

Evaluating passive strategies



Option strategies

- *Dynamic strategies* are those which are rebalanced as underlying asset prices move and/or as time passes.
- *Passive strategies* refer to portfolios that are formed and held until option's expiration.



Passive strategies

□ Purpose:

- Show terminal values of option positions as function of underlying security price.
- Use Monte Carlo simulation to analyze option portfolio outcomes.
 - Expected return/risk profiles.
- Show how to structure products from basic securities/option positions.



Passive strategies

- Six basic profit diagrams used to analyze passive strategies:
 - Buy (long) underlying asset.
 - Sell (short) underlying asset.
 - Buy call.
 - Sell call.
 - Buy put.
 - Sell put.



Profit functions

- Long asset.

$$\pi_T = S_T - Se^{bT}$$

- Short asset.

$$\pi_T = Se^{bT} - S_T$$

Profit functions

- Long call.

$$\pi_T = \begin{cases} S_T - X - ce^{rT} & \text{if } S_T > X \\ -ce^{rT} & \text{if } S_T \leq X \end{cases}$$

- Short call.

$$\pi_T = \begin{cases} -(S_T - X) + ce^{rT} & \text{if } S_T > X \\ ce^{rT} & \text{if } S_T \leq X \end{cases}$$

Profit functions

- Long put.

$$\pi_T = \begin{cases} X - S_T - pe^{rT} & \text{if } S_T < X \\ -pe^{rT} & \text{if } S_T \geq X \end{cases}$$

- Short put.

$$\pi_T = \begin{cases} -(X - S_T) + pe^{rT} & \text{if } S_T < X \\ pe^{rT} & \text{if } S_T \geq X \end{cases}$$



Combining asset/options

- To find profit diagram of portfolio consisting of asset and options, add individual profit functions.
 - E.g.: *Covered call* is long asset and short call in one-to-one ratio.

Covered call

□ Profit function

$$\pi_T = \begin{cases} S_T - Se^{bT} - S_T + X + ce^{rT} & \text{if } S_T > X \\ S_T - Se^{bT} + ce^{rT} & \text{if } S_T \leq X \end{cases}$$

Covered call

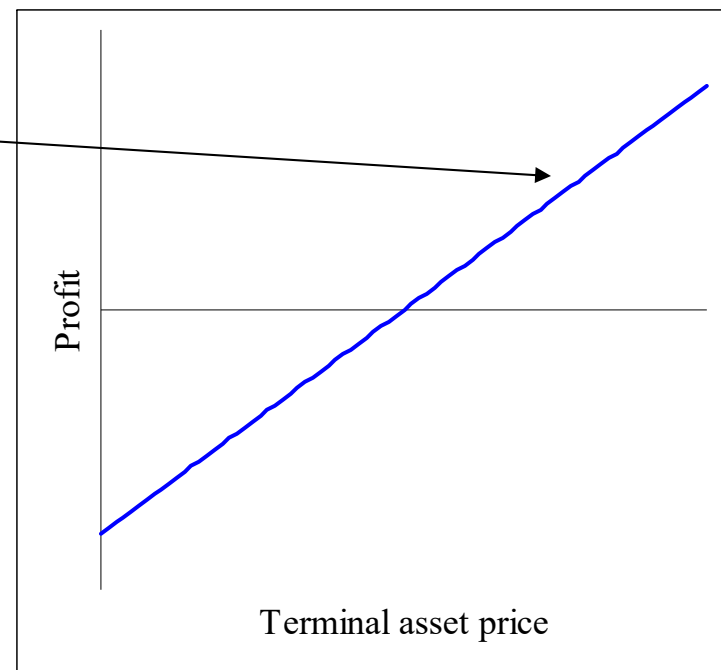
- Profit function

$$\pi_T = \begin{cases} -Se^{bT} + X + ce^{rT} & \text{if } S_T > X \\ S_T - Se^{bT} + ce^{rT} & \text{if } S_T \leq X \end{cases}$$

Covered call

- Long asset; short call.

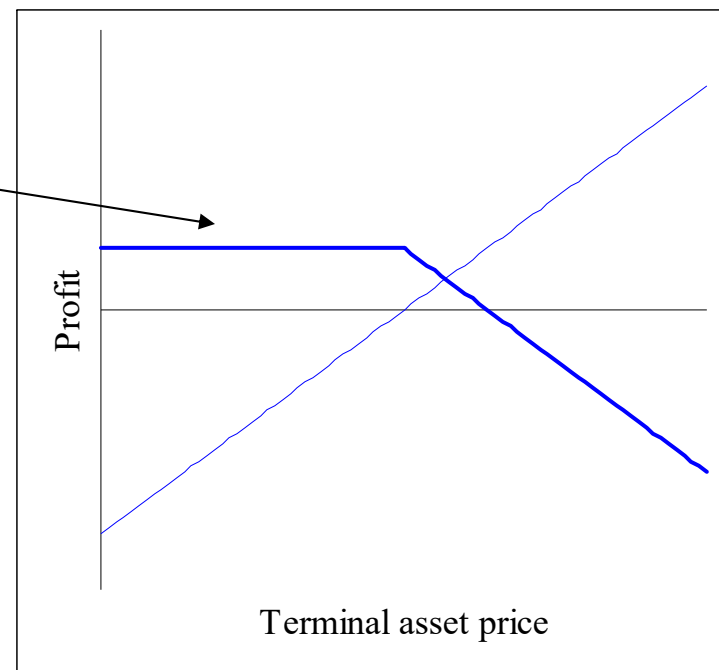
Long asset



Covered call

- Long asset; short call.

Short call

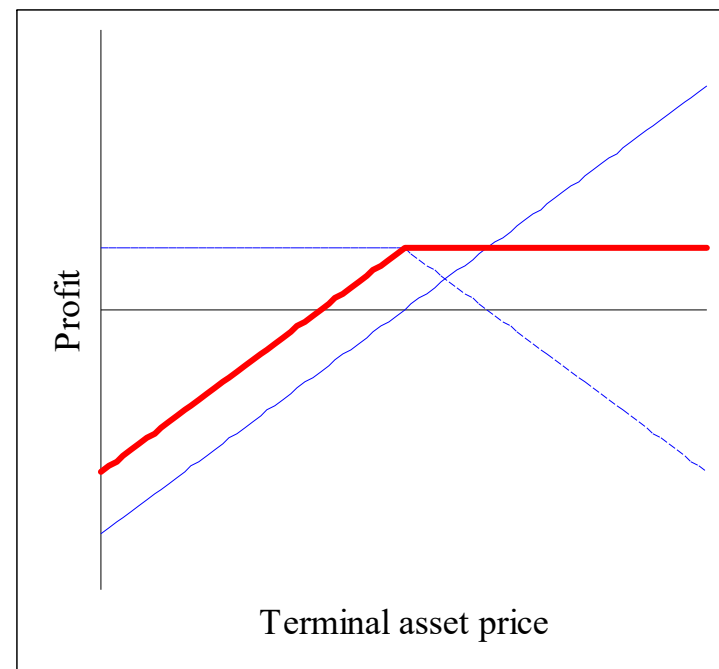


Covered call

- *Covered call* is long asset and short call.

Combined position.

Looks like short put.



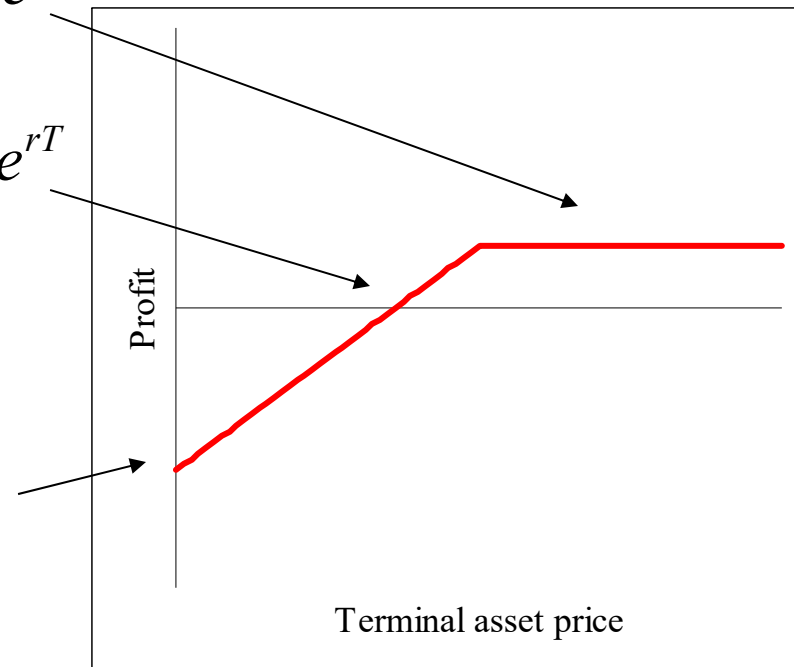
Covered call

- *Covered call* is long asset and short call.

Maximum gain: $-Se^{bT} + X + ce^{rT}$

Breakeven asset price: $Se^{bT} - ce^{rT}$

Maximum loss: $-Se^{bT} + ce^{rT}$





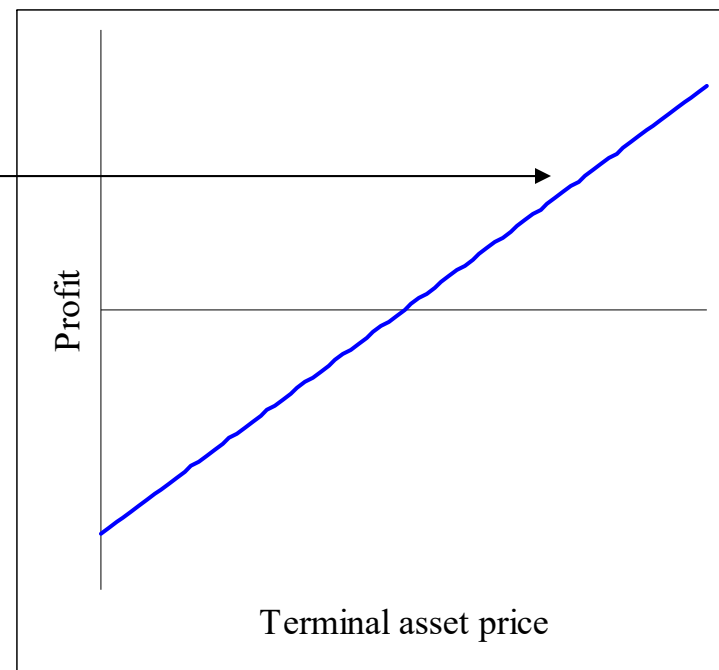
Protective put

- *Protective put* is long asset and long put in one-to-one ratio.

Protective put

- *Protective put* is long asset and long put.

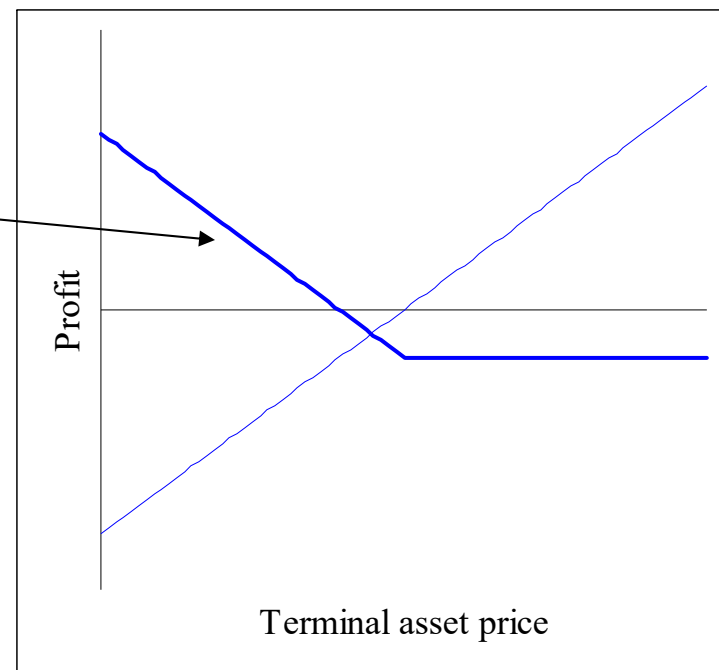
Long asset



Protective put

- *Protective put* is long asset and long put.

Long put

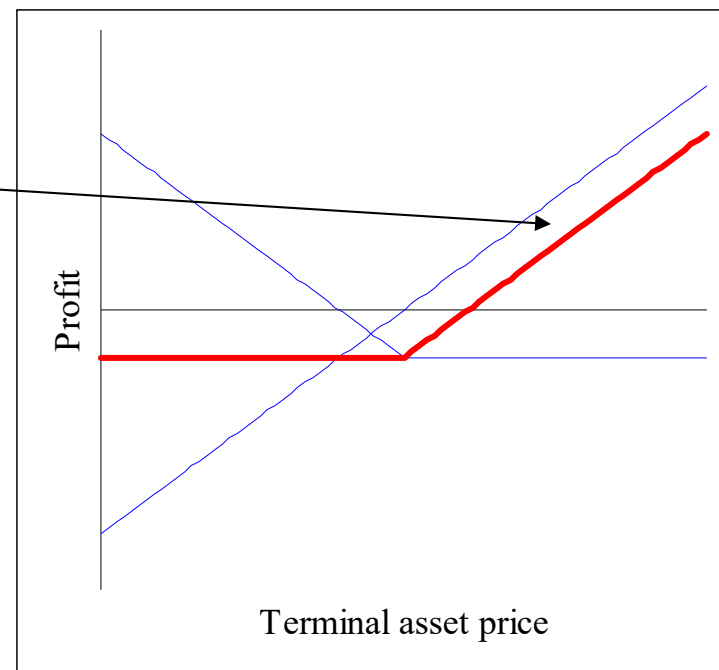


Protective put

- *Protective put* is long asset and long put.

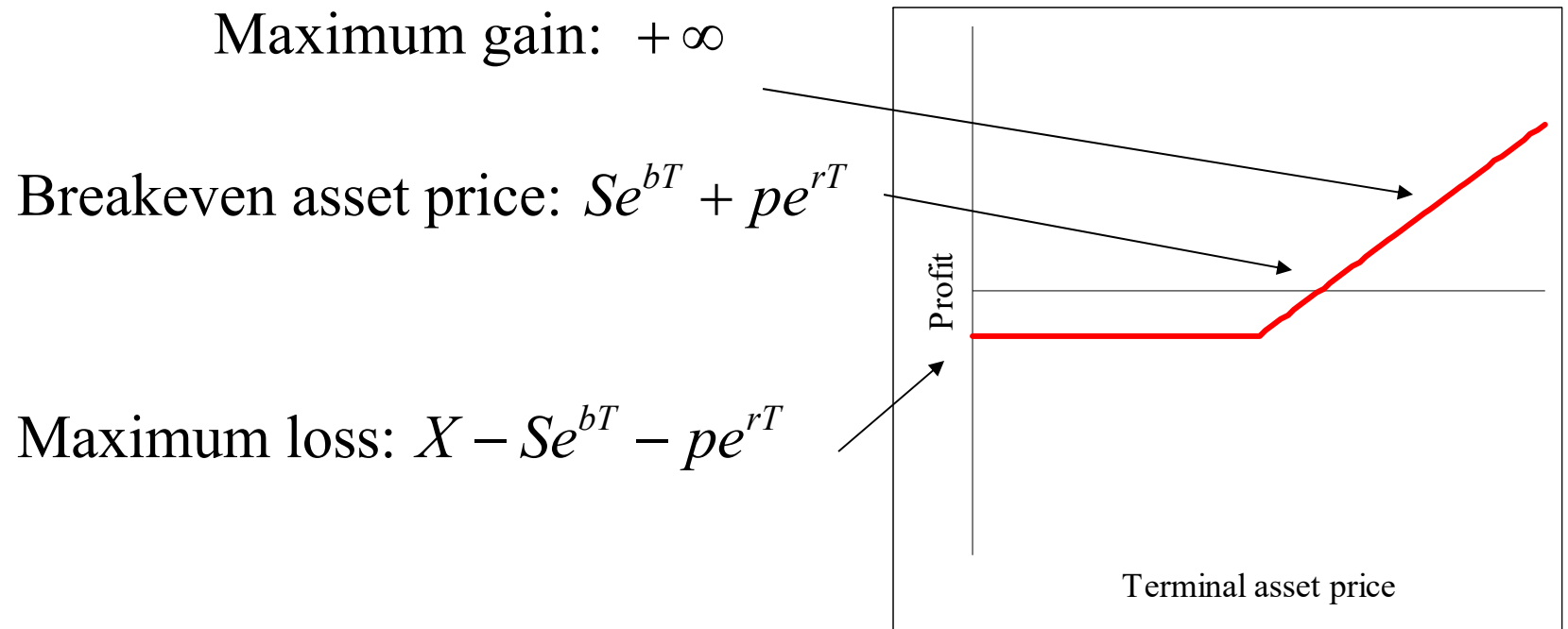
Combined position.

Looks like long call.



Protective put

- *Protective put* is long asset and long put.



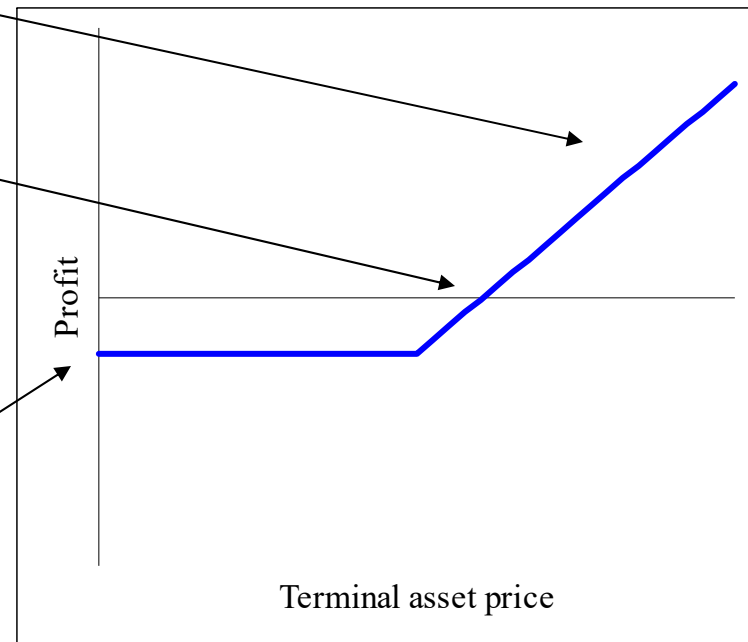
Multiple options

- Long 1 call.

Maximum gain: $+\infty$

Breakeven asset price: $X + ce^{rT}$

Maximum loss: $-ce^{rT}$



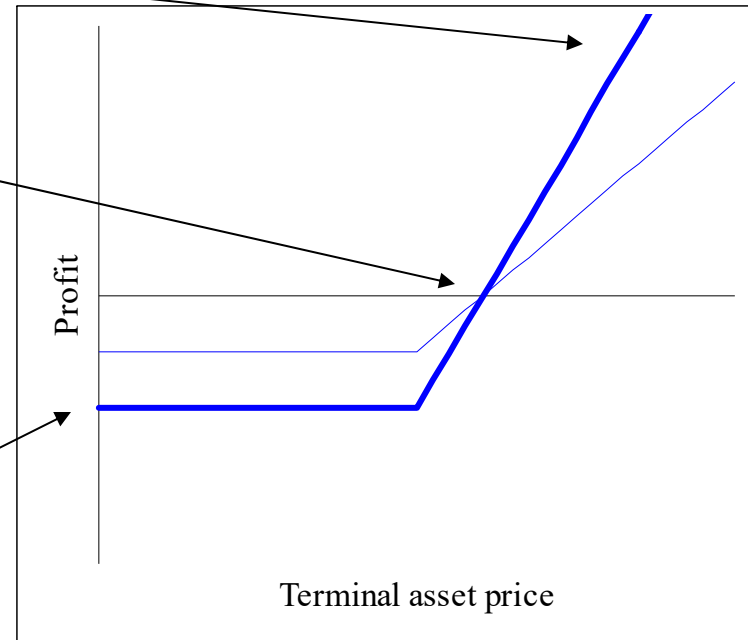
Multiple options

- Long 2 calls.

Maximum gain: $+\infty$

Breakeven asset price: $X + ce^{rT}$

Maximum loss: $-2ce^{rT}$



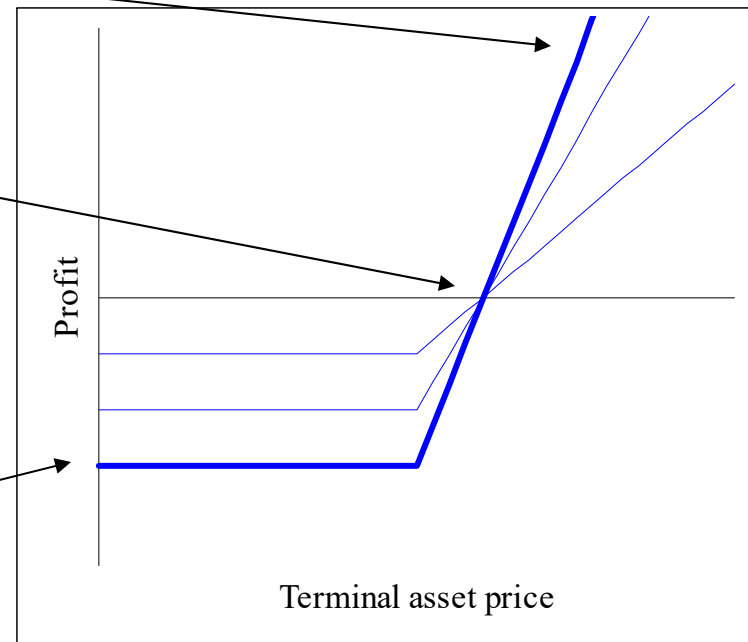
Multiple options

- Long 3 calls.

Maximum gain: $+\infty$

Breakeven asset price: $X + ce^{rT}$

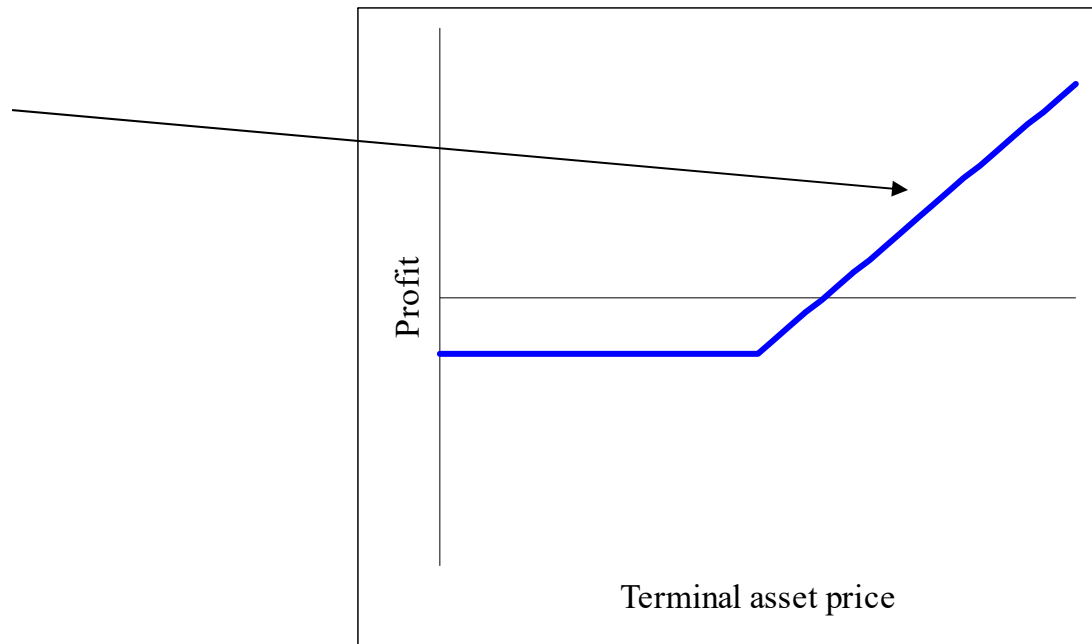
Maximum loss: $-3ce^{rT}$



Bull spread

- Long 50 call; short 55 call.

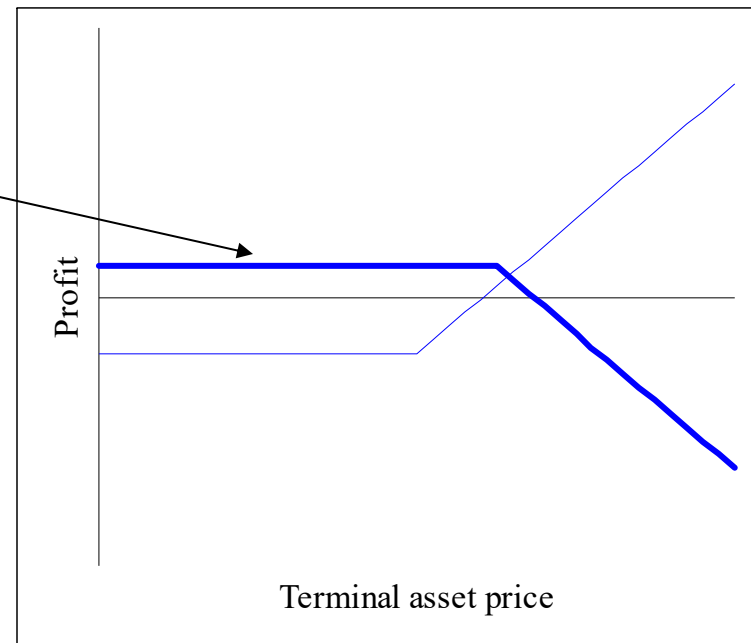
Long 50 call



Bull spread

- Long 50 call; short 55 call.

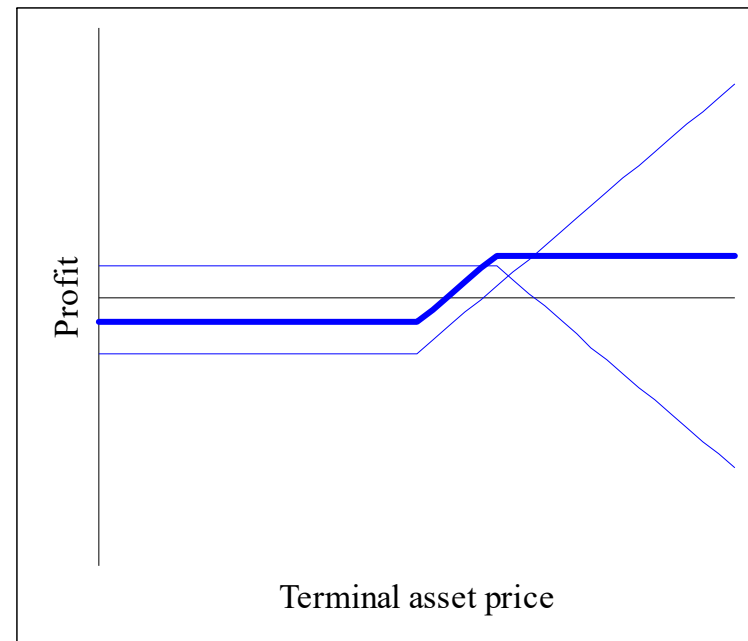
Short 55 call



Bull spread

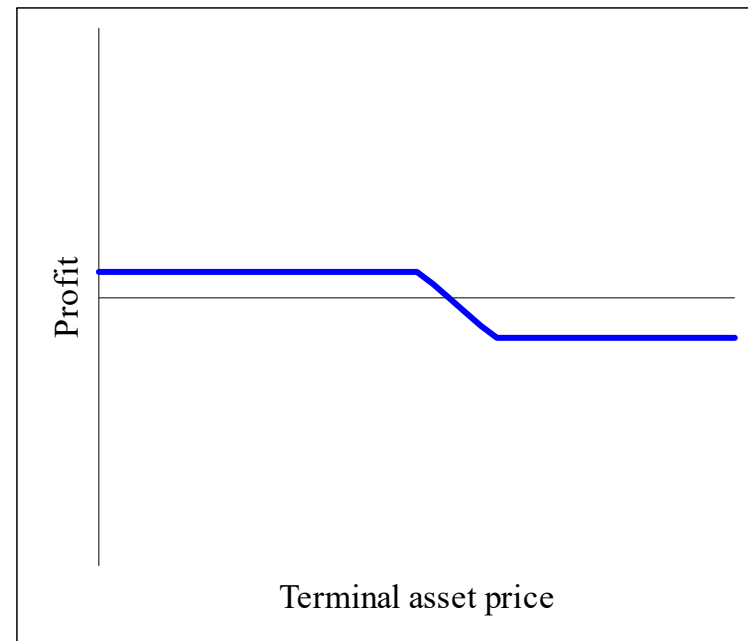
- Long 50 call; short 55 call.

Bull spread.



Bear spread

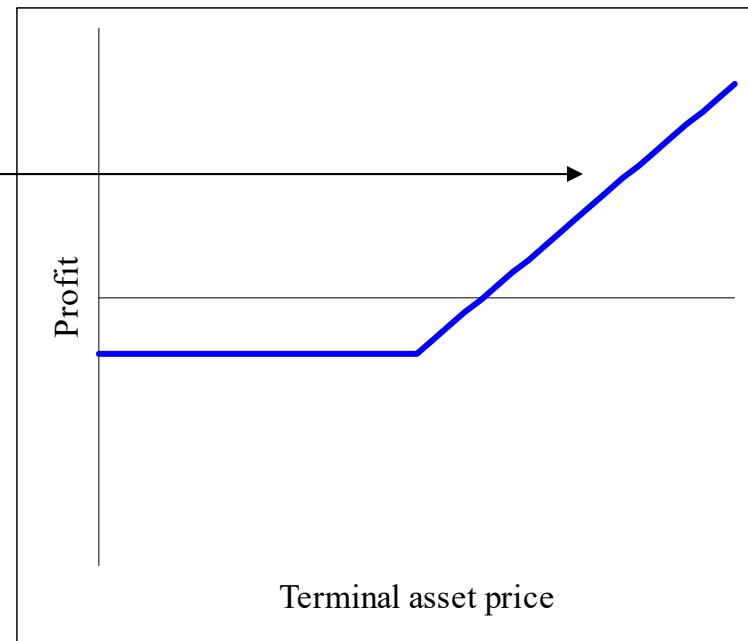
- Short 50 call; long 55 call.



Volatility spread (Straddle)

- Long 50 call; long 50 put

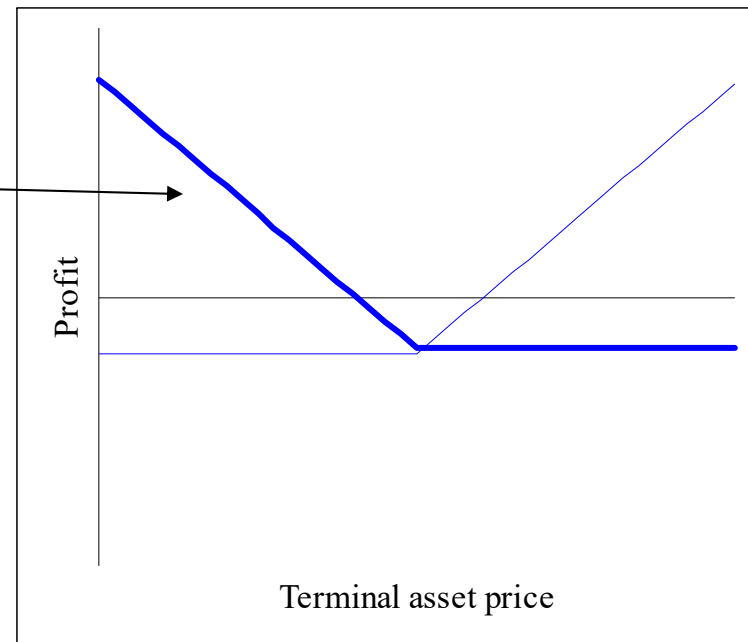
Long 50 call.



Volatility spread (Straddle)

- Long 50 call; long 50 put

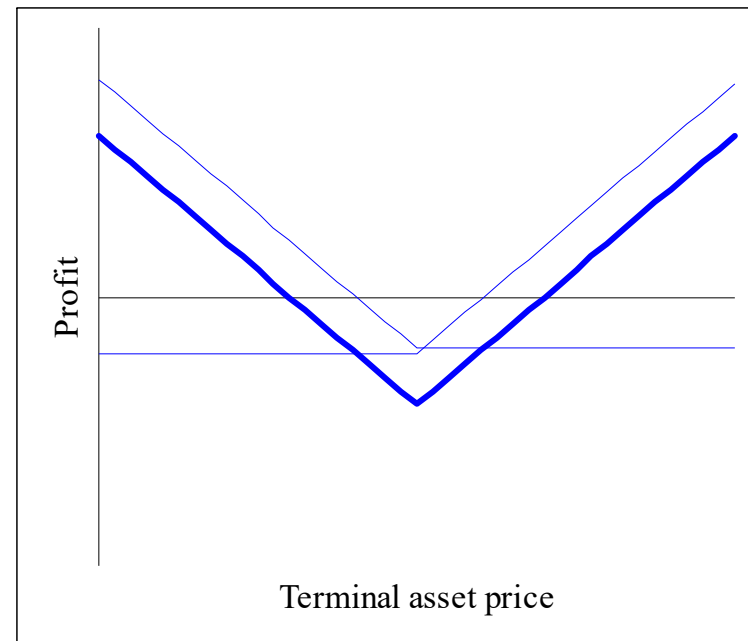
Long 50 put.



Volatility spread (Straddle)

- Long 50 call; long 50 put

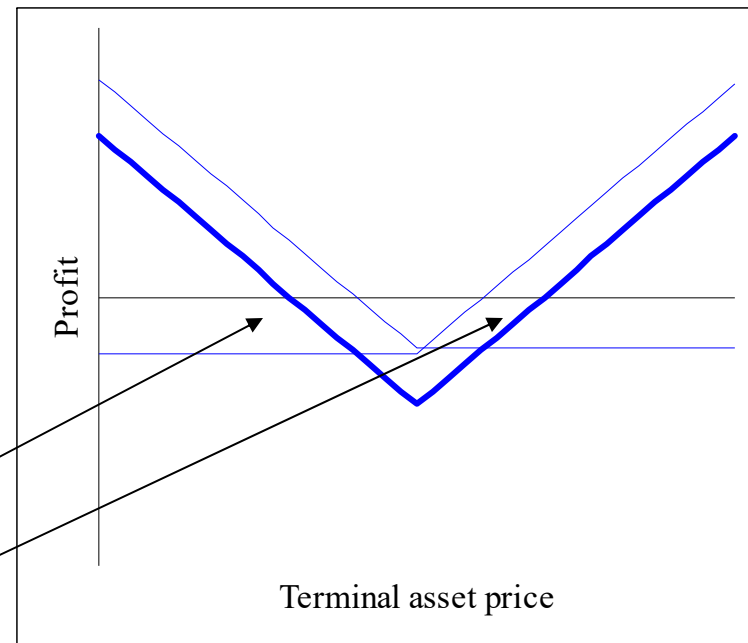
Long 50 straddle.



Volatility spread (Straddle)

- Long 50 call; long 50 put

Breakeven points: $X - (c + p)e^{rT}$
 $X + (c + p)e^{rT}$

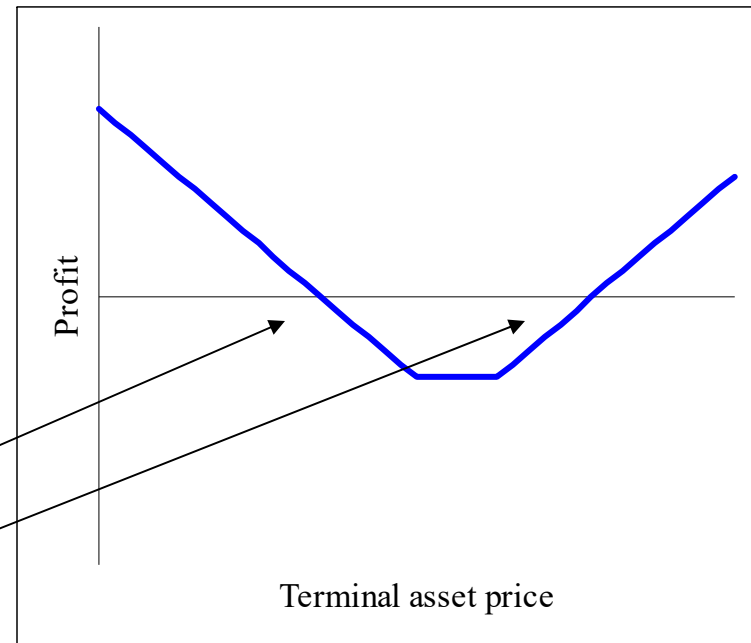


Volatility spread (Strangle)

- Long 55 call; long 50 put

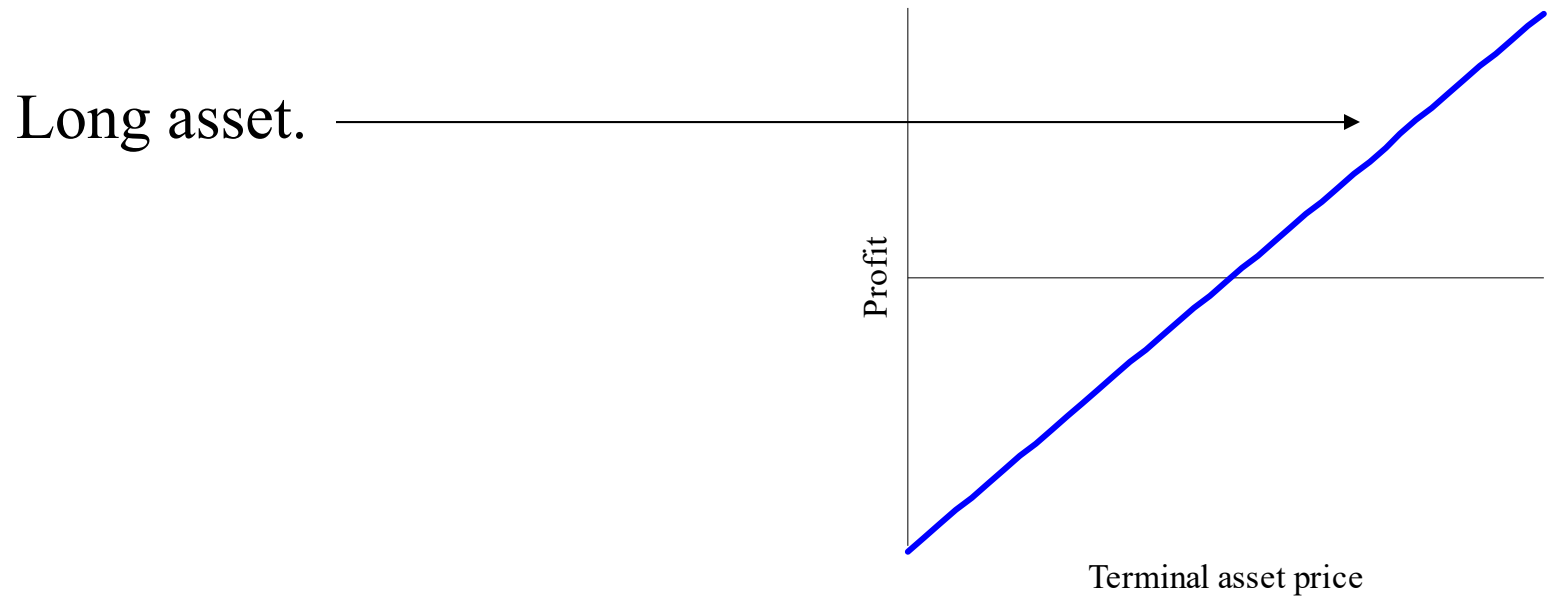
Breakeven points: $50 - (c + p)e^{rT}$

$55 + (c + p)e^{rT}$



Conversion arbitrage

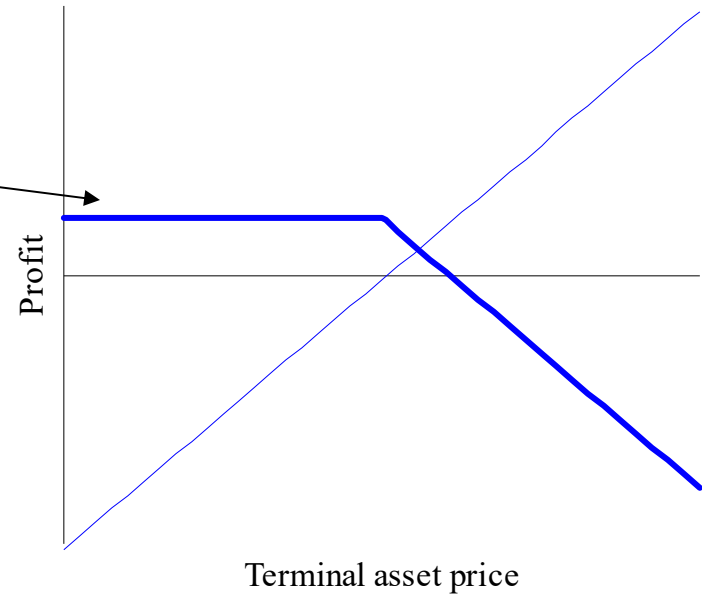
- Long asset, short call, long put.



Conversion arbitrage

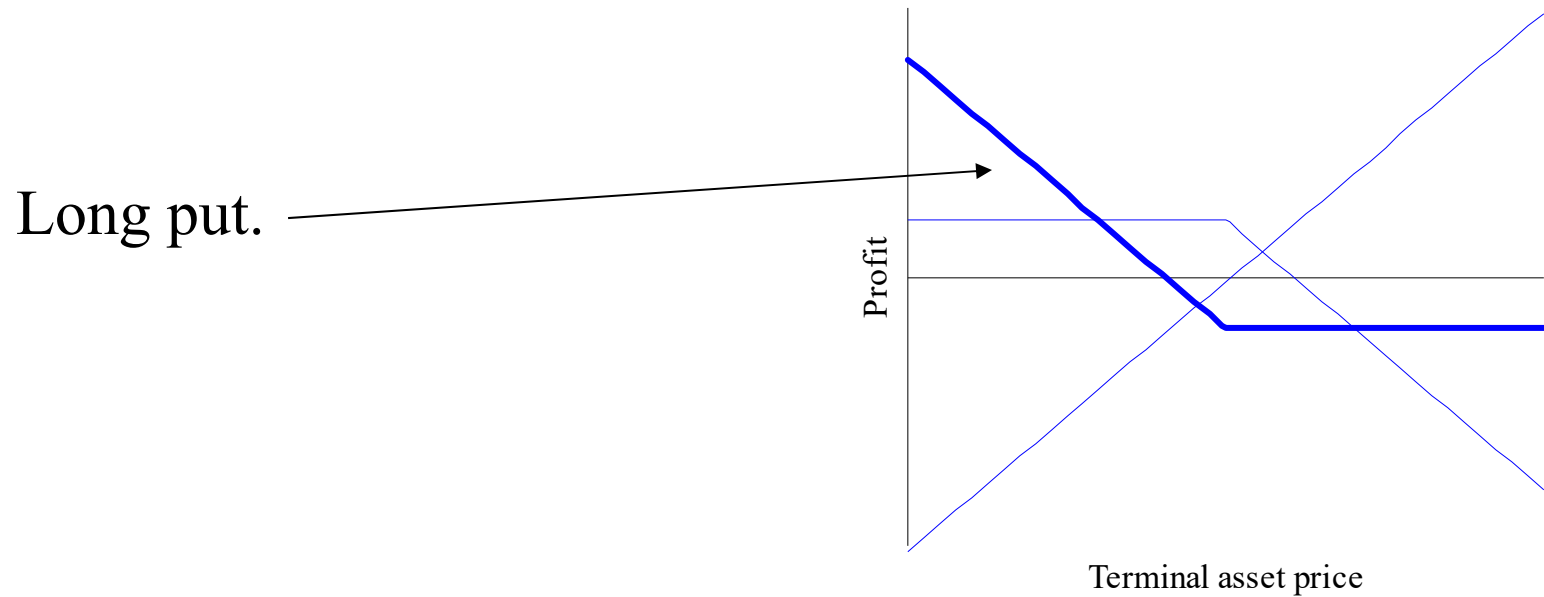
- Long asset, short call, long put.

Short call.



Conversion arbitrage

- Long asset, short call, long put.

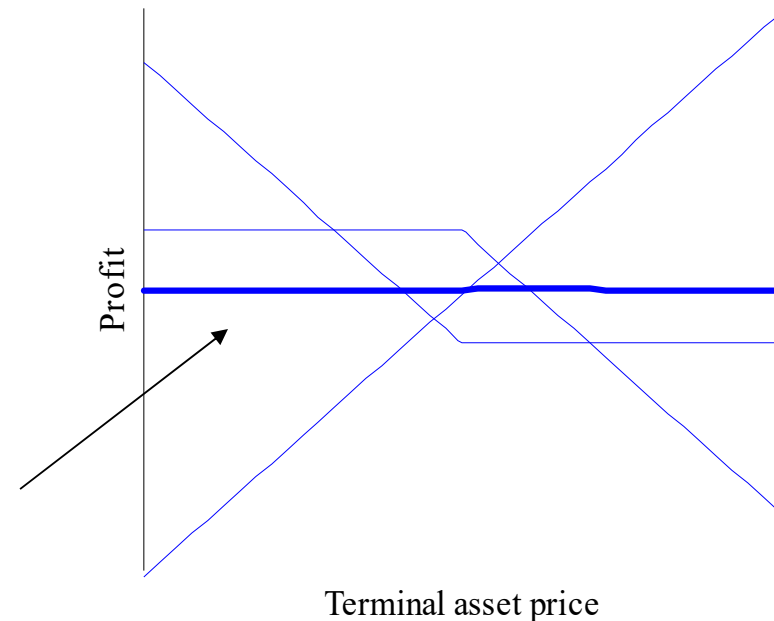


Conversion arbitrage

- Long asset, short call, long put.

Conversion arbitrage.

If asset/options are fairly priced, conversion should yield zero profit.





Breakeven probabilities

- Profit diagrams show various strategies have breakeven asset prices.
- Apply mechanics of BSM to compute breakeven probabilities.

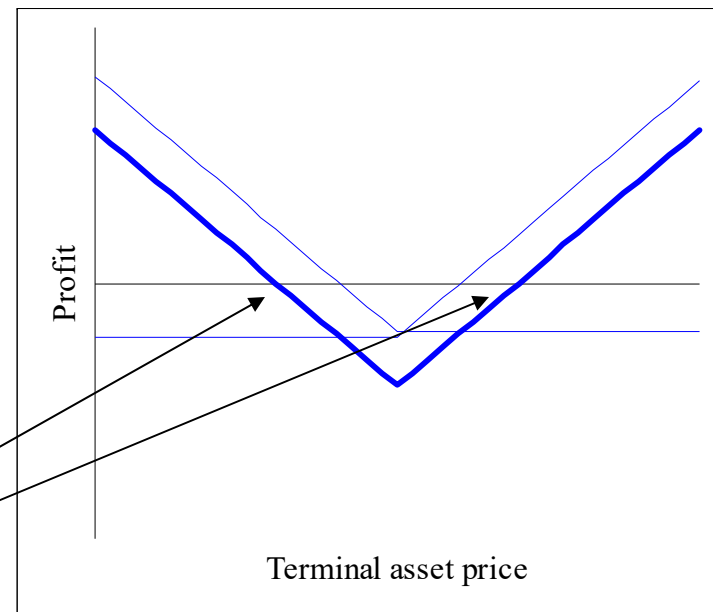


Breakeven probabilities

- Consider at-the-money straddle or volatility spread.
 - Asset
 - price is 50
 - expected asset return is 8%
 - income rate is 2%
 - Call price is 4.196
 - Put price is 3.701
 - Risk-free rate is 6%

Breakeven probabilities

- At-the-money straddle has two breakeven points.





Breakeven probabilities

- At-the-money straddle has two breakeven points.

$$BE_l = X - (c + p)e^{rT}$$

$$BE_u = X + (c + p)e^{rT}$$

Breakeven probabilities

- At-the-money straddle has two breakeven points.

$$BE_l = 50 - (4.196 + 3.701)e^{.06(.25)} = 41.984$$

$$BE_u = 50 + (4.196 + 3.701)e^{.06(.25)} = 58.016$$

Breakeven probabilities

- Probability of positive profit.

$$\Pr(S_T < BE_l \text{ or } S_T > BE_u) = N(-d_l) + N(d_u)$$

$$d_l = \frac{\ln(S e^{\alpha T} / BE_l) - .5\sigma^2 T}{\sigma\sqrt{T}}$$

$$d_u = \frac{\ln(S e^{\alpha T} / BE_u) - .5\sigma^2 T}{\sigma\sqrt{T}}$$

Breakeven probabilities

- Probability of positive profit.
 - Risk-neutral probability:

$$\alpha = b = r - i$$

- Risk-averse (real-world) probability:

$$\alpha = E_S - i$$

From CAPM



Breakeven probabilities

□ Probability of positive profit.

- Risk-neutral probability: 41.88%

$$\Pr(S_T < 41.984) = 20.51\%$$

$$\Pr(S_T > 58.016) = 21.38\%$$

- Risk-averse (real-world) probability: 41.92%

$$\Pr(S_T < 41.984) = 19.80\%$$

$$\Pr(S_T > 58.016) = 22.11\%$$



Expected profits/returns

- Expected strategy profit/return can be computed using Monte Carlo simulation.
 - Supporting file: Expected option return-risk.xlsx



Structuring products

- Oftentimes banks create passively managed products with multiple contingencies.
 - Supporting file:
 - HSBC Buffered return enhanced note.xlsx

Structuring products



Structured
Investments

HSBC USA Inc.

\$17,923,000

Buffered Return Enhanced Notes Linked to the S&P 500[®] Index due February 10, 2011 (the "notes")



Structuring products

Terms used in this pricing supplement are described or defined herein, in the accompanying product supplement, prospectus supplement and prospectus. The notes offered will have the terms described herein and in the accompanying product supplement, prospectus supplement and prospectus. **The notes are not principal protected, and you may lose up to 100.00% of your initial investment.**



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Senior unsecured debt obligations of HSBC USA Inc. maturing February 10, 2011.



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Senior unsecured debt obligations of HSBC USA Inc. maturing February 10, 2011.

Minimum denominations of \$10,000 and integral multiples of \$1,000 in excess thereof.

Structuring products

Key Terms

Issuer: HSBC USA Inc.

Issuer Rating: AA- (S&P), A1 (Moody's), AA (Fitch)*

Reference Asset: The S&P 500® Index ("SPX") (the "Reference Asset")

Principal Amount: \$1,000 per note.

Trade Date: January 22, 2010

Pricing Date: January 22, 2010

Original Issue Date: January 27, 2010

Ending Averaging Dates: February 1, 2011, February 2, 2011, February 3, 2011, February 4, 2011 and February 7, 2011 (the Final Valuation Date), subject to adjustment as described herein and in the accompanying product supplement.



Structuring products

Cash Settlement Value: For each note, you will receive a cash payment on the Maturity Date that is based on the Reference Return (as described below):

If the Reference Return is greater than or equal to 0.00%, you will receive an amount equal to 100.00% of the principal amount plus the lesser of: (i) the product of (a) the principal amount multiplied by (b) the Reference Return multiplied by the Upside Participation Rate; and (ii) the product of (a) the principal amount multiplied by (b) the Maximum Return.



Structuring products

Cash Settlement Value: For each note, you will receive a cash payment on the Maturity Date that is based on the Reference Return (as described below):

If the Reference Return is less than 0.00% but greater than or equal to -10.00%, meaning that the level of the Reference Asset declines by no more than the 10.00% Buffer Amount, at maturity, you will receive 100.00% of the principal amount; and



Structuring products

Cash Settlement Value: For each note, you will receive a cash payment on the Maturity Date that is based on the Reference Return (as described below):

If the Reference Return is greater than or equal to 0.00%, you will receive an amount equal to 100.00% of the principal amount plus the lesser of:

- (i) the product of (a) the principal amount multiplied by (b) the Reference Return multiplied by the Upside Participation Rate; and
- (ii) the product of (a) the principal amount multiplied by (b) the Maximum Return.

If the Reference Return is less than 0.00% but greater than or equal to -10.00%, meaning that the level of the Reference Asset declines by no more than the 10.00% Buffer Amount, at maturity, you will receive 100.00% of the principal amount; and

If the Reference Return is less than -10.00%, meaning that the level of the Reference Asset declines by more than the 10.00% Buffer Amount, at maturity, you will lose 1.11111% of the principal amount for



Structuring products

If the Reference Return is less than -10.00%, meaning that the level of the Reference Asset declines by more than the 10.00% Buffer Amount, at maturity, you will lose 1.11111% of the principal amount for each percentage point that the Reference Return is below -10.00%. **This means that if the Reference Return is -100.00%, you will lose your entire investment.**

Upside Participation Rate: 200.00%

Maximum Return: 10.74%

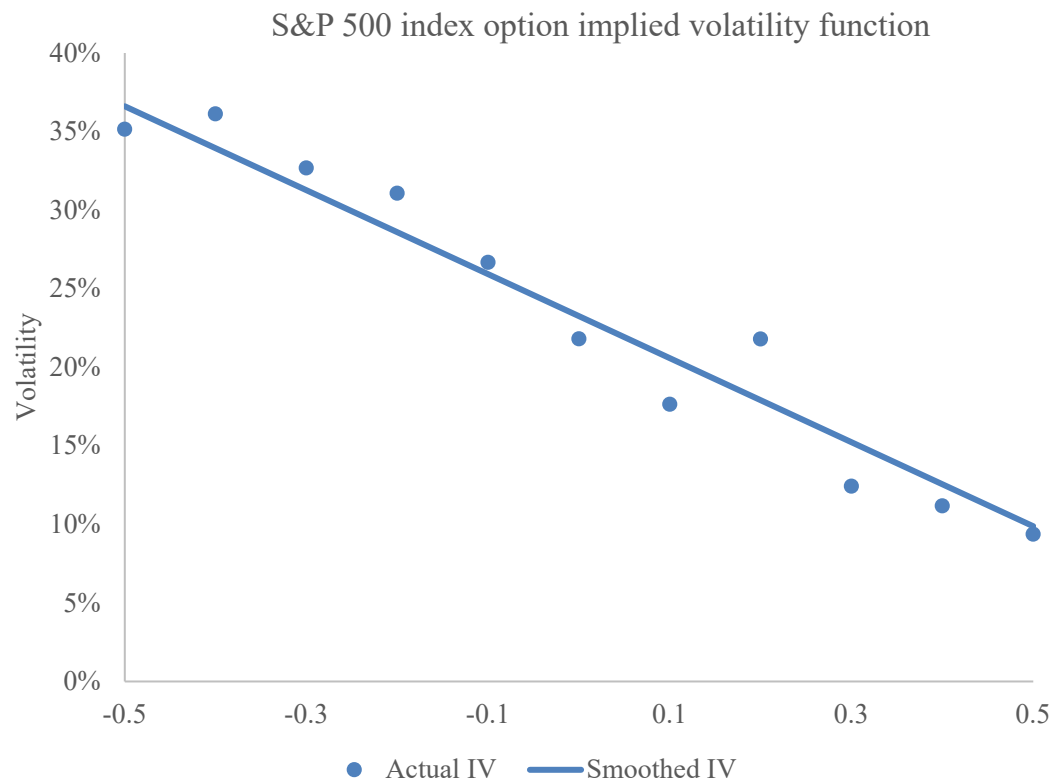
Buffer Amount: 10.00%. Your principal is protected against up to a 10.00% decline in the level of the Reference Asset over the term of the notes.

Downside Leverage Factor: 1.11111

Structuring products



Structuring products



Structuring products

<i>Valuation</i>	No. of options	C/P	Exercise price	Moneyness X/S-1	Volatility	Total value
Buy ATM calls.	2	C	100.00	0.00	0.2325	19.778
Sell OTM calls.	-2	C	105.37	0.0537	0.2181	(18.622)
Sell OTM puts.	-1.1111	P	90.00	-0.1000	0.2592	(11.132)
Buy risk-free bonds						99.055
Value of buffered return enhanced note						89.079
Margin						10.921
Margin (%)						12.26%



Lesson summary

- *Passive strategies* can be analyzed using six basic profit diagrams:
 - Buy (long) underlying asset.
 - Sell (short) underlying asset.
 - Buy call.
 - Sell call.
 - Buy put.
 - Sell put.



Lesson summary

- *Passive strategies* refer to portfolios that are formed and held until option's expiration.
 - Analyzed using:
 - Profit functions
 - Breakeven probabilities
 - Expected profits/returns
 - Create structured product using valuation by replication.
 - Not hard to do.