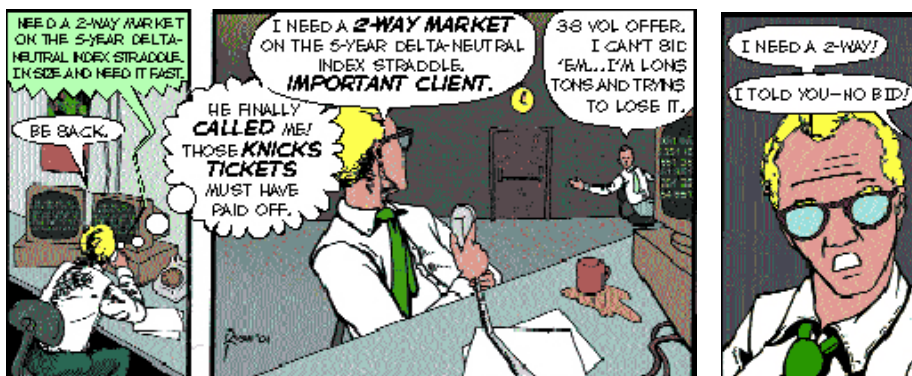


10

Trading strategies involving options



It will not do to leave a live dragon out of your plans if you live near one.

—J.R.R. Tolkien

Overview

- Strategies involving a single option and a stock
- Spreads — ≥ 2 options of same type (all calls, or all puts)
- Combinations — mixture of calls and puts

- Other payoffs

Introduction

- Consider equity options, but same for FX, indices etc.
- European options
- Ignore time value of money
- Think of calls and puts as Lego bricks from which to build
- Figures
 - dashed lines – instruments
 - solid lines – portfolio

Strategies involving a single option and a stock

Possible strategies

- Four possibilities
 - a. long stock, short call
 - b. short stock, long call
 - c. long put, long stock
 - d. short put, short stock
- (a) *Writing a covered call* – long stock “covers” (protects) short call, if $S_T \uparrow$
- (b) reverse of (a)
- (c) *Protective put*
- (d) reverse of (c)

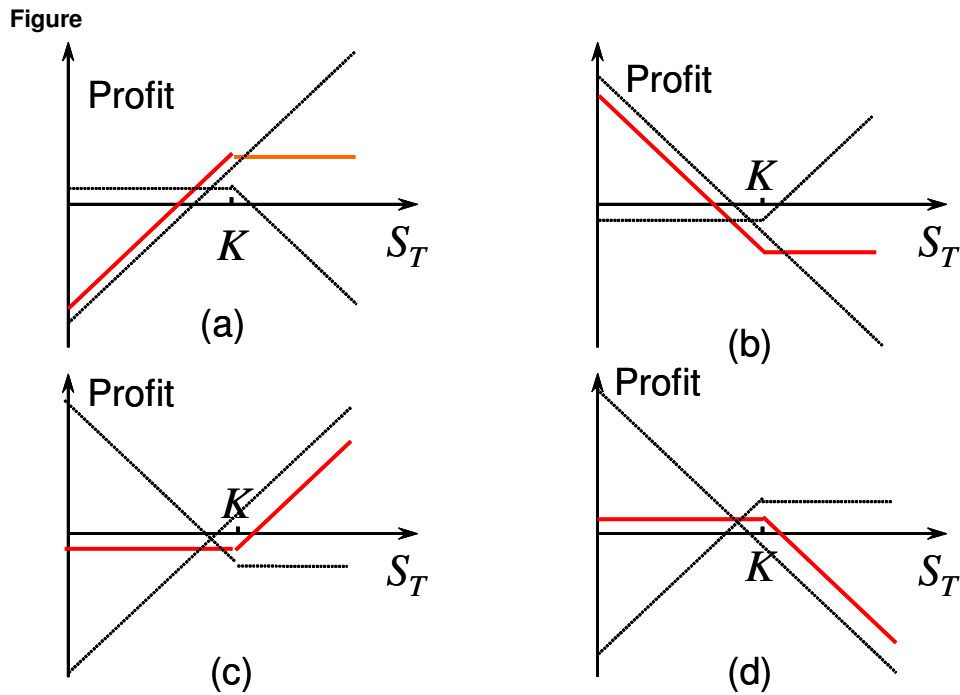


Figure 10.1: Profit patterns • (a) long stock, short call • (b) short stock, long call • (c) long put, long stock • (d) short put, short stock

Put-call parity

- Portfolio payoffs ("profit patterns") correspond to call and put payoffs
- Reason is put-call parity

$$c + \bar{K} + D = p + S_0 \tag{10.1}$$

- I.e. put + stock = call + cash

Spreads

Types of spreads

- Bull
- Bear
- Box
- Butterfly
- Calendar
- Diagonal

Bull spreads

- Bull Spread = long call at K_1 + short call at K_2 , $K_1 < K_2$
- Limits upside and downside – hope stock $\uparrow \square \downarrow \square$
- 3 types to do with moneyness of calls, in order of aggressiveness
 - Both in
 - One in, one out
 - Both out
- Alternatively, long put at K_1 , short put at K_2

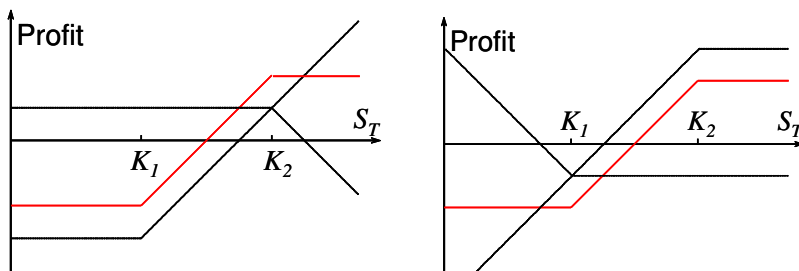


Figure 10.2: Bull spread using calls (left) and puts (right)

Payoffs in each interval

Table 10.1. Payoff from a bull spread created using calls

Interval	Long call	Short call	Total
$K_2 \leq S_T$	$S_T - K_1$	$-(S_T - K_2)$	$K_2 - K_1$
$K_1 < S_T < K_2$	$S_T - K_1$	0	$S_T - K_1$
$S_T \leq K_1$	0	0	0

Example

Example 10.1. A call, with strike price \$30, is bought by an investor for \$3 in combination with a short position in a call, strike price \$35, priced at \$1.

- What is the name of such a strategy?
- What is the payoff when the stock price is below \$30 and above \$35?
- What does the strategy cost?
- What is the profit in all stock price ranges?

Bull spread.
\$0 and \$5, respectively.

Cost of strategy is $\$3 - \$1 = \$2$

Price range	Profit
$35 \leq S_T$	-2
$30 < S_T < 35$	$S_T - 32$
$30 \leq K_1$	3

Bear spreads

- Anticipation prices ↓
- Bear Spread = short call at K_1 + long call at K_2 , $K_1 < K_2$

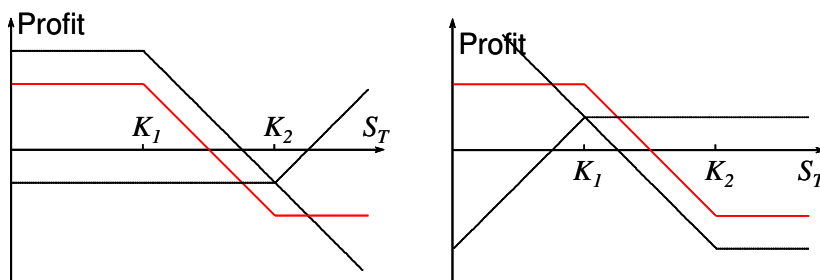


Figure 10.3: Bear spread using calls (left) and puts (right)

Payoffs in each interval

Table 10.2. Payoff from a bear spread created using puts

Interval	Long put	Short put	Total
$K_2 \leq S_T$	0	0	0
$K_1 < S_T < K_2$	$K_2 - S_T$	0	$K_2 - S_T$
$S_T \leq K_1$	$K_2 - S_T$	$-(K_1 - S_T)$	$K_2 - K_1$

Box spreads

- Combination of spreads:
 - bull call
 - bear put
- Valuation
 - European – box spread worth PV of difference between strikes
 - American – not so

Payoffs in each interval

Table 10.3. Payoff from a box spread

<i>Interval</i>	<i>Bull call</i>	<i>Bear put</i>	<i>Total</i>
$K_2 \leq S_T$	$K_2 - K_1$	0	$K_2 - K_1$
$K_1 < S_T < K_2$	$S_T - K_1$	$K_2 - S_T$	$K_2 - K_1$
$S_T \leq K_1$	0	$K_2 - K_1$	$K_2 - K_1$

Butterfly spreads

- Butterfly = long call at K_1 + short two calls at K_2 + long one call at K_3
- Buy low and high, sell intermediate strike
- Bet on stock price staying put
- Small outlay required

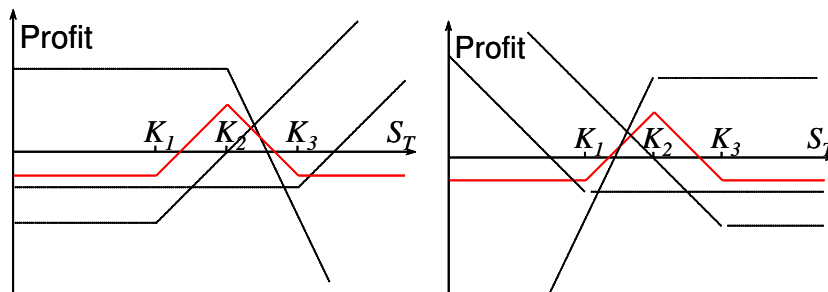


Figure 10.4: Butterfly spread using calls (left) and puts (right)

Payoffs in each interval

- Take $K_2 = \frac{(K_1 + K_3)}{2}$

Table 10.4. Payoff from a butterfly spread

<i>Interval</i>	<i>Long call 1</i>	<i>Long call 2</i>	<i>Short calls</i>	<i>Total</i>
$S_T \leq K_1$	0	0	0	0
$K_1 < S_T < K_2$	$S_T - K_1$	0	0	$S_T - K_1$
$K_2 < S_T < K_3$	$S_T - K_1$	0	$-2(S_T - K_2)$	$K_3 - S_T$
$K_3 \leq S_T$	$S_T - K_1$	$S_T - K_3$	$-2(S_T - K_2)$	0

Calendar spreads

- Same strike, but different expiration dates
- Sell short T call, buy longer T call
- Usually requires initial investment
- Flavours of calendar spread
 - *bearish* – strike < spot
 - *neutral* – strike \approx spot

- *bullish* – strike > spot

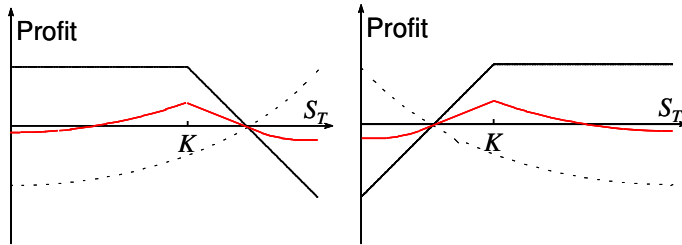


Figure 10.5: Calendar spread using calls (left) and puts (right)

Combinations

- Both calls and puts on same stock

Types of combinations

- Straddle
- Strips and straps
- Strangles

Straddle

- Long – *bottom vertical combination*; short – *top vertical combination*
- Investor expects move, but unsure of direction
- Also *bottom straddle*, or *straddle purchase*
- Cf. *top straddle*, or *straddle write* is reverse

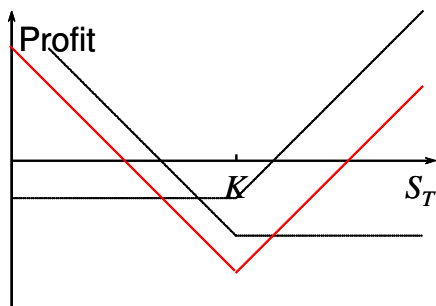


Figure 10.6: Straddle

Payoffs in each interval

Table 10.5. Payoff from a straddle

Interval	Call	Put	Total
$S_T \leq K$	0	$K - S_T$	$K - S_T$
$K < S_T$	$S_T - K$	0	$S_T - K$

Strips and straps

- *Strip* – long one call and two puts; bullish, but more bearish
- *Strap* – long two calls and one put; bearish, but more bullish

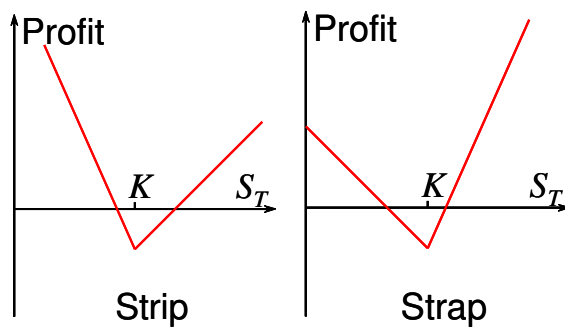


Figure 10.7: Strip (left) and strap (right)

Strangles

- Also *bottom vertical combination*
- Buy call and put with different strikes
- Bet on move, unsure of direction cf. straddle
- Distance between strikes increases
 - downside risk
 - distance stock moves until profit
- Cf. *top vertical combination* is sale of strangle, has unlimited loss

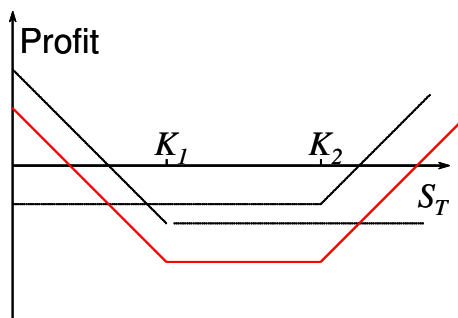


Figure 10.8: Strangle

Payoffs in each interval

Table 10.6. Payoff from a strangle

<i>Interval</i>	<i>Call</i>	<i>Put</i>	<i>Total</i>
$S_T \leq K_1$	0	$K_1 - S_T$	$K_1 - S_T$
$K_1 < S_T < K_2$	0	0	0
$K_2 \leq S_T$	$S_T - K_2$	0	$S_T - K_2$

Other payoffs

Arrow-Debreu securities

- Consider butterfly when $K_1 - K_3 \rightarrow 0$,
- Gives a "spike" payoff
- *Arrow-Debreu securities*:
 - pay off 1 in one state of world; nothing otherwise
 - any payoff superposition of these
 - most basic security
 - not directly traded
 - foundation of economic basis of derivative pricing
 - used in risk management and pricing
 - consistently price these \Rightarrow price any exotic derivative

Summary

Strategies involving a single option and a stock

- E.g. writing a covered call – _____ stock, _____ call
- E.g. protective put – _____ put, _____ stock

Spreads — ≥ 2 options of same type (all calls, or all puts)

- Bull
- Bear
- Box
- Butterfly
- Calendar
- Diagonal

Combinations — mixture of calls and puts on same stock

- Straddle
- Strips and straps
- Strangles

10 *Ian Buckley*

Other payoffs

- Theoretically any