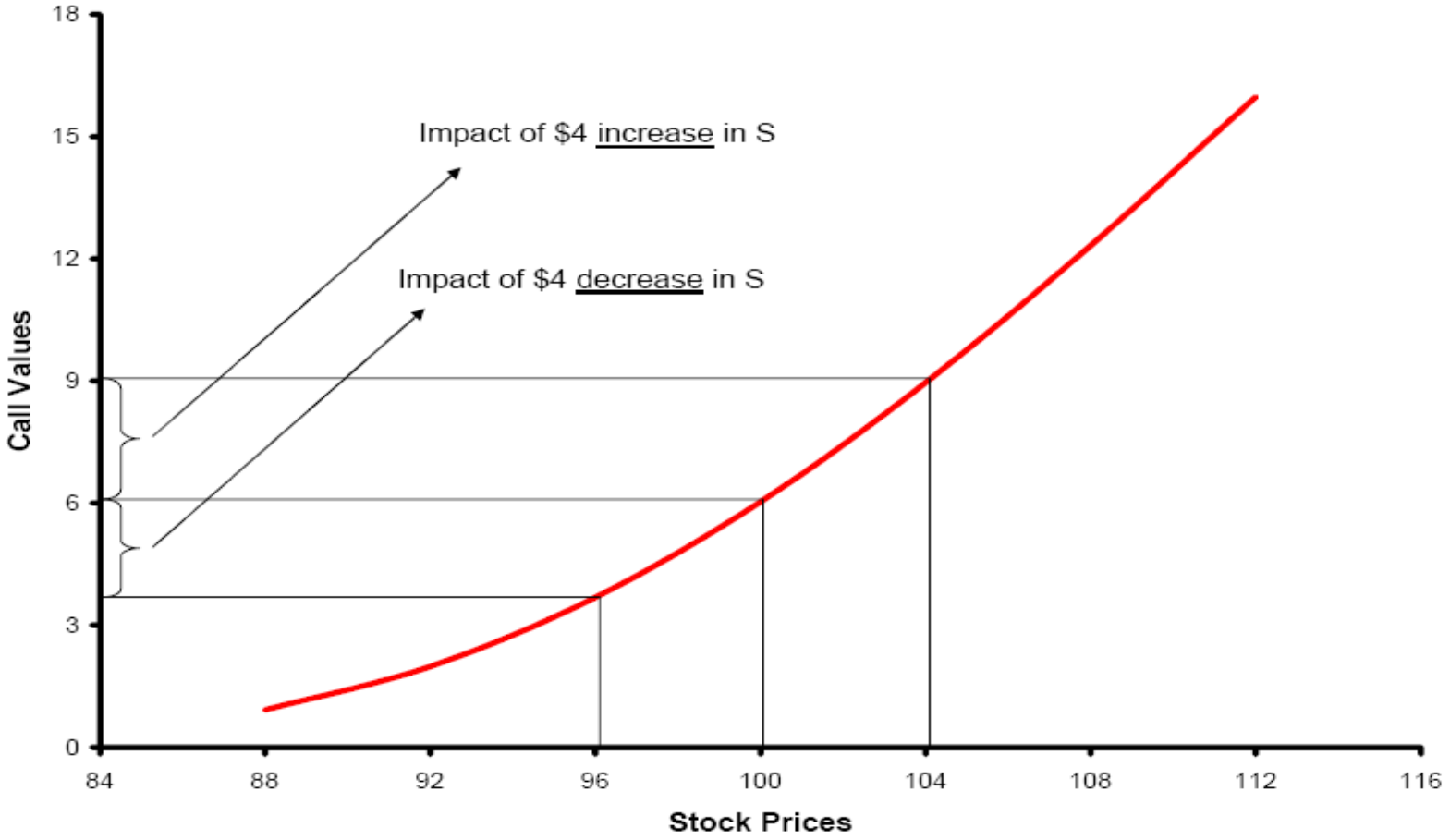


Long gamma Position

Gamma as a View on Volatility

- As a measure of curvature, gamma reflects a view on **volatility**
- As motivation for this point, consider the holder of a call option
- The curvature in the call implies that the holder of a call benefits more from a price increase than he loses from a corresponding price decrease
- Ex.) in a Black-Scholes model with $K = 100$, $\sigma = 0.2$, $r = 0.05$, T-t=0.5 years, we can check the following:
  - At S = 100, we have C = 6.889.
  - If S increases to 104, the option price increases by 2.600.
  - If S falls to 96, the option price decreases by only 2.166

Curvature and Asymmetric Responses



Gamma and the Asymmetry

- Thus, curvature creates **asymmetric** exposure to price changes
- This is also true for puts: put holders benefit more from price decreases than they lose from price increases.
- The extent of the asymmetry depends on the gamma:
  - Large $\Gamma \Rightarrow$ considerable curvature $\Rightarrow$ substantial asymmetry
  - Small $\Gamma \Rightarrow$ option price is nearly linear $\Rightarrow$ little asymmetry

Long Gamma: Long Volatility

- Asymmetric exposure is desirable if you expect an increase in volatility: it will enable you to benefit more on the upside than you lose on the downside
- Thus, a positive gamma position can be regarded as a **bullish** view on volatility
- Analogously, a **negative** gamma position, which is the gamma of the **short** position in the option, can be regarded as a **bearish** view on volatility

내용

1. Principal Protected Note — Knock Out
2. Naked v. Hedged Position — Covered Call, Protective Put
3. Spreads — Bull/Bear Spread, Butterfly
   Calendar Spread
4. Combinations — Straddle, Strangle

내용

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Strategies to be Considered

- Bond plus option to create principal protected note
- Stock plus option
- Two or more options of the same type (: spread)
- Two or more options of different types (: combination)

Principal Protected Note

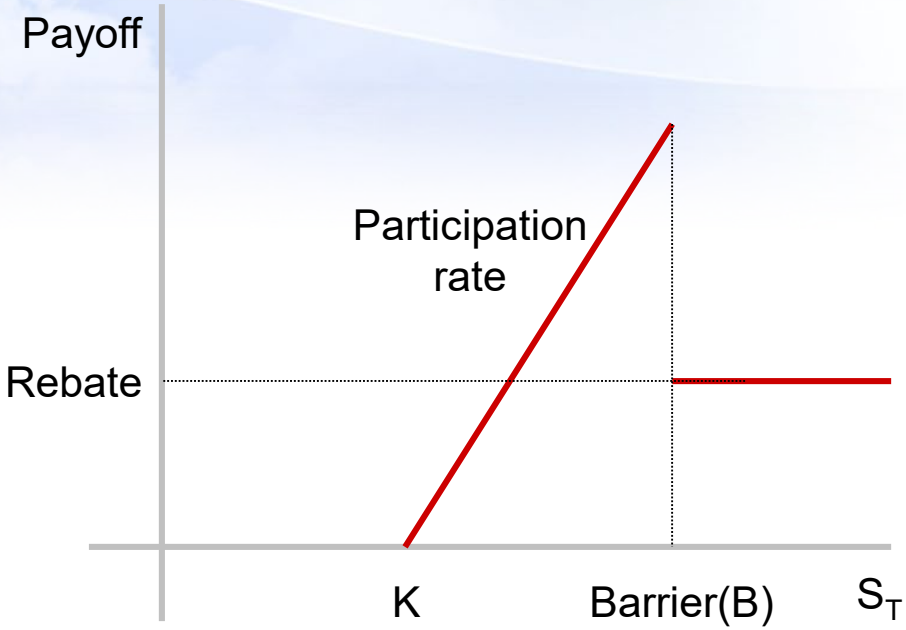
- The return earned by the investor depends on the performance of a stock, a stock index, or other risky asset, but the initial principal amount invested is not at risk.
- Example: $1000 instrument consisting of
  - 3-year zero-coupon bond with principal of $1000
  - 3-year at-the-money call option on a stock portfolio currently worth $1000

Principal Protected Notes continued

- Viability depends on
  - Level of dividends
  - Level of interest rates
  - Volatility of the portfolio
- Variations on standard product
  - Out of the money strike price
  - Caps on investor return
  - Knock outs, averaging features, etc

Example

❖ Knock out & Rebate

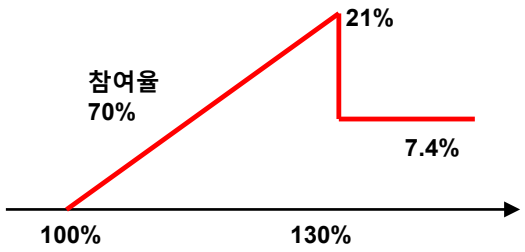
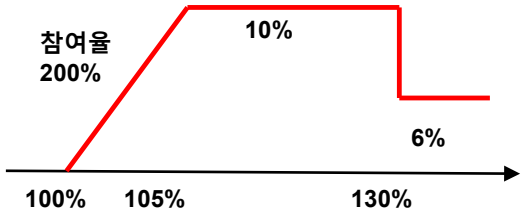
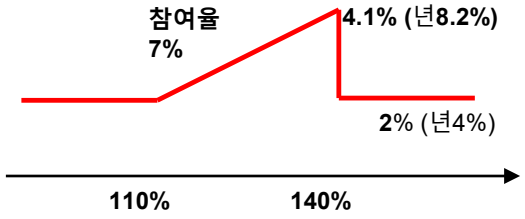


[수익구조]

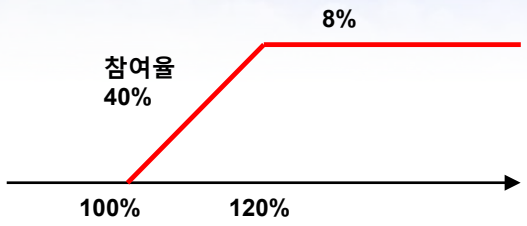
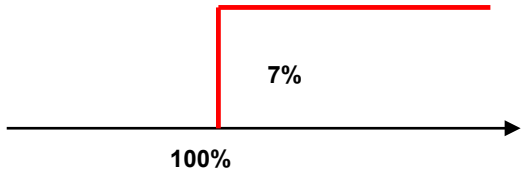
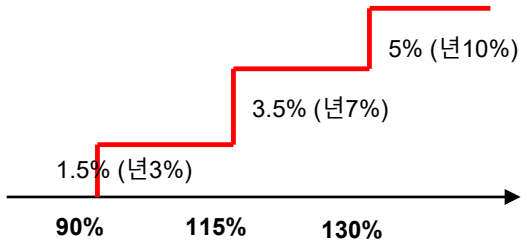
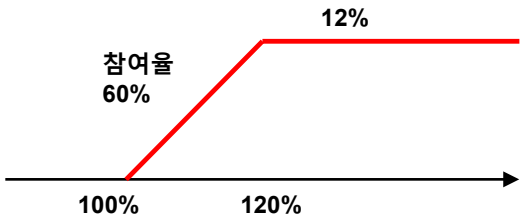
1. 기초자산이 만기 평가일까지 단 1회라도 베리어(B)를 초과 상승한 적이 있는 경우, **Principal x (1+Rebate rate)**
2. '1'의 경우에 해당하지 않고, 만기평가지수(S_T)가 최초 기준가(K)의 100%이하에 있는 경우, **Principal**
3. 만기평가지수가 최초 기준가(K)와 베리어(B) 미만에 있는 경우,

   Principal x [1+(S_T - K) / K] x Participation rate

Example (continued)

상품 유형	대표적 만기손익	상품 특징
넉아웃 형 (Knock-Out)		만기 1년형 ELS 초기 시장 상품, 시장 상승 예상 및 베리어에 도달하여도 충분한 Rebate 보상
		만기 1년 상품으로, 주가지수가 800을 넘어선 국면에서 등장했던 초기 상품. 지수가 5%이상만 올라도 년 10% 수익이 가능
이자 + 넉아웃 형		만기 6개월 상품으로, 초단기 상품이 유행하던 때 발행되었던 구조. Rebate 보상액을 높혀 안정을 추구한 것이 특징(2%, 6개월)

Example (continued)

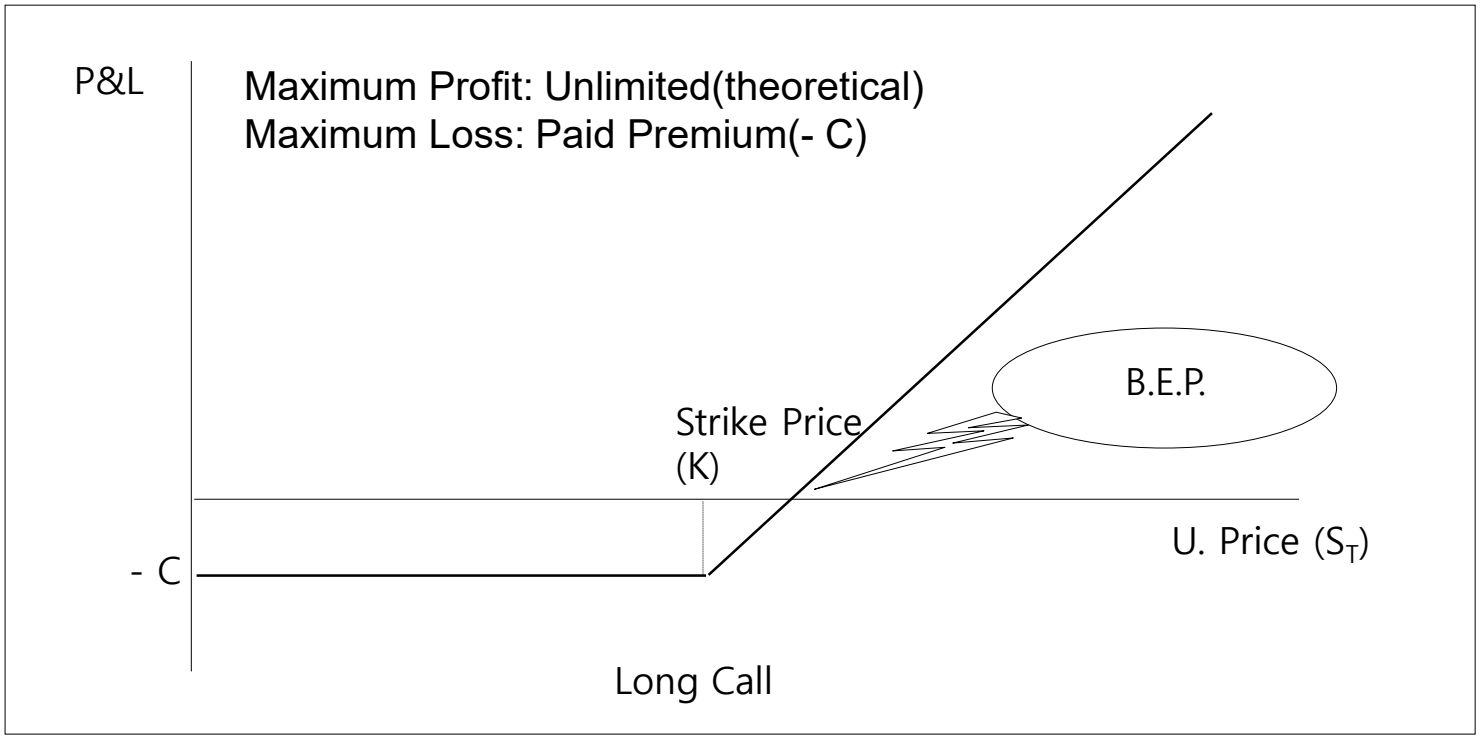
불 스프레드 형 (Bull Spread)		만기 1년 상품으로, 넉아웃 구조와 달리 행사정지 위험이 없는 구조
디지털 형 (Digital)		만기 1년 상품으로, 수익구조가 가장 간단한 구조임. 만기 지수가 현 지수보다 상승하면 7% 수익 확정
		만기 6개월 상품으로, 단순 디지털 형의 복합 구조로 Step Up과 Step Down이 있음. 지수 구간별로 각각 1.5%, 3.5%, 5%의 수익 확정.
아시안 형 (Asian Type)		만기 1년 상품으로, 매월 평균 주가를 기준으로 수익 확정. 불 스프레드보다 참여율이 높은 것이 일반적 특징

내용

1. Principal Protected Note — Knock Out
2. Naked v. Hedged Position — **Covered Call, Protective Put**
3. Spreads — Bull/Bear Spread, Butterfly, Calendar Spread
4. Combinations — Straddle, Strangle

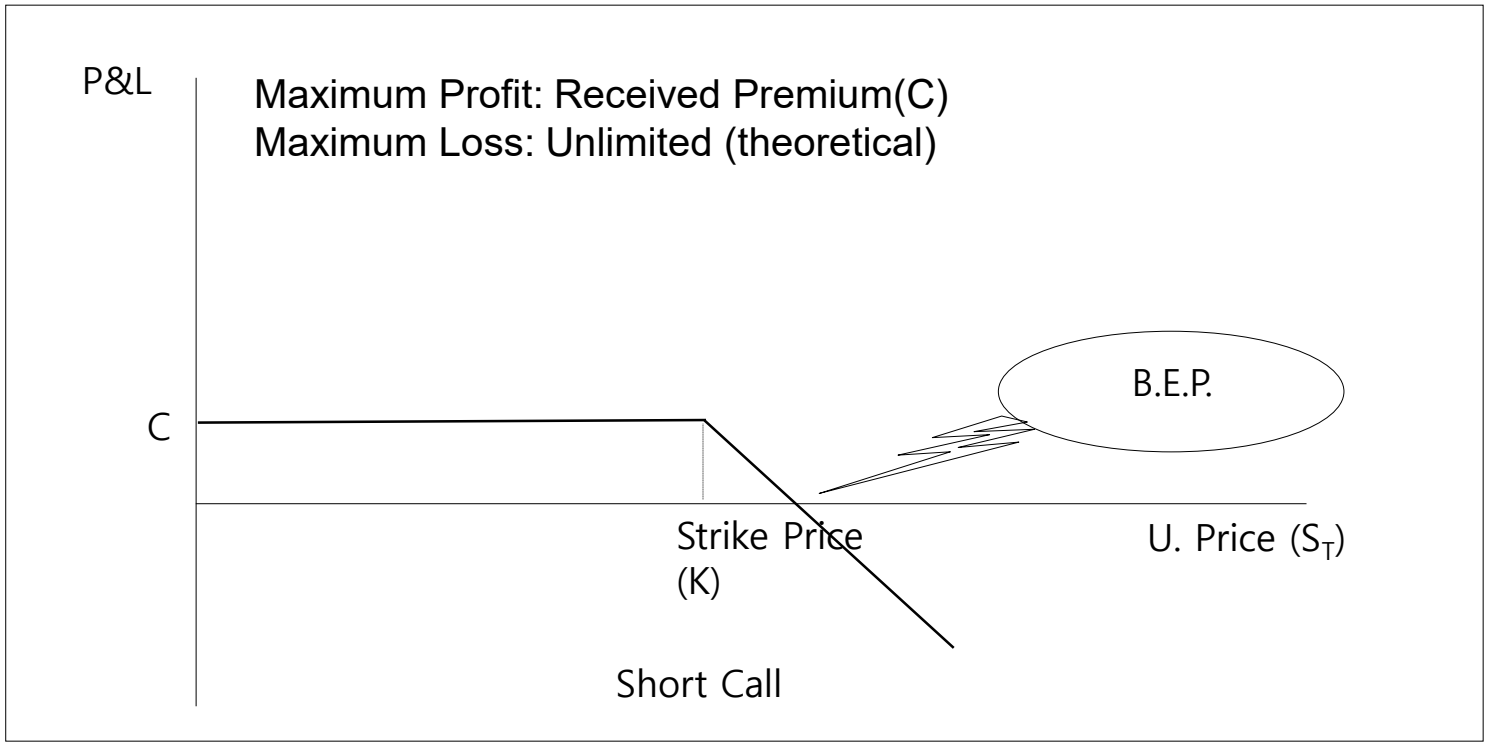
Naked Position: Long Call

거래동기: 기초자산 가격의 상승 시 레버리지 효과를 통하여 높은 수익을 얻고자 함



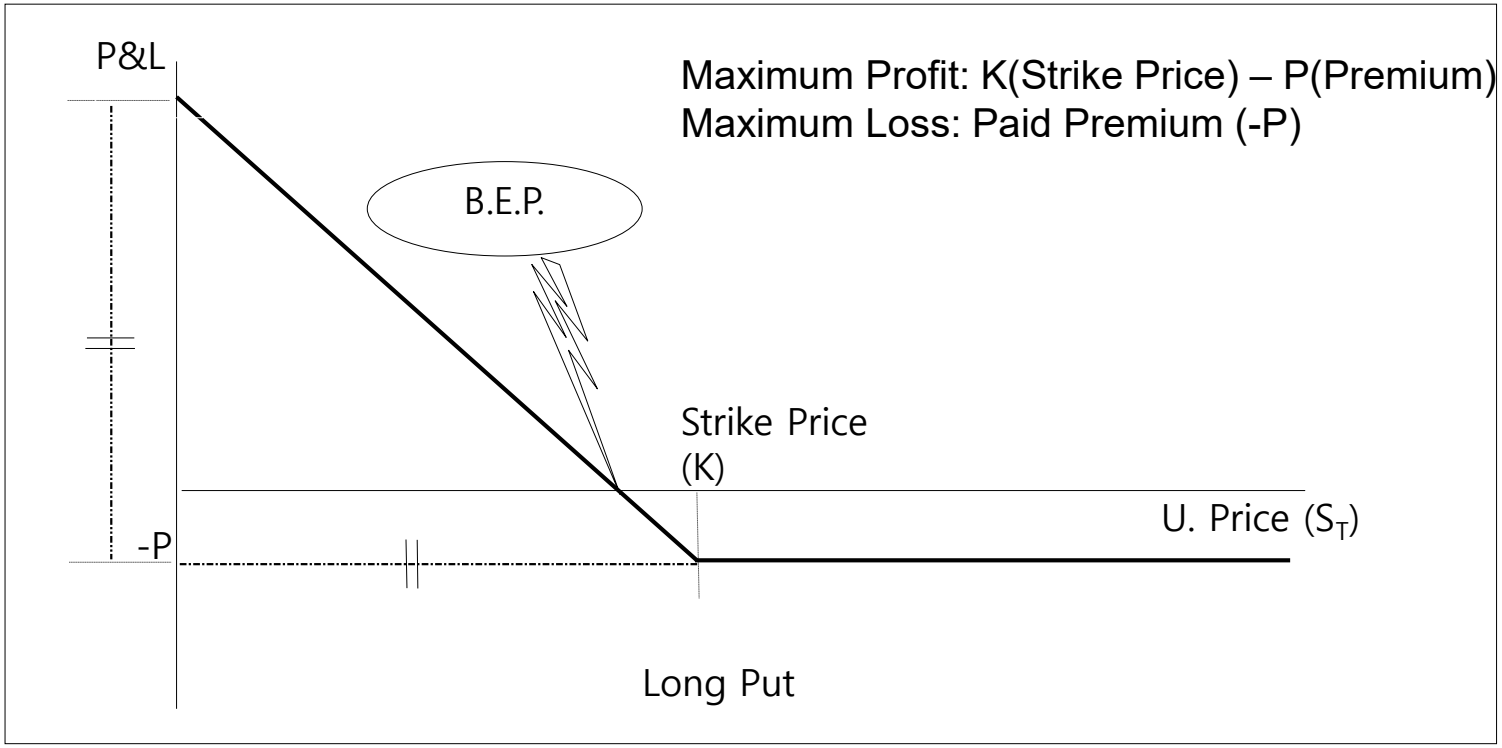
Naked Position: Short Call

거래동기: 기초자산 가격의 변동이 적거나 기초자산 가격의 하락이 예상될 때 프리미엄 수입을 기대



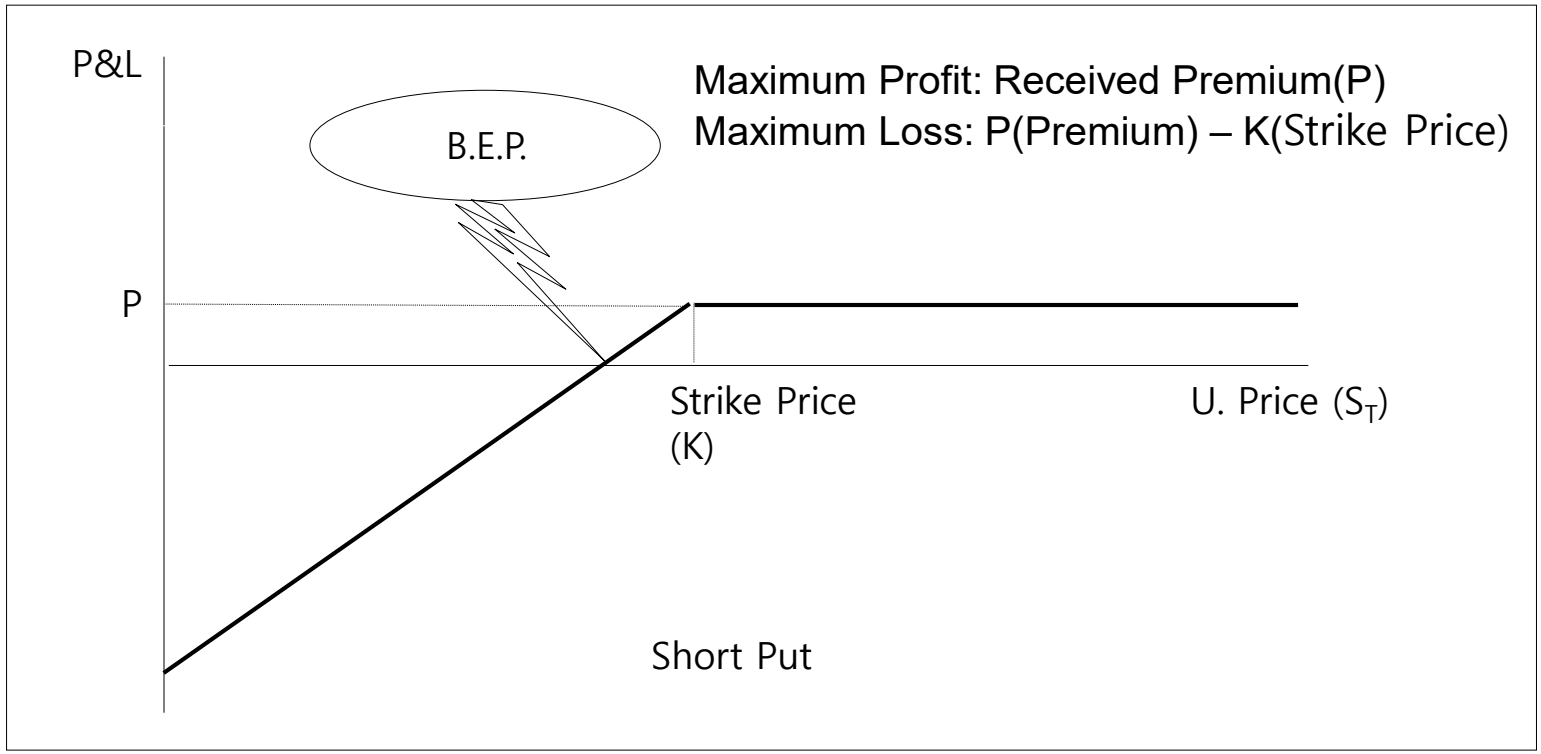
Naked Position: Long Put

거래동기: 기초자산 가격의 하락 시 레버리지 효과를 통하여 높은 수익을 얻고자 함



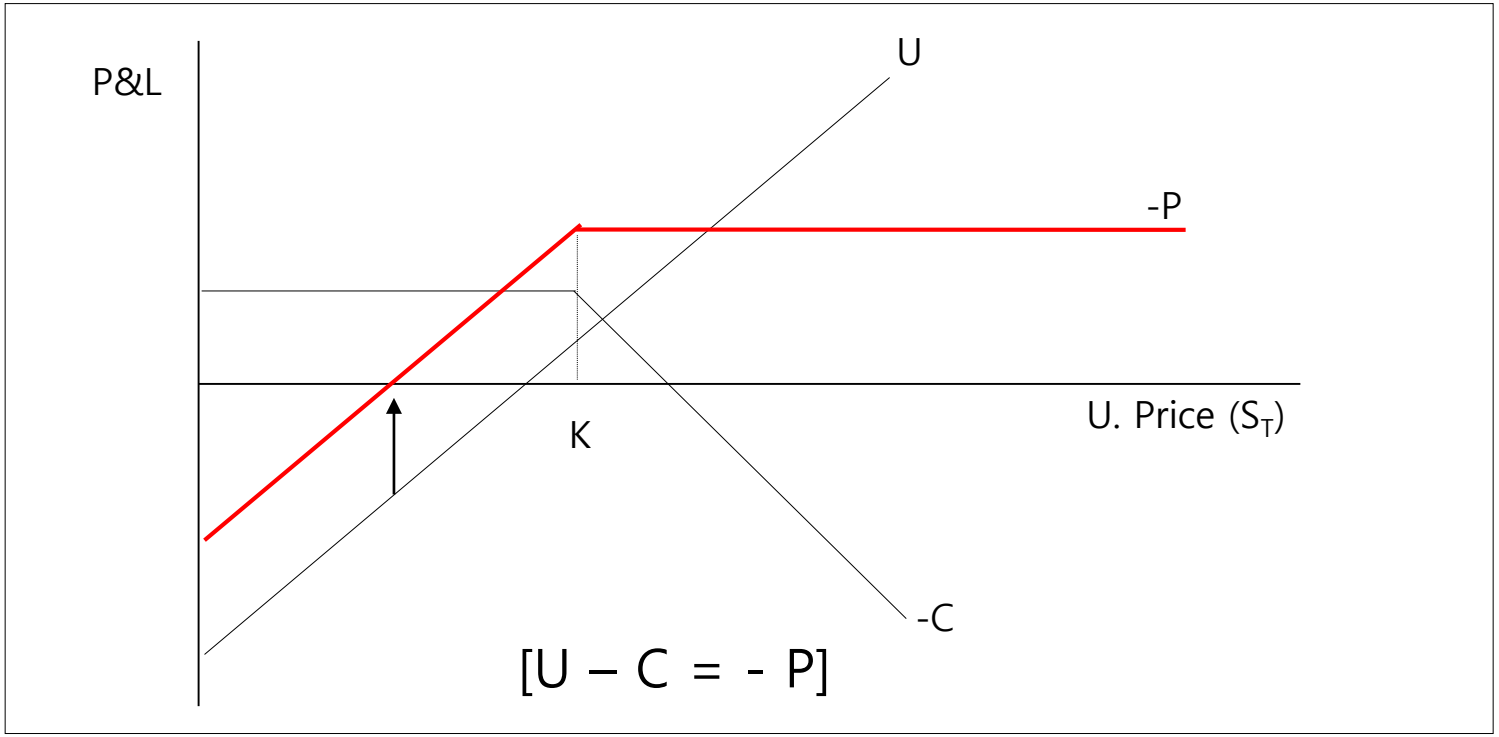
Naked Position: Short Put

거래동기: 기초자산 가격의 변동이 작거나 기초자산 가격의 상승이 예상될 때 프리미엄 수입을 기대



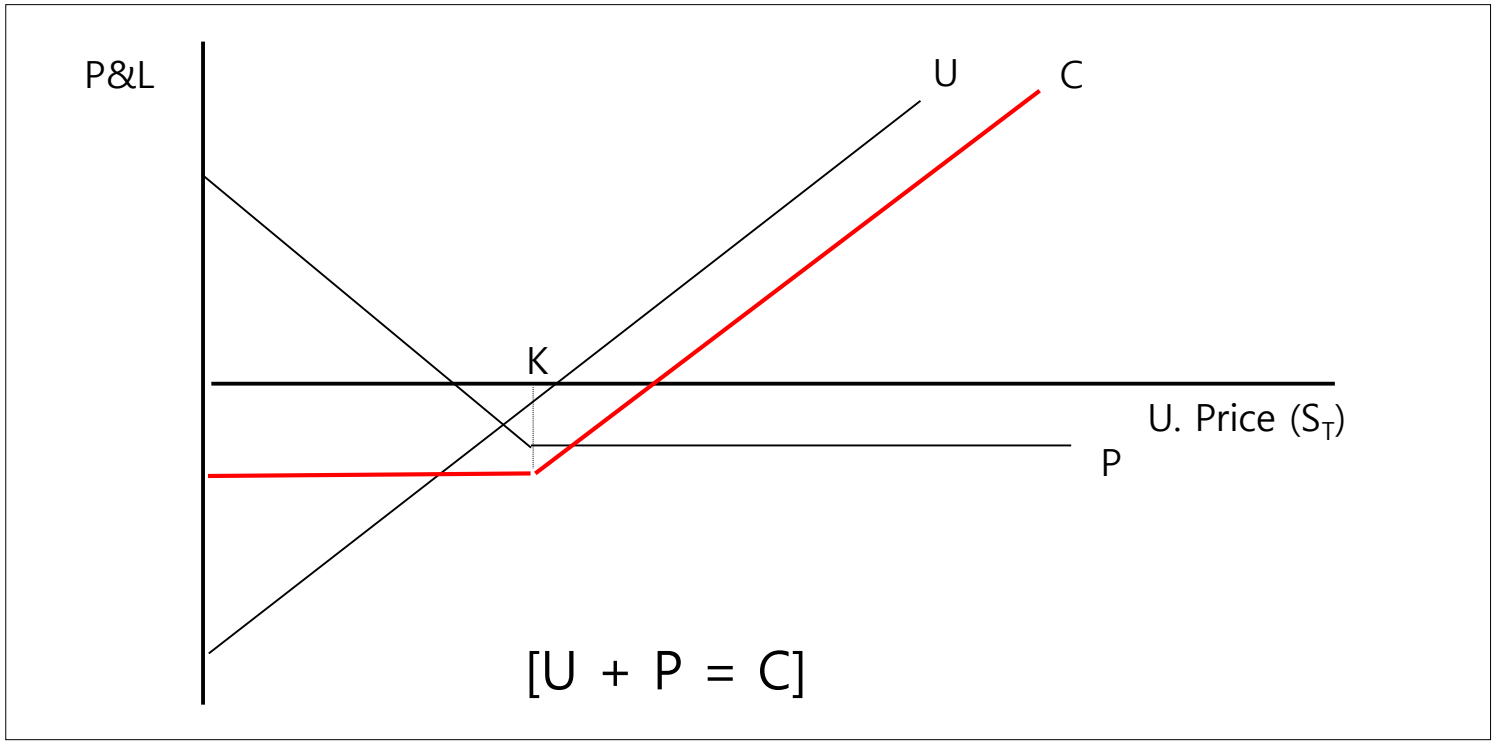
Hedged Position: Covered Call

거래동기: 기초자산 보유 상태에서 가격 하락 대비 헤지 포지션 구축. 동시에 변동성이 크지 않을 것으로 예상될 때

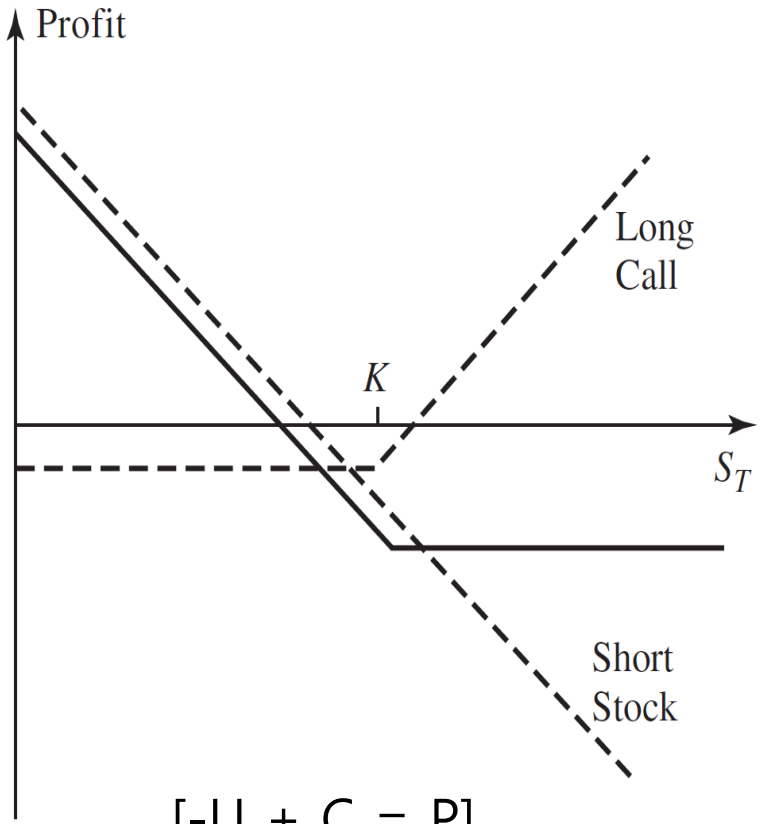


Hedged Position: Protective Put

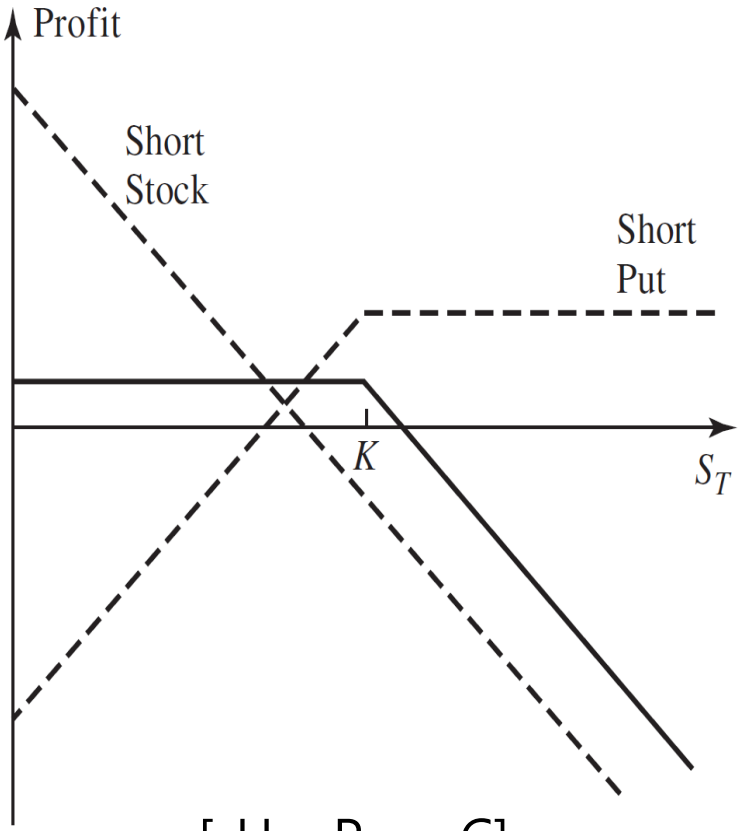
거래동기: 기초자산 보유 상태에서 가격 하락 대비 헤지 포지션 구축. 동시에 변동성이 클 것으로 예상될 때



Hedged Position with Short Underlying Asset



[-U + C = P]

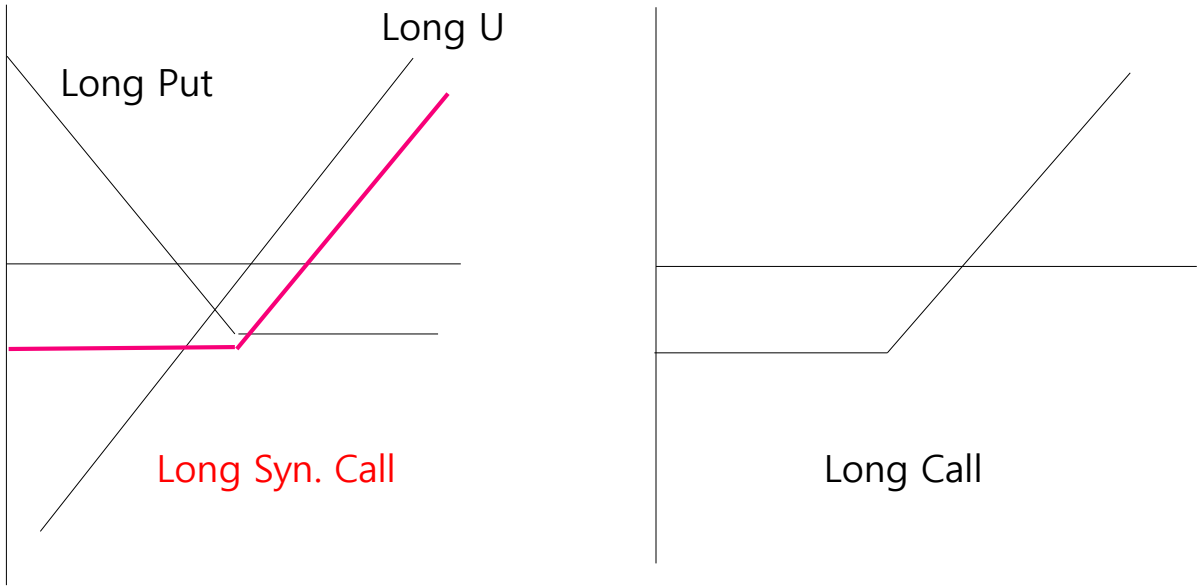


[-U - P = -C]

Synthetic Position

U = C – P

Position		Synthetic Equivalent
+P	=	+C - U
U-C	=	-P
+C	=	U+P
U+P	=	+C
-C+P	=	-U
-P+C	=	+U



Arbitrage

❖ Long Call + Short Put = Synthetic Futures
vs. Traded Futures

S_T / Position	If $S_T \geq K$, Payoff at T	If $S_T < K$, Payoff at T
Long Call	$S_T - K - P_C$	$-P_C$
Short Put	P_P	$S_T - K + P_P$
Long Call + Short Put	**$S_T - K + (P_P - P_C)$**	**$S_T - K + (P_P - P_C)$**

Practical Example

[Prices] same M.
70.0 C: 3.0
70.0 P: 2.0
F: **70.5**

Syn. Futures Price = 3.0 - 2.0 + 70.0 =**71.0**

Short Syn. F. @71.0 + Long F @70.5

➔ risk-free profit 0.5pt(=71.0-70.5)
(∵ same maturity)

Supposed that Contract sizes are different!!
Ex.) Futures: ₩500,000 per Contract,
Options: ₩100,000 per Contract

➔ $Q_{OPTION} = 5 \times Q_{FUTURES}$

5 Short 70.0 Call @3.0 5 Long 70.0인 Put @2.0	1 Long F @70.5

Arbitrage Gain = 0.5pt × 500,000 = 250,000

Practical Example (continued)

❖ Long Call + Short Put = Synthetic Futures
vs. Traded Futures

	If $S_T \geq 70$ (S_T=100), Payoff at T	If $S_T < 70$ (S_T=50), Payoff at T
5 Short 70 Call @3.0	-5 x [(100 – 70) - 3.0] x 100,000 = -13,500,000	5 x 3.0 x 100,000 = 1.500,000
5 Long 70 Put @2.0	5 x (-2.0) x 100,000 = -1,000,000	5 x [(70-50) - 2.0] x 100,000= 9,000,000
1 Long Futures @70.5	[100 – 70.5] x 500,000 = 14,750,000	[50 – 70.5] x 500,000 = -10,250,000
Profit	**250,000**	**250,000**

내용

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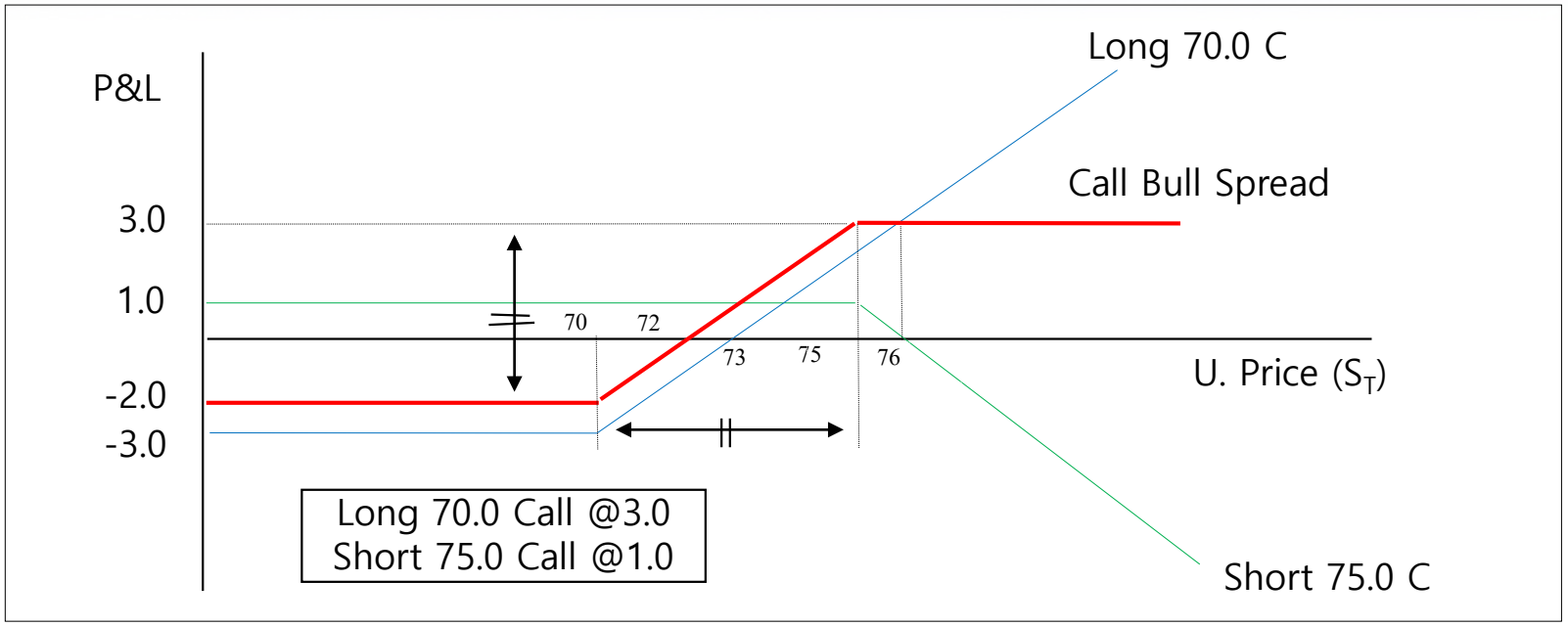
4. Combinations — Straddle, Strangle

Spread Position

A spread trading strategy involves taking a position in two or more options of the **same type** (i.e., two or more calls or two or more puts).

- Call spread vs. Put spread
- Price spread or Money spread
  vs. Calendar spread or Time spread
- Long spread vs. Short spread
- Bull spread vs. Bear spread

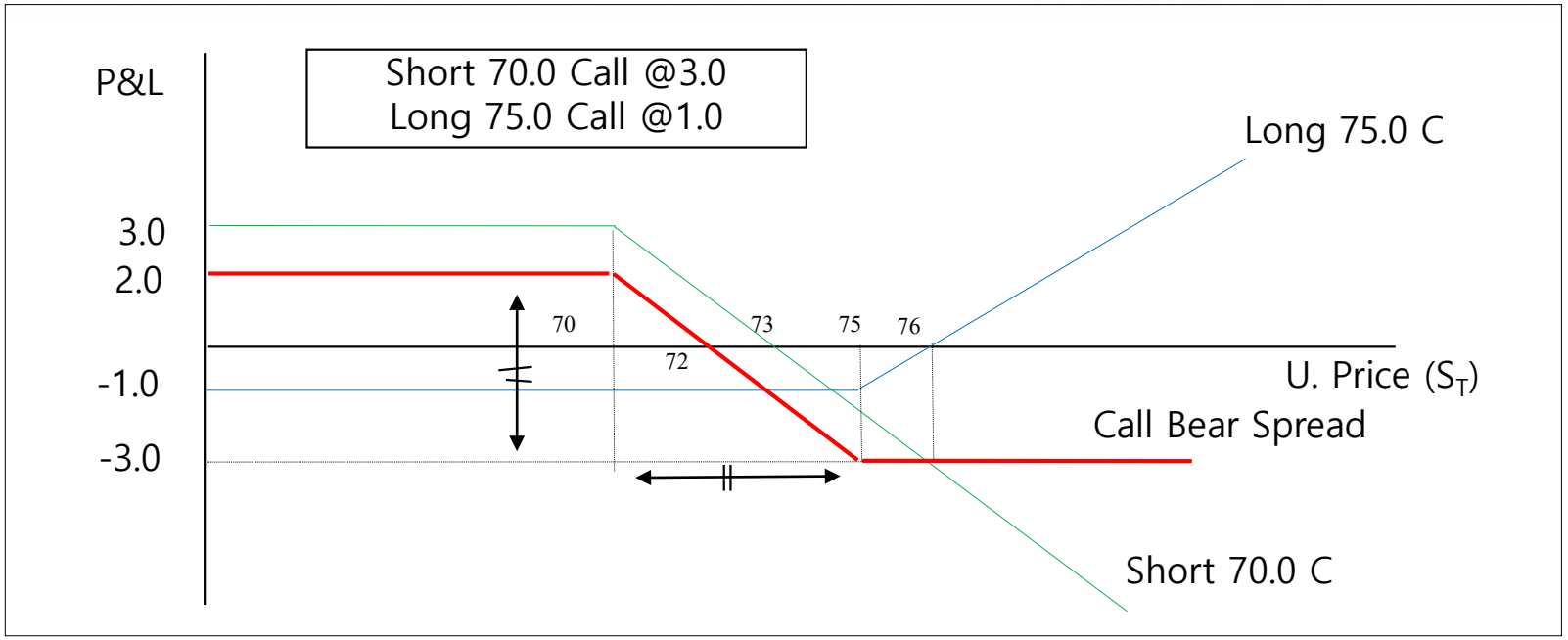
Bull Spread Using Calls



- Maximum Profit – Maximum Loss = $K_2 - K_1$ (Difference between the two exercise prices)
  =3.0 - (-2.0) = 5.0 =75.0 - 70.0

Bull Spread = Long Call or Put (K_1) + Short Call or Put (K_2) when **$K_2 > K_1$**

Bear Spread Using Calls



- Maximum Profit – Maximum Loss = $K_2 - K_1$ (Difference between the two exercise prices)
  =2.0 - (-3.0) = 5.0 =75.0 - 70.0

Bear Spread = Short Call or Put (K_1) + Long Call or Put (K_2) when $\mathbf{K_2 > K_1}$

Question?

Short 70.0 Put @1.0
Long 75.0 Put @3.0

Box Spread

- A box spread is a combination of a bull call spread with strike prices K_1 and K_2 and a bear put spread with the same two strike prices
- If all options are European, the payoff from a box spread is always K_2 - K_1. The value of a box spread is therefore always the present value of this payoff or

$$(K_2 - K_1)e^{-rT}$$

- If they are American, this is not necessarily so (see Business Snapshot 11.1)

Box Spread Payoff

Table 12.3 Payoff from a box spread.

Stock price range	*Payoff from bull call spread*	*Payoff from bear put spread*	*Total payoff*
$S_T \leqslant K_1$	0	$K_2 - K_1$	$K_2 - K_1$
$K_1 < S_T < K_2$	$S_T - K_1$	$K_2 - S_T$	$K_2 - K_1$
$S_T \geqslant K_2$	$K_2 - K_1$	0	$K_2 - K_1$

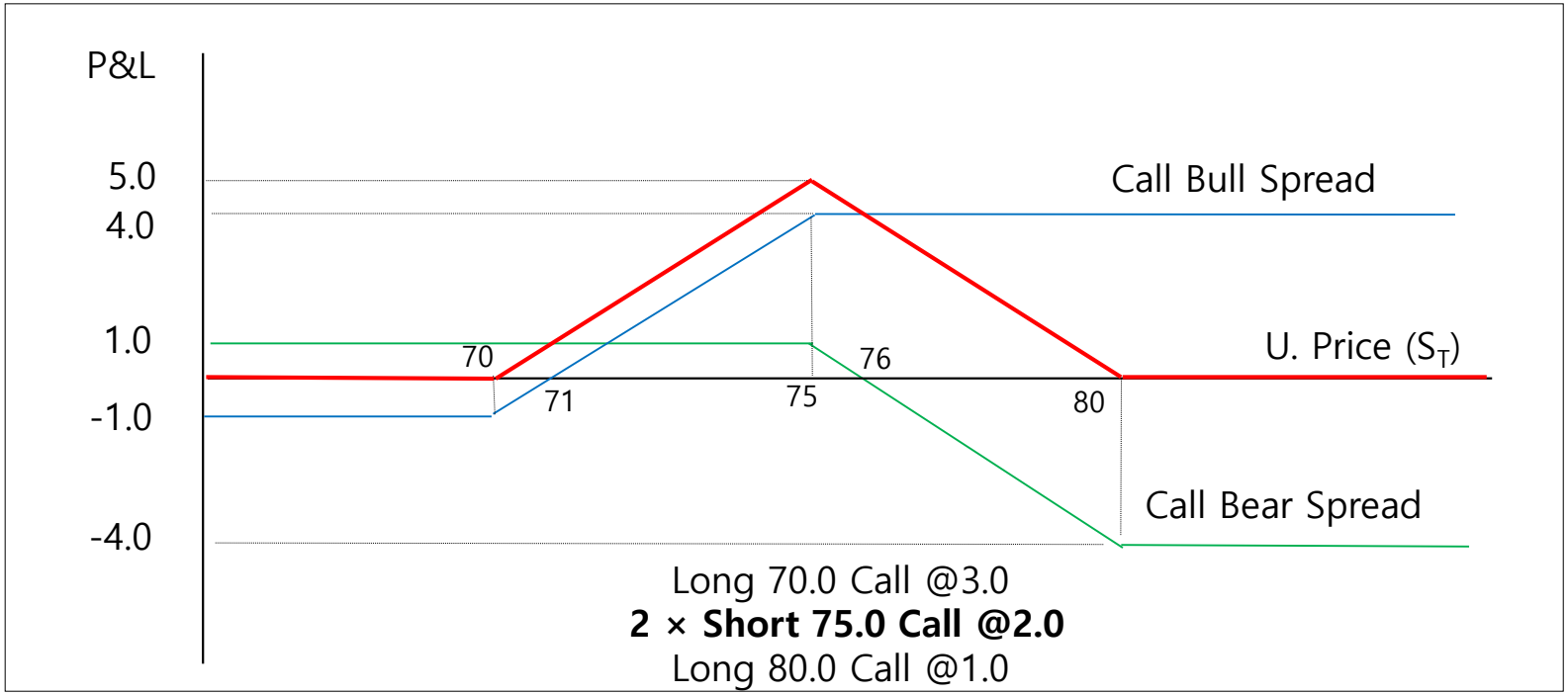
Butterfly Spread

- A butterfly spread involves positions in options with three different strike prices
- It can be created by buying a European call option with a relatively low strike price K_1, buying a European call option with a relatively high strike price K_3, and selling two European call options with a strike price K_2 that is halfway between K_1 and K_3. Generally, K_2 is close to the current stock price
- Butterfly = Bull Spread + Bear Spread

Butterfly Spread Using Calls

❖ Long Butterfly

<Bull Spread>	<Bear Spread>
Long 70.0 Call @3.0	**Short 75.0 Call @2.0**
Short 75.0 Call @2.0	Long 80.0 Call @1.0



Question?

<Bear Spread>
Short 70.0 Call @5.0
Long 75.0 Call @2.0

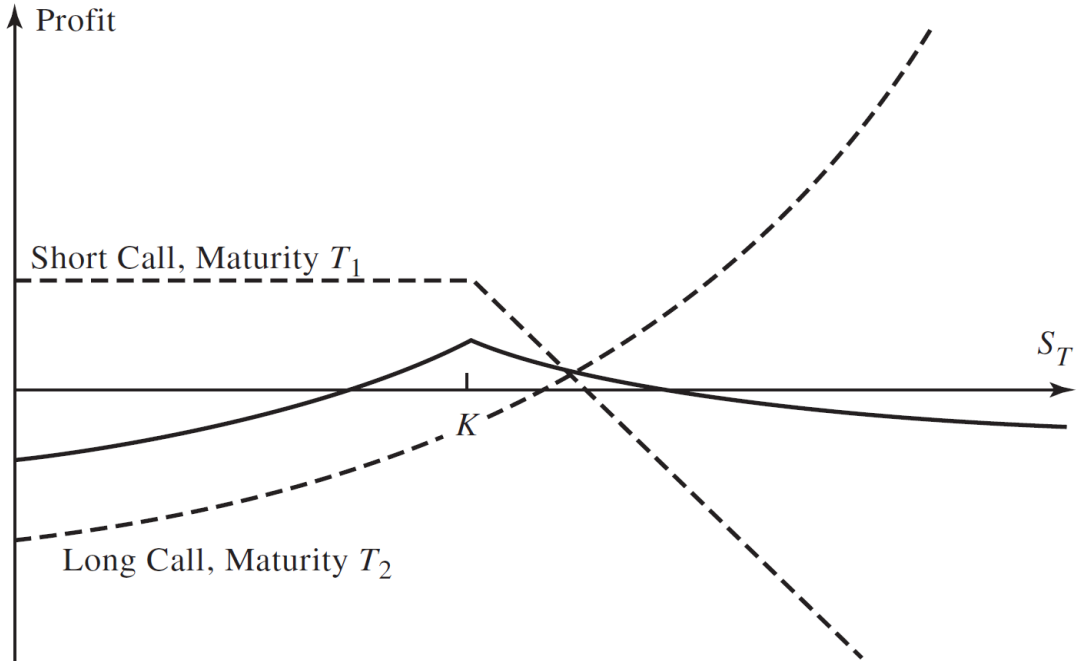
<Bull Spread>
Long 75.0 Call @2.0
Short 80.0 Call @1.0

Calendar Spreads

- A calendar spread can be created by selling a European call option with a certain strike price and buying a longer-maturity European call option with the same strike price
- The longer the maturity of an option, the more expensive it usually is. A calendar spread therefore usually requires an initial investment.
- Profit diagrams for calendar spreads are usually produced so that they show the profit when the short-maturity option expires on the assumption that the long-maturity option is closed out at that time.

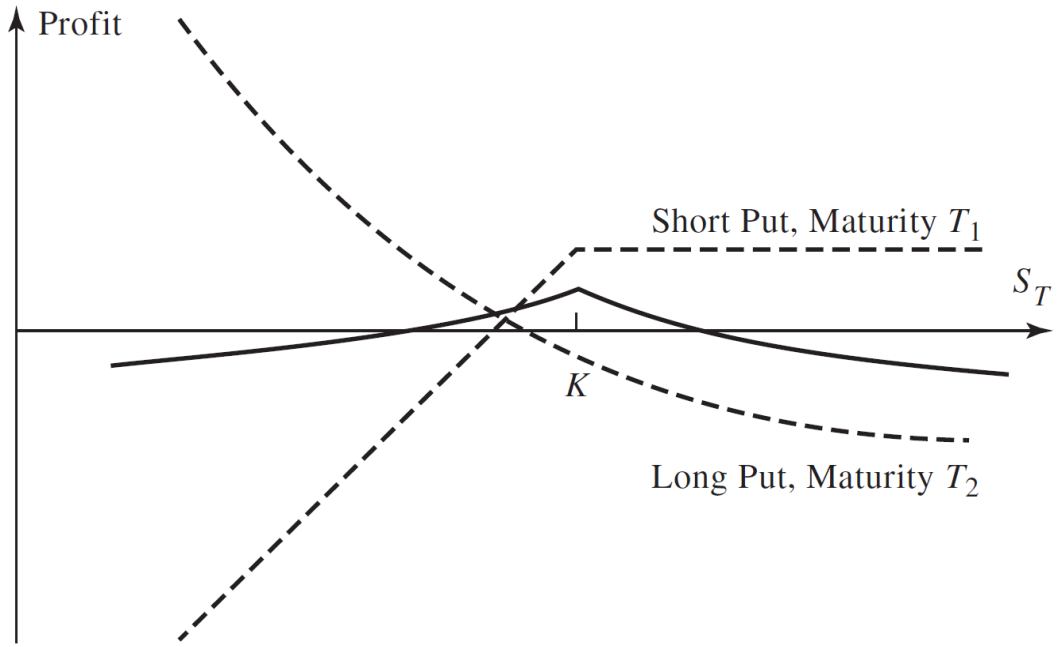
Calendar Spread Using Calls

Figure 12.8 Profit from calendar spread created using two call options, calculated at the time when the short-maturity call option expires.



Calendar Spread Using Puts

Figure 12.9 Profit from calendar spread created using two put options, calculated at the time when the short-maturity put option expires.



Diagonal Spreads

- Bull, bear, and calendar spreads can all be created from a long position in one call and a short position in another call
- In the case of bull and bear spreads, the calls have different strike prices and the same expiration date
- In the case of calendar spreads, the calls have the same strike price and different expiration dates
- In a diagonal spread both the expiration date and the strike price of the calls are different. This increases the range of profit patterns that are possible.

내용

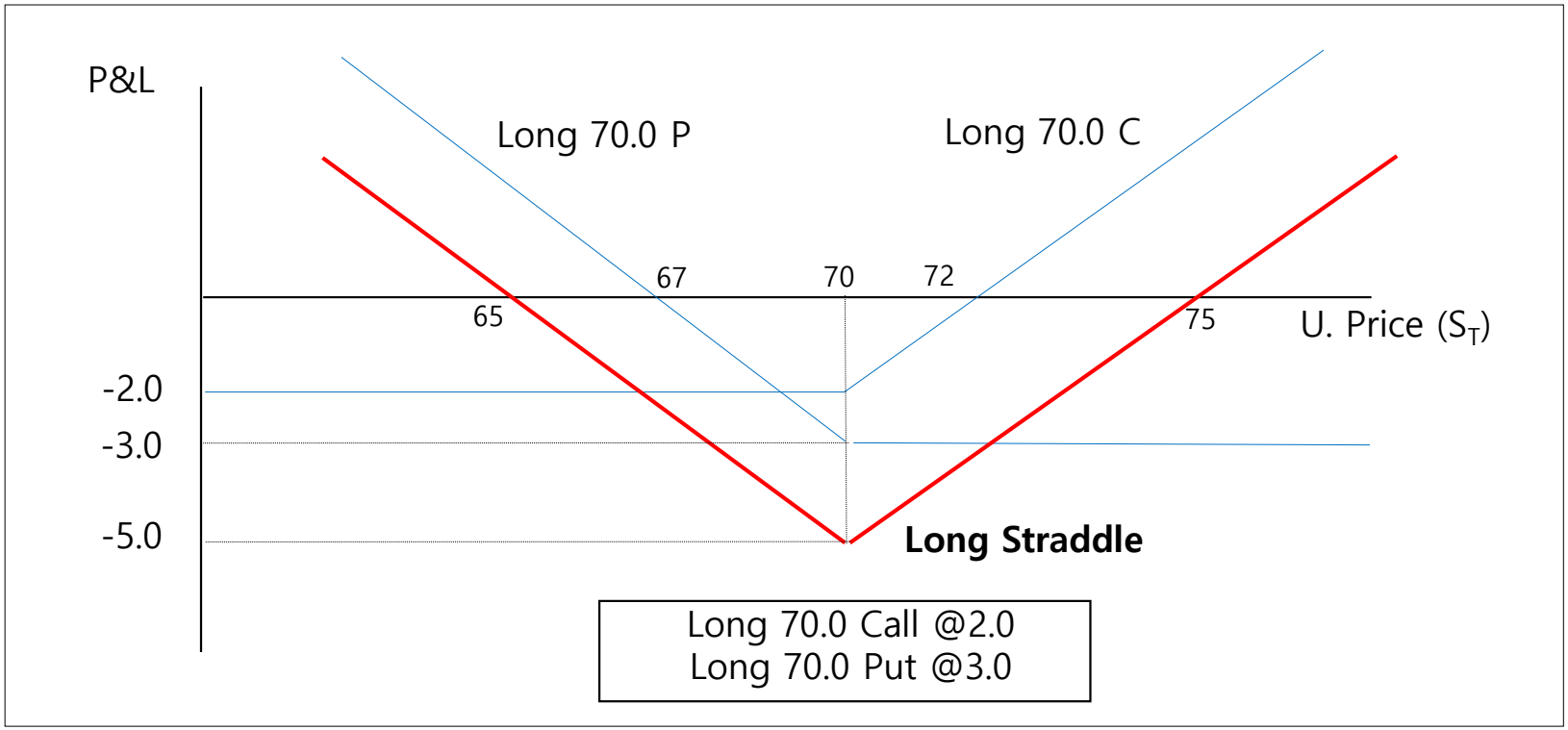
1. Principal Protected Note — Knock Out
2. Hedged Position — Covered Call, Protective Put
3. Spreads — Bull/Bear Spread, Butterfly, Calendar Spread
4. Combinations — **Straddle, Strangle**

Combinations

- A combination is an option trading strategy that involves taking a position in both calls and puts on the same stock.
  - Straddles
  - Strips
  - Straps
  - Strangles

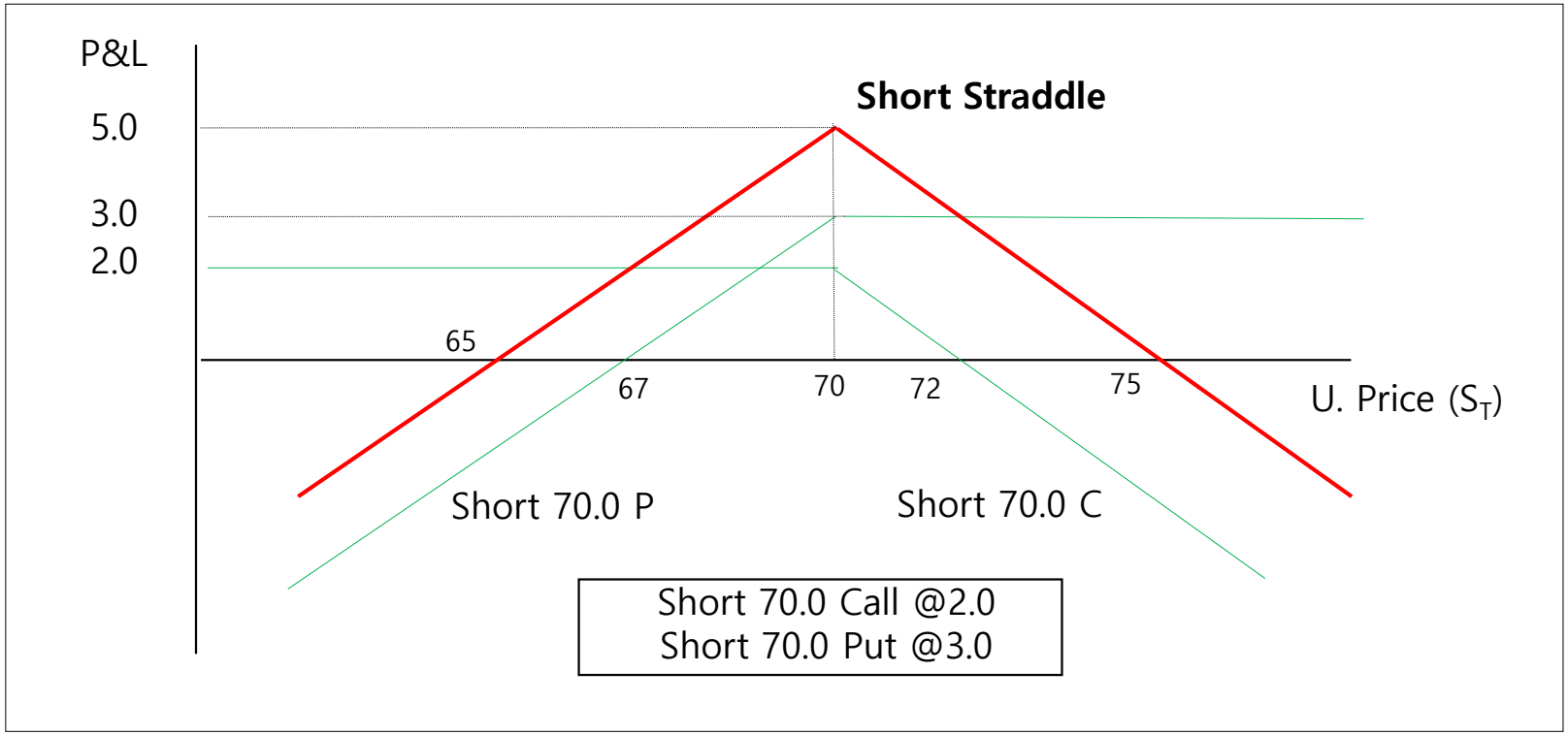
Long Straddle

Buying a European call and put with the same strike price and expiration date



Short Straddle

Selling a European call and put with the same strike price and expiration date

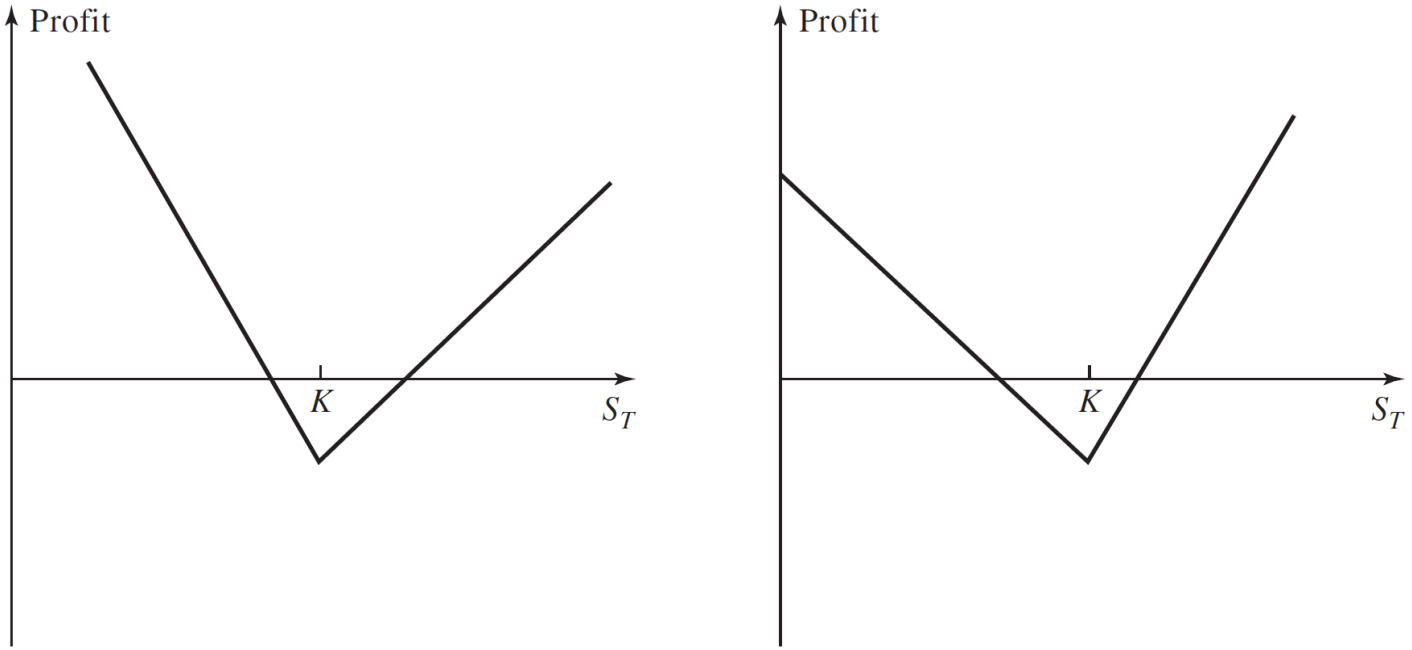


Strips and Straps

- A strip consists of a long position in one European call and two European puts with the same strike price and expiration date
- In a strip the investor is betting that there will be a big stock price move and considers a decrease in the stock price to be more likely than an increase
- A strap consists of a long position in two European calls and one European put with the same strike price and expiration date.
- In a strap the investor is also betting that there will be a big stock price move and considers an increase in the stock price to be more likely than a decrease

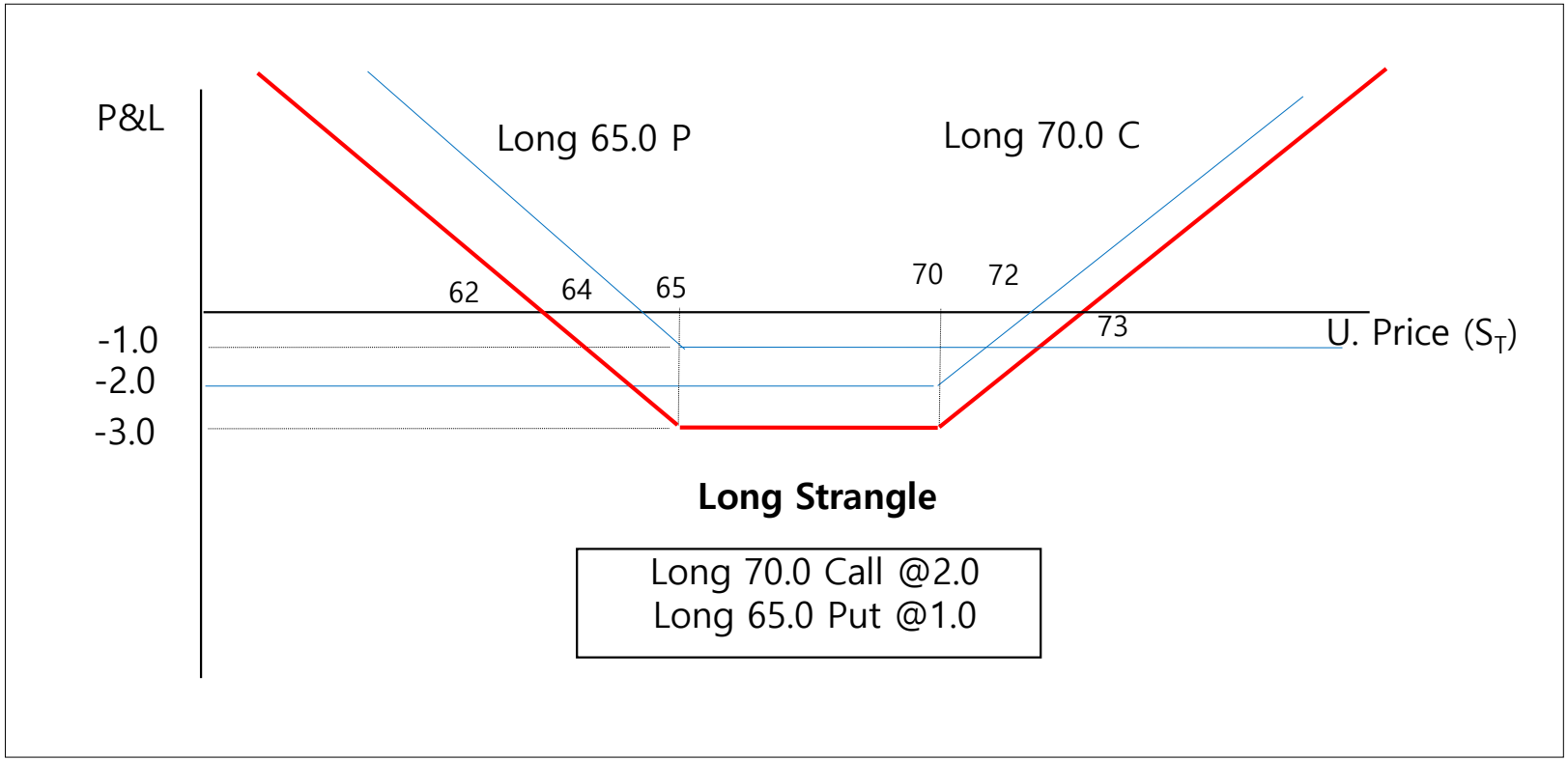
Profit from a Strip and a Strap

Figure 12.11 Profit from a strip and a strap.



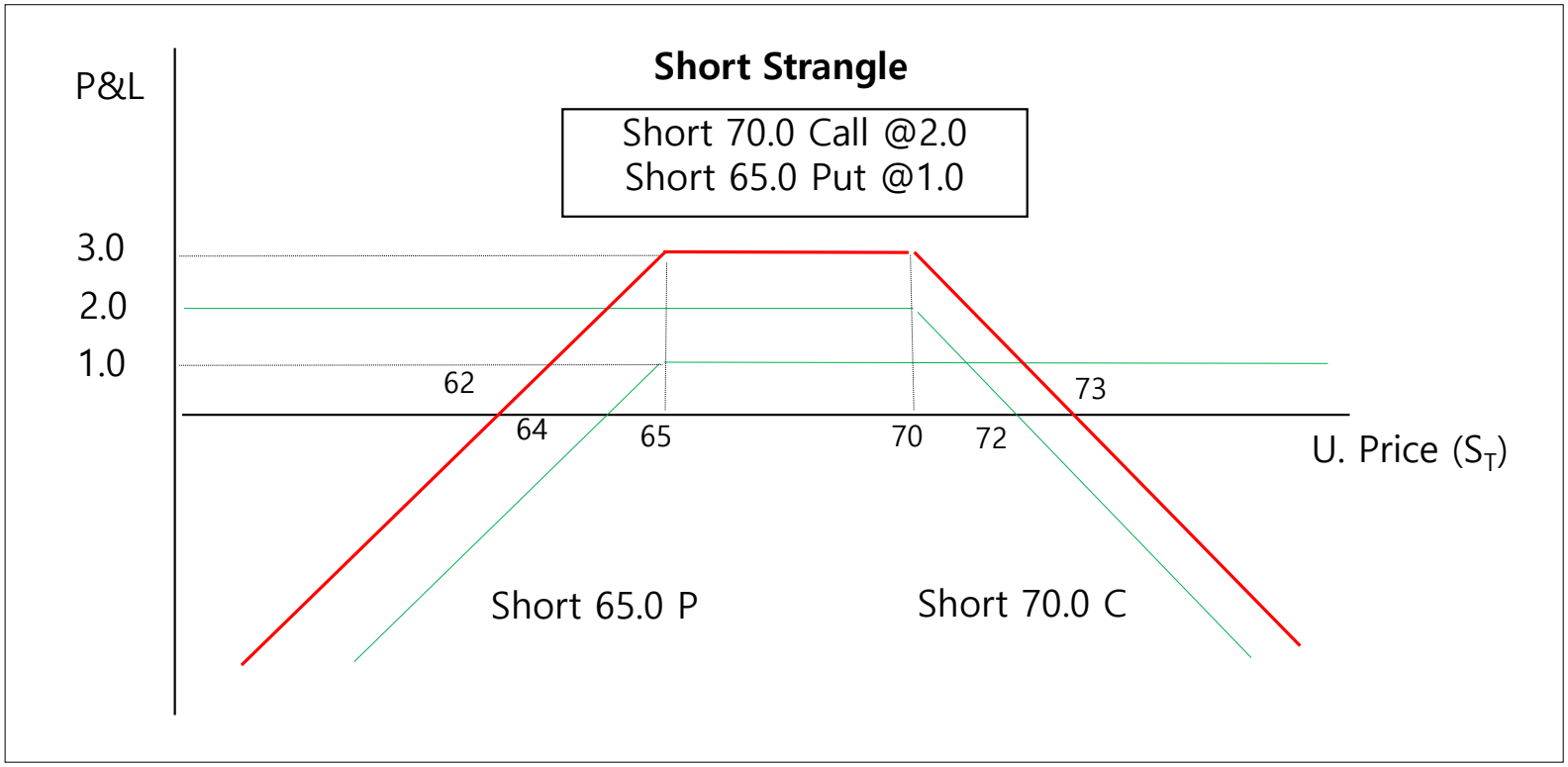
Long Strangle

Buying a European call and put with the same expiration date and different strike prices

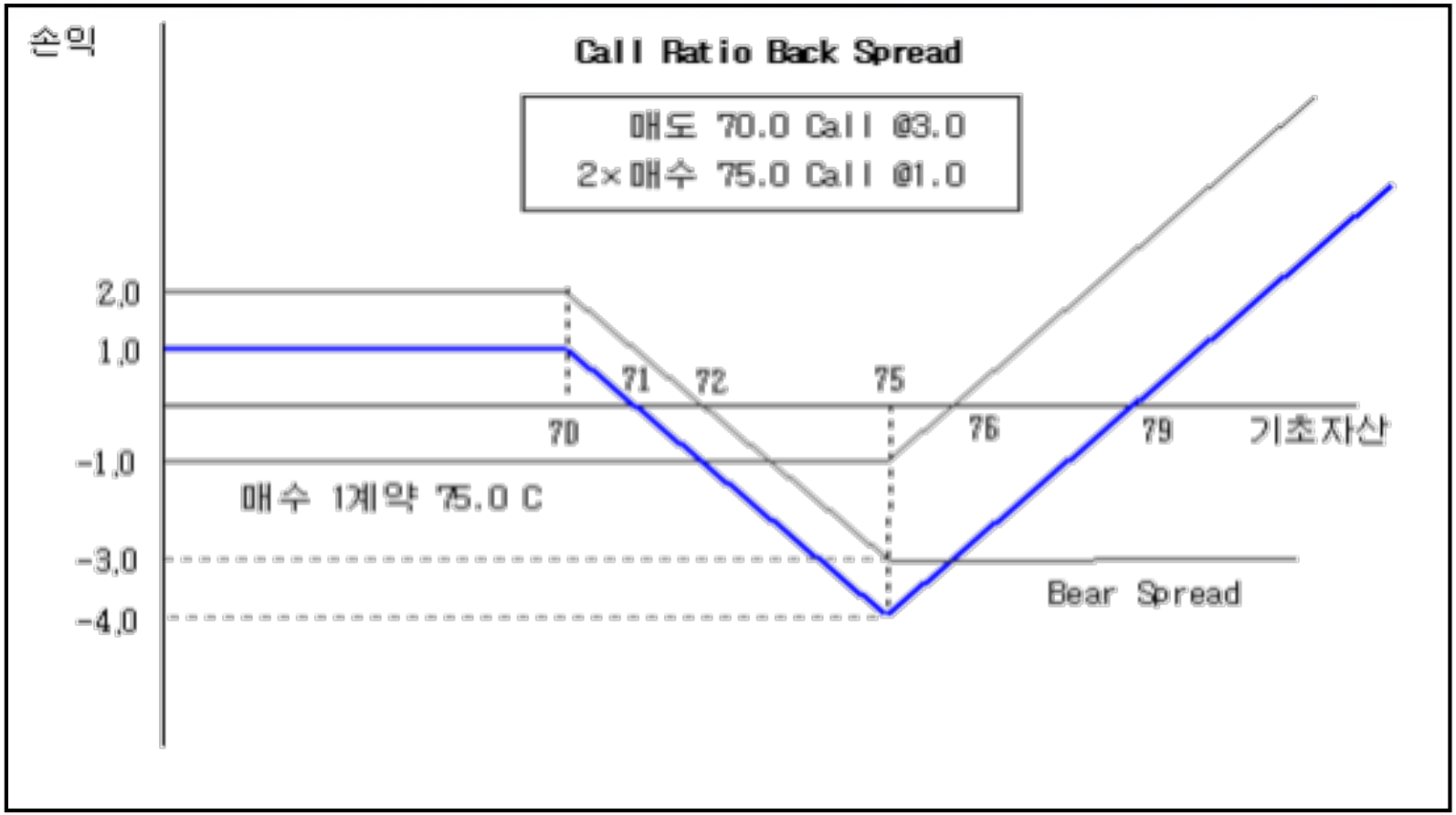


Short Strangle

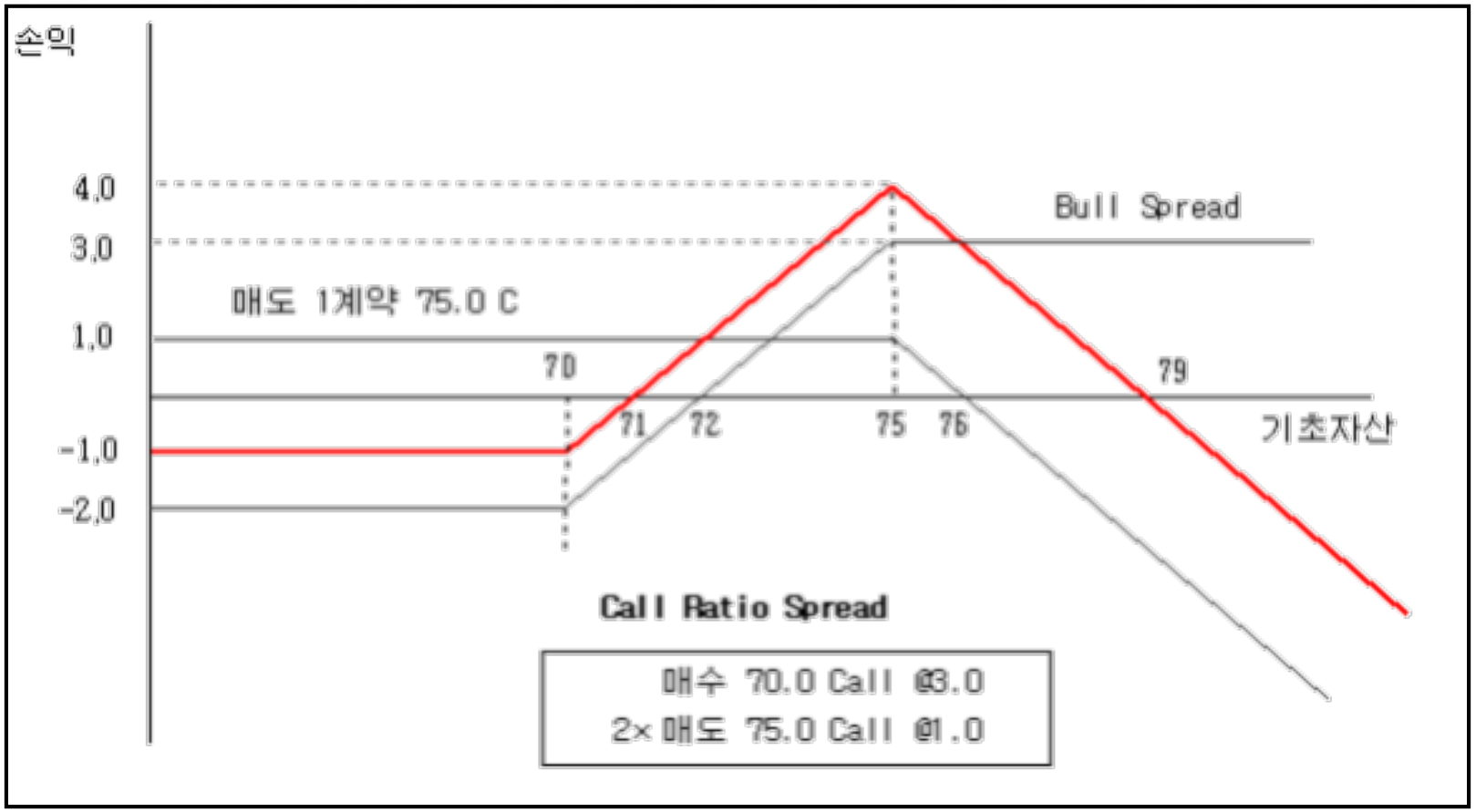
Selling a European call and put with the same expiration date and different strike prices



Ratio Backspread Using Call



Ratio Vertical Spread using Call



Other Payoff Patterns

- When the strike prices are close together, a butterfly spread provides a payoff consisting of a small “spike”
- If options with all strike prices were available, any payoff pattern could (at least approximately) be created by combining the spikes obtained from different butterfly spreads

Homework ch.12

1. Problem 12.8
2. Problem 12.11
3. Problem 12.21

   A trader sells a strangle by selling a call option with a strike price of $50 for $3 and selling a put option with a strike price of $40 for $4. For what range of prices of the underlying asset does the trader make a profit?
4. Problem 12.24 (8 ed. 22)
5. Problem 12.26 (8 ed. 24)
6. Short 70.0 Put @1.0 + Long 75.0 Put @3.0
7. Butterfly

<Bear Spread>
Short 70.0 Call @5.0
Long 75.0 Call @2.0

<Bull Spread>
Long 75.0 Call @2.0
Short 80.0 Call @1.0