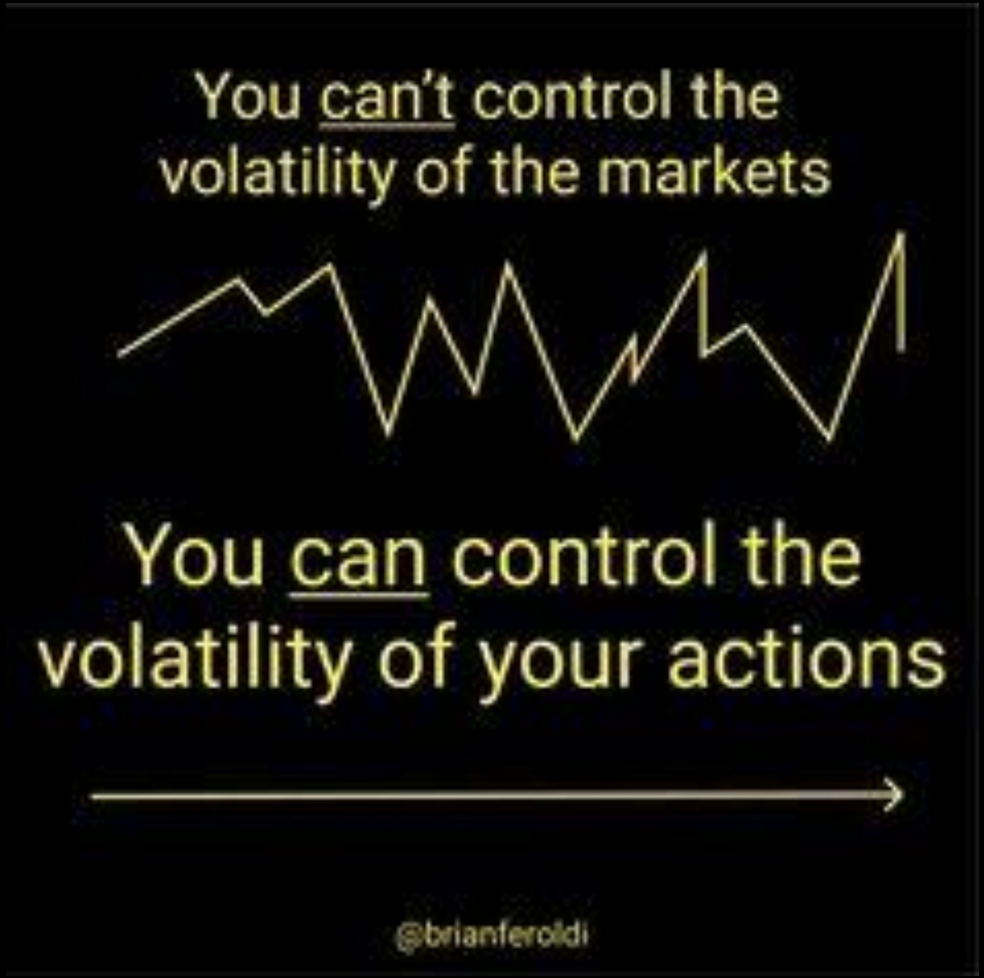
Options Strategies and Swaps

Session 9 & 10

Agenda

- Overview of Derivative Markets
- Call Option
- Put Option
- Properties of Options
- RBI Recent changes
- Revision
- Factors affecting option Pricing
- Put-Call Parity
- Binomial Option Pricing Model
- Option Strategies
- Swaps



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Derivatives in India

ETPrime

Desperate retail investors drive India's options craze

By Andy Mukherjee, Bloomberg • Last Updated: Dec 12, 2023, 10:12:52 AM IST

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Synopsis

The Securities and Exchange Board of India's crackdown on social-media influencers peddling advice is a losing battle. Although nine out of 10 individual traders are losing money, retail investors can't get enough of derivatives. A smartphone-led gamification of investing is complete.

It is especially worrying in India, where trading in futures and options is now more than 400 times bigger than the underlying cash-market turnover

Derivatives Markets in India

How to trade IHCL, Hindalco and Bharat Forge with F&O.

- The Indian market cheered the five state election results on Monday with both Nifty and Nifty Bank reaching their all-time high levels.

  Hindalco stock showing upward movements with limits. The stock decisively crossed this level with good volumes than previous month.

- On the derivative front, huge writing was seen on the put side with significant open interest at the strike prices of 520, 510, and 500.

- Stock can see the level of 550 in the short term.

- Indian Hotels has been on an upward momentum since April 2021 reaching an all-time high of 436. Seeing the option chain, writing was seen on the put side whereas huge buying on the call side

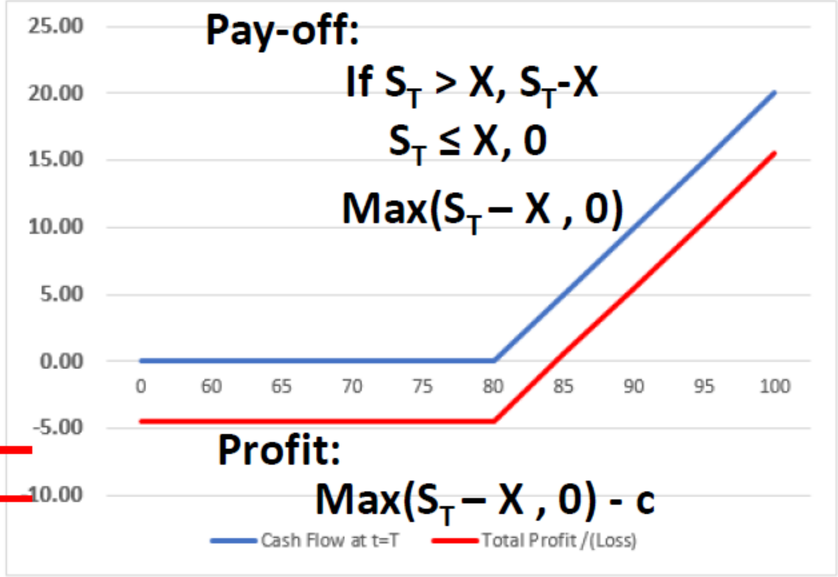
Trading News in F&O

Bharat Forge rallied although huge writing was seen on the put fresh new sell positions were created on the put side whereas call writers reduced their position depicting the conviction of the bulls. So, for a short-term, Bharat Forge can be bought with a target of 1220.

Pay-off & Profit (Loss) for Call Option Holder

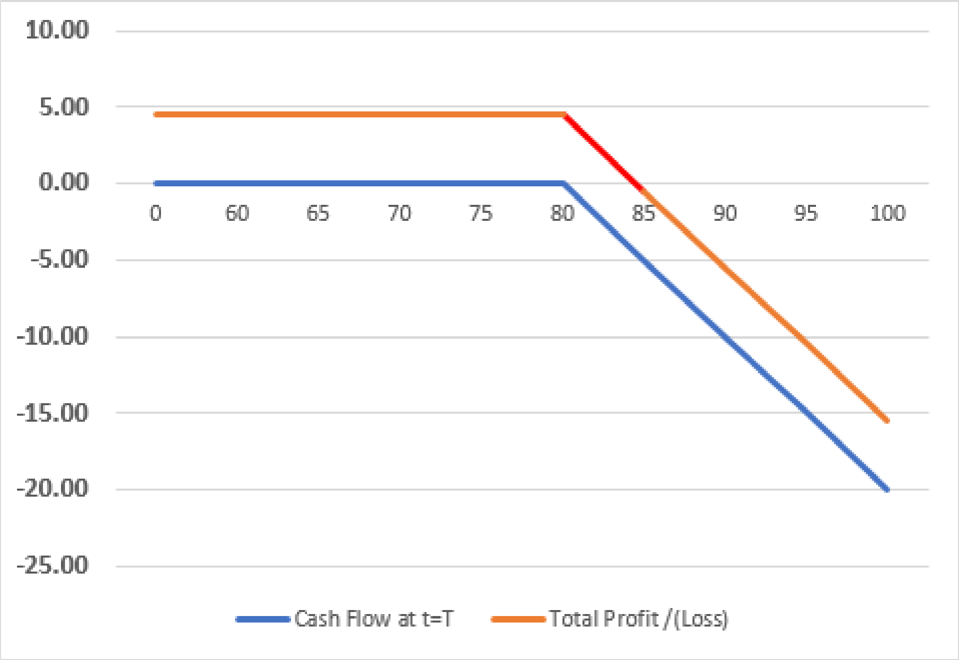
Call Price on January 1	4.50
Exercise Price (X)	80.00

	Stock Price on April 15	Cash Flow at t=0	Will Call Buyer exercise Call Option?	Cash Flow at t=T	Total Profit /(Loss)
	0	-4.50	No	0.00	-4.50
	60	-4.50	No	0.00	-4.50
OTM	65	-4.50	No	0.00	-4.50
	70	-4.50	No	0.00	-4.50
	75	-4.50	No	0.00	-4.50
ATM	80	-4.50	Indifferent	0.00	-4.50
	85	-4.50	Yes	5.00	0.50
ITM	90	-4.50	Yes	10.00	5.50
	95	-4.50	Yes	15.00	10.50
	100	-4.50	Yes	20.00	15.50



Pay-off & Profit (Loss) for Call Option Seller

Call Price on January 1				4.50
Exercise Price (X)				80.00
Stock Price on April 15	**Cash Flow at t=0**	**Will Call Buyer exercise Call Option?**	**Cash Flow at t=T**	**Total Profit /(Loss)**
0	4.50	No	0.00	4.50
60	4.50	No	0.00	4.50
65	4.50	No	0.00	4.50
70	4.50	No	0.00	4.50
75	4.50	No	0.00	4.50
80	4.50	Indifferent	0.00	4.50
85	4.50	Yes	-5.00	-0.50
90	4.50	Yes	-10.00	-5.50
95	4.50	Yes	-15.00	-10.50
100	4.50	Yes	-20.00	-15.50



Profit/(Loss) for Put Option Holder

Put Price on January 1: 5.20

Put Exercise Price(X): 75.00

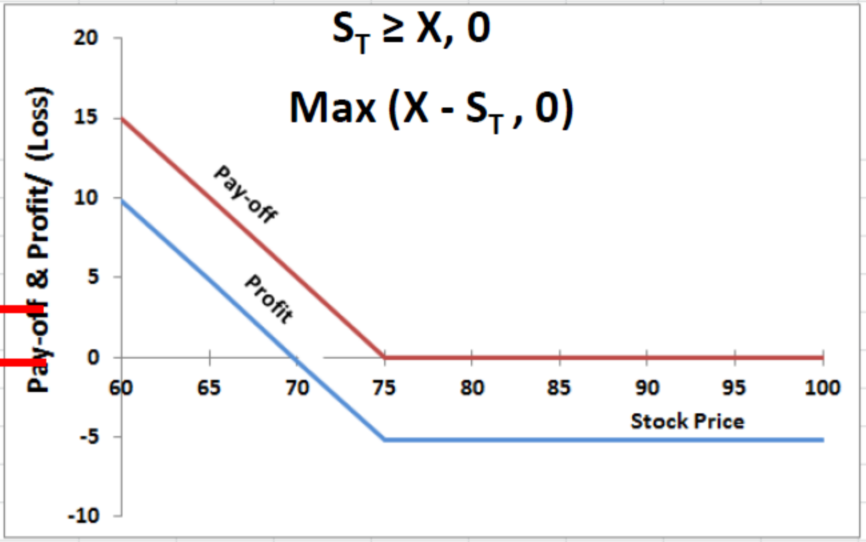
	Stock Price on April 15	Cash Flow at t=0	Will Put Buyer exercise the Put?	Cash Flow at t=T	Total Profit/ (Loss)
	0	-5.20	Yes	75.00	69.80
ITM	60	-5.20	Yes	15.00	9.80
	65	-5.20	Yes	10.00	4.80
	70	-5.20	Yes	5.00	-0.20
ATM	75	-5.20	Indifferent	0.00	-5.20
	80	-5.20	No	0.00	-5.20
	85	-5.20	No	0.00	-5.20
	90	-5.20	No	0.00	-5.20
OTM	95	-5.20	No	0.00	-5.20
	100	-5.20	No	0.00	-5.20

Pay-off:

If $S_T < X$, $X - S_T$

$S_T \geq X$, 0

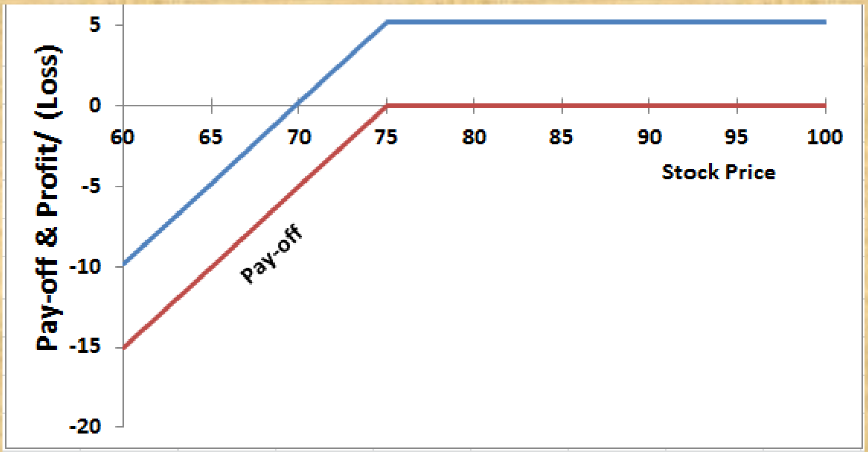
Max $(X - S_T, 0)$



➢ When you **Buy a Put Option**, you Buy the right to sell the stock in the future for a pre-determined price, for which you pay the Put premium today.

Profit/(Loss) for Put Option Writer

Stock Price on April 15	Cash Flow at t=0	Will Put Buyer exercise the Put?	Cash Flow at t=T	Total Profit/ (Loss)
0	5.20	Yes	-75.00	-69.80
60	5.20	Yes	-15.00	-9.80
65	5.20	Yes	-10.00	-4.80
70	5.20	Yes	-5.00	0.20
75	5.20	Indifferent	0.00	5.20
80	5.20	No	0.00	5.20
85	5.20	No	0.00	5.20
90	5.20	No	0.00	5.20
95	5.20	No	0.00	5.20
100	5.20	No	0.00	5.20



Adjustments for Corporate Actions (Stock Options)

- Corporate actions like dividends, bonus shares or stock splits change the value of underlying stock and hence options of these stock would also change in value.

- Adjustment for Dividends: Exchange traded options do not provide for adjustment for dividends.

- For dividends upto10% of the market value of underlying stock, no adjustment is made to no. of share or exercise price is made.

- For extra-ordinary dividends (above 10%), amount of dividend is reduced from the all the exercise prices on the stock (w.e.f. ex-dividend date).

Adjustments for Corporate Actions (Bonus Shares)

Adjustment for Bonus Shares (Stock Dividend) : Bonus shares do not change the aggregate value of shares but affects the stock price.

- For an '*a:b*' bonus issue, No. of shares increase to (1+ *a/b*)of its previous value and Exercise price goes down by 1/ (1+ *a/b*)of its previous value.

No. of Shares in 1 Options Contract 500 (1+Bonus ratio) 500*(1+2/5) =700

Exercise Price 140 1/(1+Bonus ratio) 140* 1/(1+2/5) = 100

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Closure of Options

For Buyer of an Option:

✓By Exercising the Option

✓By letting the Option to expire

- For Seller of an Option:

✓By entering an offsetting trade

•An *obligation* to sell/buy stands nullified by a *right* to buy/sell and not by creating another obligation to buy/sell.

If Means To Nullify Sold Call Obligation to Sell → Buy Call
Sold Put Obligation to → Buy Put

Factors Affecting Option Prices

The following factors have a bearing on the price of a Stock Option:

1. Current Stock Price (S0)
2. Strike Price (X)
3. Time to expiration (t)
4. Volatility of the Stock Price
5. Risk-free interest rate (rf)
6. Dividends expected during the life of the option.

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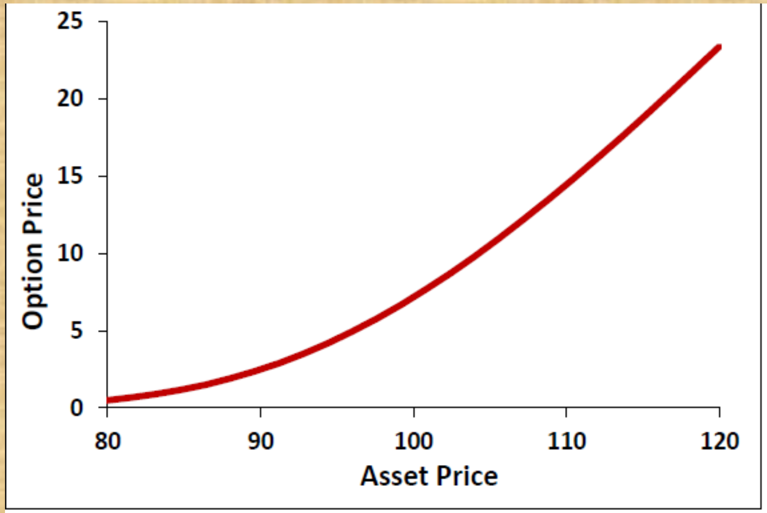
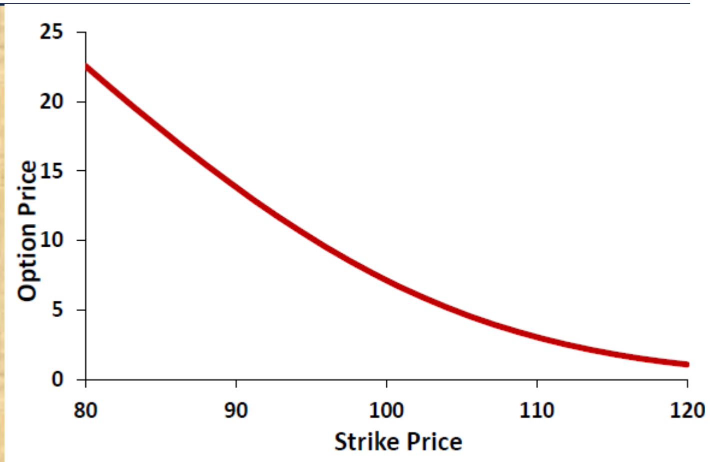
Stock Prices



Call Option:

- Call option is exercised, if Stock Price(S) > Exercise Price(X).
- Hence, call option becomes more valuable, if the Stock Price (S) increases.

Exercise/Strike Price

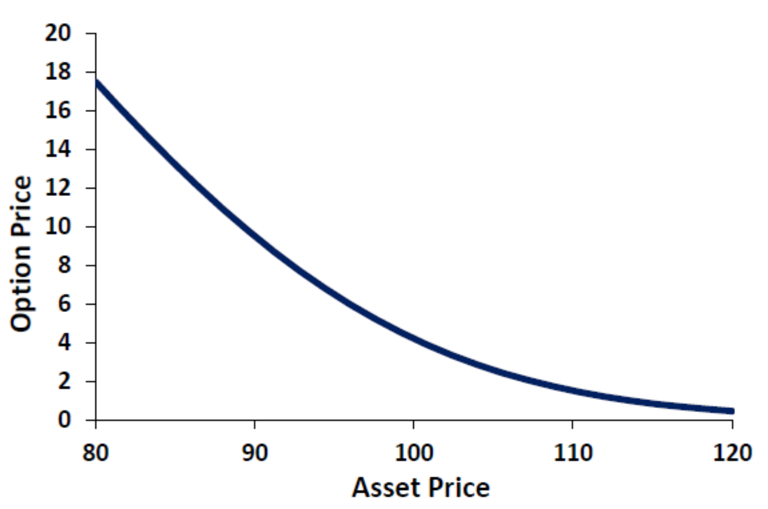


Call Option:

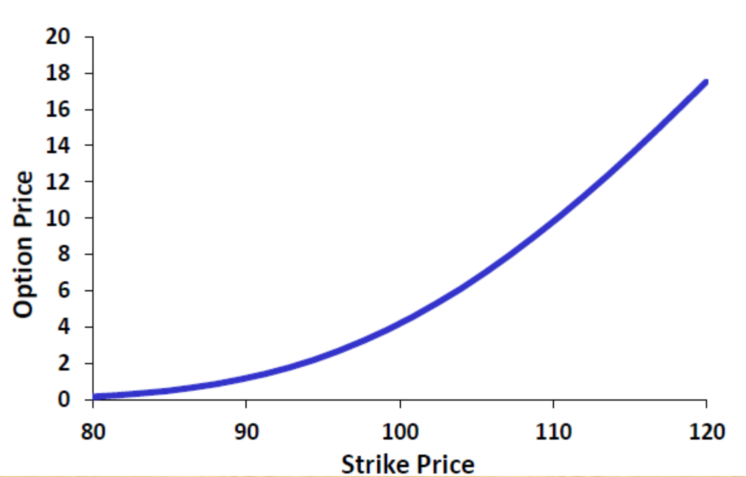
- Again, call option is exercised, if Stock Price(S) > Exercise Price(X).
- So, for higher exercise prices, call option would become cheaper.

PUT Options

- Put Option:
- Put Option is exercised, if Exercise Price (X) > Stock Price (S)
- Put option becomes more valuable, if Stock Price (S) decreases.



PUT Option



Put Option:

- Put Option is exercised, if **Exercise Price (X) > Stock Price (S).**

- Put option becomes more expensive for higher Exercise prices(X).

Time to Expiration

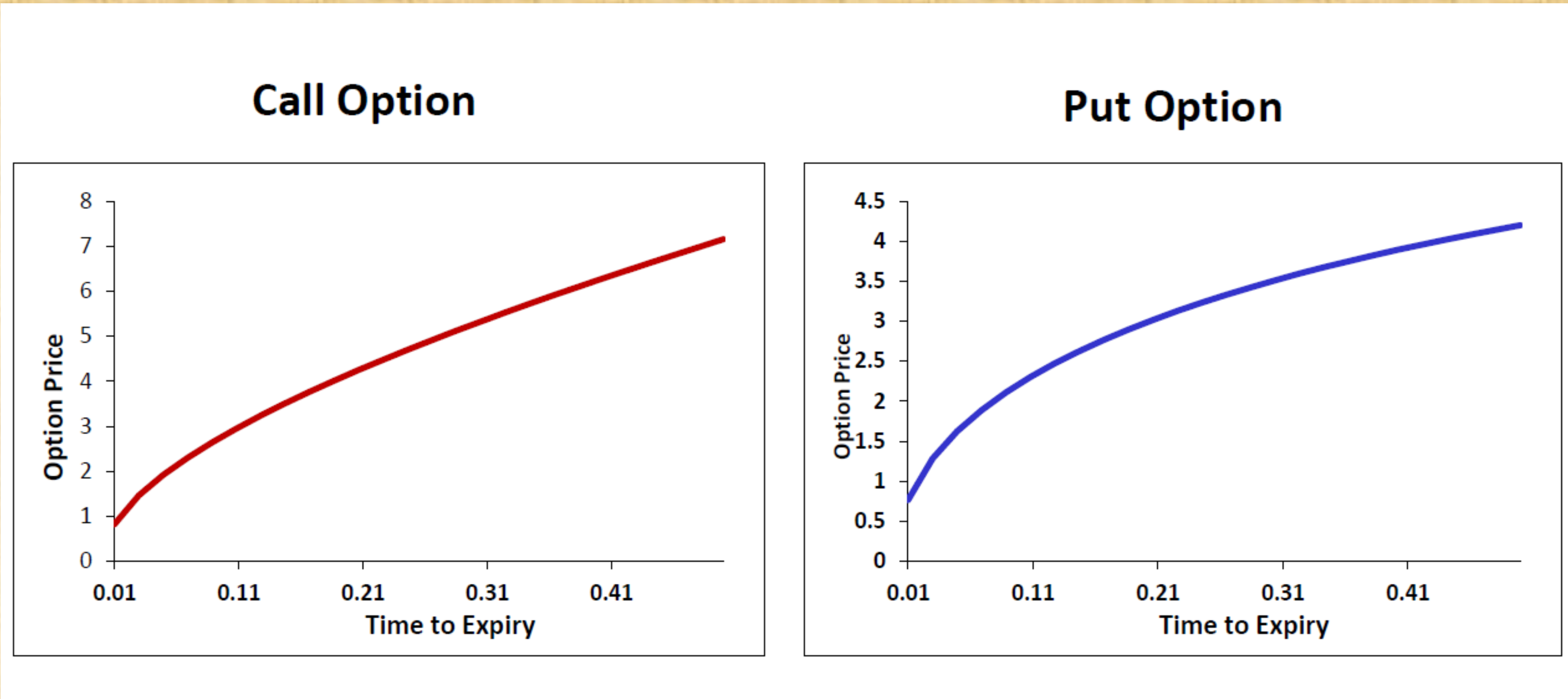
Consider two American Call/Put options which differ only in their time to expiration.

- Owner of the longer-life option not only has all the exercise opportunities as the shorter-life options, but also more.
- Hence, longer life American Options would be worth more than the shorter-life Options.

- Usually, European Call & put options also become more valuable as time to expiration increases.

- However, events in the intervening period, may reduce the value of a long-life option, thereby making it less valuable than a short-life option.

Time to Expiration



Volatility

Volatility means uncertainty about the prices of the underlying asset.

- Call option holder benefits from price increases but has a limited downside in case the stock price falls.

- Put option holder benefits from decreases in stock prices but have limited downside in case the prices increase.

- Hence, price of both, call & put options increases with increase in Volatility of the underlying asset.

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Risk-free Interest Rate

- Impact on Call Options:

–By paying the Call premium now, a trader saves ‘X’ till maturity. So higher the interest rate, higher will be his savings.

–Hence, as rf increases, Call will become more attractive.

- Impact on Put Options:

–When a trader sells the underlying asset (on exercise of put option) he receives ‘X’ in the future.

–So, the present value of ‘X’ would reduce, as interest rates increase.

–Hence, as rfincreases, Put will become less attractive.

Dividends

Dividends decrease the stock prices on ex-dividend date.

- Hence, call price decreases with dividends, and put price increases with dividends.

Summary

Impact of each factor on Option Price *(keeping all other factors fixed)*

Factors	Call Option	Put Option
Stock Price ↑	↑	↓
Strike Price ↑	↓	↑
Time to Expiration ↑ *(American Options)*	↑	↑
Volatility ↑	↑	↑
Risk-free Interest Rate ↑	↑	↓
Dividends ↑	↓	↑

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Put –Call Parity

Prices of European Put and Call options on the same underlying with identical exercise price and expiration dates have a special relationship.

- Consider the following portfolios:

✓Portfolio A: One European Call Option and cash of Xe^{-rT}

$(CE + Xe^{-rT})$

✓Portfolio B: One European Put Option and One Share

(PE+ S0)

What is the worth of each portfolio on expiration?

Put –Call Parity

Consider the stock of Reliable Industries which is currently trading at Rs.750/-,while the 3-month European call option on it is trading at Rs.67.50 for exercise price of Rs.745/-.If the risk-free interest rate is 6% pa , what should be the price of a put option on the same stock with the same exercise price and expiration date?

S0 =Rs. 750/- CE = Rs. 67.50 ; X = Rs. 745/-; rf= 6% pa;
PE = ?
CE + Xe-rT= PE +S0

67.50 + 745e-(0.06)3/12 = PE +750

PE= 67.50 + 733.91 –750.00 = Rs. 51.41

Uses of Put –Call Parity

To check for arbitrage opportunities resulting from relative mispricing of Call and Put options.

- If $CE + Xe^{-rT} > PE + S0$, then Portfolio 'A' is overvalued relative to Portfolio 'B'. Hence, sell the securities in Portfolio 'A' and buy securities in Portfolio 'B', and make arbitrage profits.

- If $CE + Xe^{-rT} < PE + S0$, then Portfolio 'B' is overvalued relative to Portfolio 'A'. Hence, sell the securities in Portfolio 'B' and buy securities in Portfolio 'A', and make arbitrage profits.

Uses of Put –Call Parity

Consider a dividend paying stock trading at Rs.50/-..An ATM1-month European call is available for Rs.3.50. If an ATM put option on the stock is trading at Rs.2.70, is there any arbitrage opportunity? (Assuming risk-free interest rate as 2% p.a). Assume strike price and stock price now as same.

Put –Call Parity

$S_O = X$ = Rs. 50/- ; C_E = Rs. 3.50; P_E = 2.70 ; r_f = 2% pa (cc) ; t = 1/12 yrs

- Portfolio A: $C_E + Xe^{-rT} = 3.50 + 50e^{-(0.02)1/12} = 3.50 + 49.92 =$ **53.42**
- Portfolio B: $P_E + S_O = 2.70 + 50 =$ **52.70**
- Portfolio A > Portfolio B.

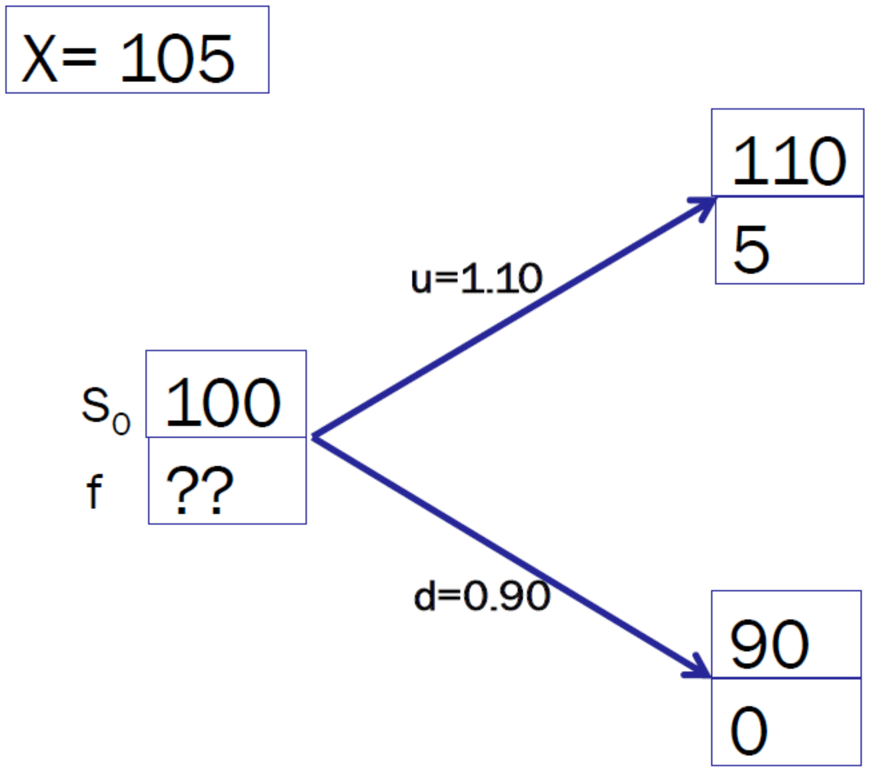
➢ **Today:** Buy Put, Buy Stock, Sell Call and sell Bond (Borrow)

Cash Flow (at t=0) : - 2.70 - 50.00 + 3.50 + 49.92 = 0.72

➢ **After 1-month:**

If $S_T < X$	If $S_T > X$
1. Put : ITM : Sell the stock for X =50 2. Call : OTM : No action 3. Stock: Deliver the Put option. 4. Borrowings: Repay with interest $49.92e^{(0.02)1/12} = 50$ **Net Cash Flow = 50 - 50 = Nil**	1. Put : OTM : No action 2. Call : ITM : Sell stock at X =50 3. Stock: Deliver under Call option. 4. Borrowings: Repay with interest $49.92e^{(0.02)1/12} = 50$ **Net Cash Flow = 50 - 50 = Nil**

Binomial Option Pricing Model



$S_u = S_0 * u$

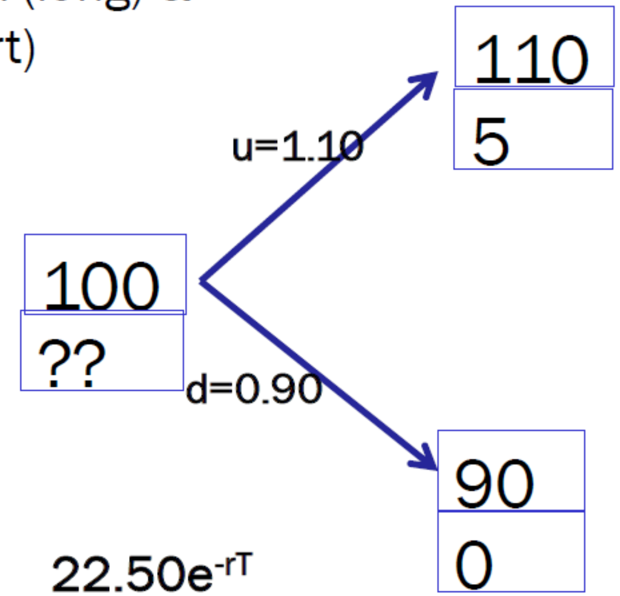
$f_u = \text{Max}\ (S_T - X, 0)$

$S_d = S_0 * d$

$f_d = \text{Max}\ (S_T - X, 0)$

Binomial Option Pricing Model

Construct a risk-less portfolio of Δ Stock (long) & 1 call(short)



$\Delta 110 - 5$

Value of Portfolio

$(0.25*110) - 5 = 22.50$

$\Delta 110 - 5 = \Delta 90$

$\Delta = 5/20 = 0.25$

$\Delta 90 - 0$

$(0.25*90) - 0 = 22.50$

Value of Portfolio today: $22.50e^{-rT} = 21.62$

Value of Δ stock $= (0.25*100) = 25$ - Value of Option f

$25 - f = 21.62$ or $f = 3.38$

$r_f = 8\%$

$T = 0.5$ years

Binomial Option Pricing Model

$$S * e^{rt} = S_{u*}\mathrm{p} + S_{d*}(1 - \mathrm{p})$$

$$p = \frac{S * e^{rt} - Sd}{Su \ - sd}$$

Where, S= current Stock price
r = risk free rate
t= time period
su= when stock price moves up
p = probability
Sd = when stock price moves down

Binomial Option Pricing Model

To find the price of Call option, using the above formula:

$$p = \frac{e^{rT} - d}{u - d} = \frac{e^{0.08*0.5} - 0.90}{1.10 - 0.90} = 0.70405$$

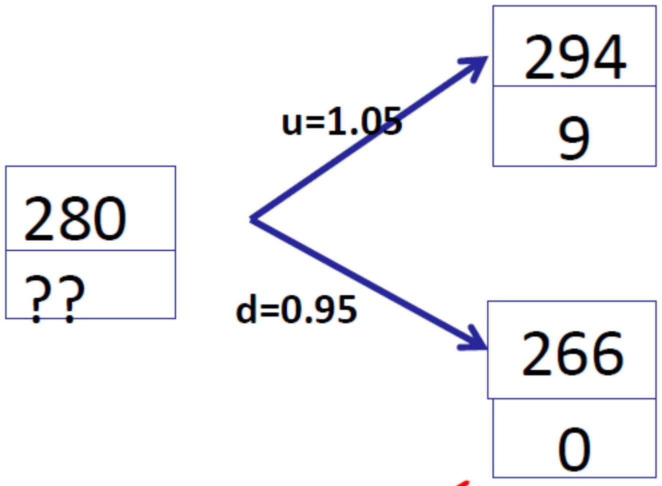
$$f = e^{-rT}\{pf_u + (1-p)f_d\}$$

$$f = e^{-0.08*0.5}\{0.70405*5 + (1-0.70405)*0\}$$

f = 3.38224 = **Rs.3.38**

Binomial Option Pricing Model

S0= Rs280/-; X =Rs. 285/-; T =3/12 years; u =1.05 ; d = 0.95; rf=8%, Find the value of Call option, using 1 stage Binomial Pricing model.



Δ =9/28 =0.32143

Value of Portfolio

0.32143*294 - 9 = 85.50

0.32143*266 = 85.50

Value of Portfolio today **$85.5e^{-rT}$ = 83.81**

Value of Δ stock **0.32143*280 = 90**

Value of Option **f = 90 – 83.81 = 6.19**

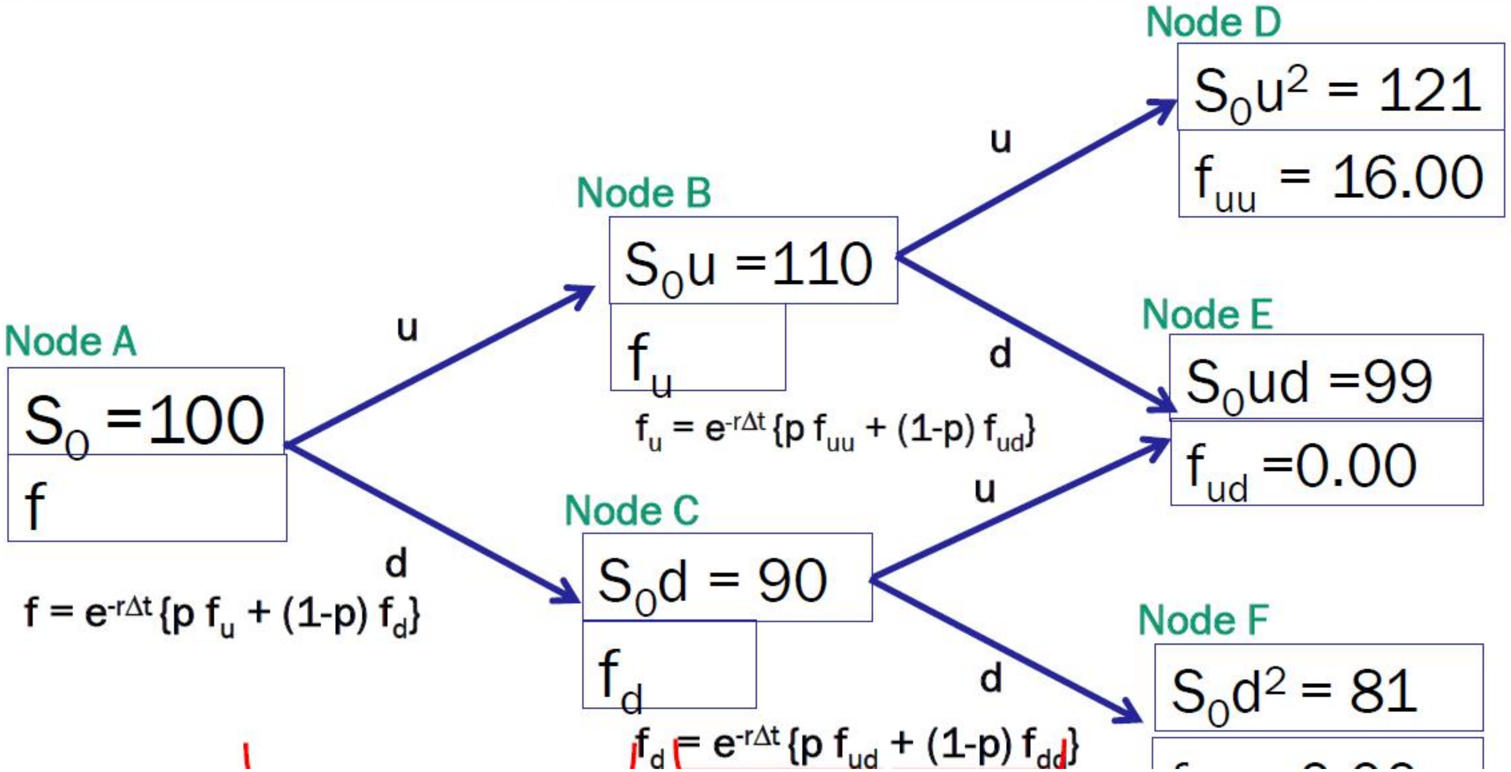
Binomial Option Pricing Model

To find the price of Call option, using the above formula:

$$p = \frac{e^{rT} - d}{u - d} = \frac{e^{0.08*0.25} - 0.95}{1.05 - 0.95} = 0.70201$$

2 Stage European Call Option

S_0 = Rs 100/- ; X =Rs. 105/- ; T = 0.5 years (Δt =0.25); u = 1.10 ; d = 0.90; r_f=8%, Find the value of Call option, using 2 stage Binomial Pricing model.



2 Stage European Call Option

$$p = \frac{e^{0.08*0.25} - 0.90}{1.10 - 0.90} = \frac{1.0202 - 0.90}{1.10 - 0.90} = 0.60101$$

Node B

$f_u = e^{-r\Delta t}\{p\, f_{uu} + (1-p)\, f_{ud}\}$

$f_u = e^{-0.08*0.25}\{0.60101*16 + (1-0.60101)*0\}$

$f_u = 9.42575 = 9.43$

Node C

$f_d = e^{-r\Delta t}\{p\, f_{ud} + (1-p)\, f_{dd}\}$

$f_d = e^{-0.08*0.25}\{0.60101*0 + (1-0.60101)*0\}$

$f_d = 0.00$

Node A

$f = e^{-r\Delta t}\{p\, f_u + (1-p)\, f_d\}$

$f = e^{-0.08*0.25}\{0.60101*9.43 + (1-0.60101)*0\}$

$f = 5.55530 = 5.55$

2 Stage European PUT Option

$$p = \frac{e^{0.08*0.25} - 0.90}{1.10 - 0.90} = \frac{1.0202 - 0.90}{1.10 - 0.90} = 0.60101$$

Node B

$f_u = e^{-r\Delta t}\{p\, f_{uu} + (1-p)\, f_{ud}\}$

$f_u = e^{-0.08*0.25}\{0.60101*0 + (1-0.60101)*6\}$

$f_u = 2.34654 = 2.35$

Node C

$f_d = e^{-r\Delta t}\{p\, f_{ud} + (1-p)\, f_{dd}\}$

$f_d = e^{-0.08*0.25}\{0.60101*6 + (1-0.60101)*24\}$

$f_d = 12.92080 = 12.92$

Node A

$f = e^{-r\Delta t}\{p\, f_u + (1-p)\, f_d\}$

$f = e^{-0.08*0.25}\{0.60101*2.35 + (1-0.60101)*12.92\}$

$f = 6.43728 = 6.44$

$$f = e^{-2r\Delta t}\{p^2 f_{uu} + 2p(1-p) f_{ud} + (1-p)^2 f_{dd}\}$$

$f = e^{-2*0.08*0.25}\{(0.60101)^2*0 + 2(0.60101)(1-0.60101)*6 + (1-0.60101)^2*24\}$

$f = 6.43555 = 6.44$

2 Stage European PUT Option

$$p = \frac{e^{0.08*0.25} - 0.90}{1.10 - 0.90} = \frac{1.0202 - 0.90}{1.10 - 0.90} = 0.60101$$

Node B

$f_u = e^{-r\Delta t}\{p\, f_{uu} + (1-p)\, f_{ud}\}$

$f_u = e^{-0.08*0.25}\{0.60101*0 + (1-0.60101)*6\}$

$f_u = 2.34654 = 2.35$

Node C

$f_d = e^{-r\Delta t}\{p\, f_{ud} + (1-p)\, f_{dd}\}$

$f_d = e^{-0.08*0.25}\{0.60101*6 + (1-0.60101)*24\}$

$f_d = 12.92080 = 12.92$

Node A

$f = e^{-r\Delta t}\{p\, f_u + (1-p)\, f_d\}$

$f = e^{-0.08*0.25}\{0.60101*2.35 + (1-0.60101)*12.92\}$

$f = 6.43728 = 6.44$

$$f = e^{-2r\Delta t}\{p^2 f_{uu} + 2p(1-p) f_{ud} + (1-p)^2 f_{dd}\}$$

$f = e^{-2*0.08*0.25}\{(0.60101)^2*0 + 2(0.60101)(1-0.60101)*6 + (1-0.60101)^2*24\}$

$f = 6.43555 = 6.44$

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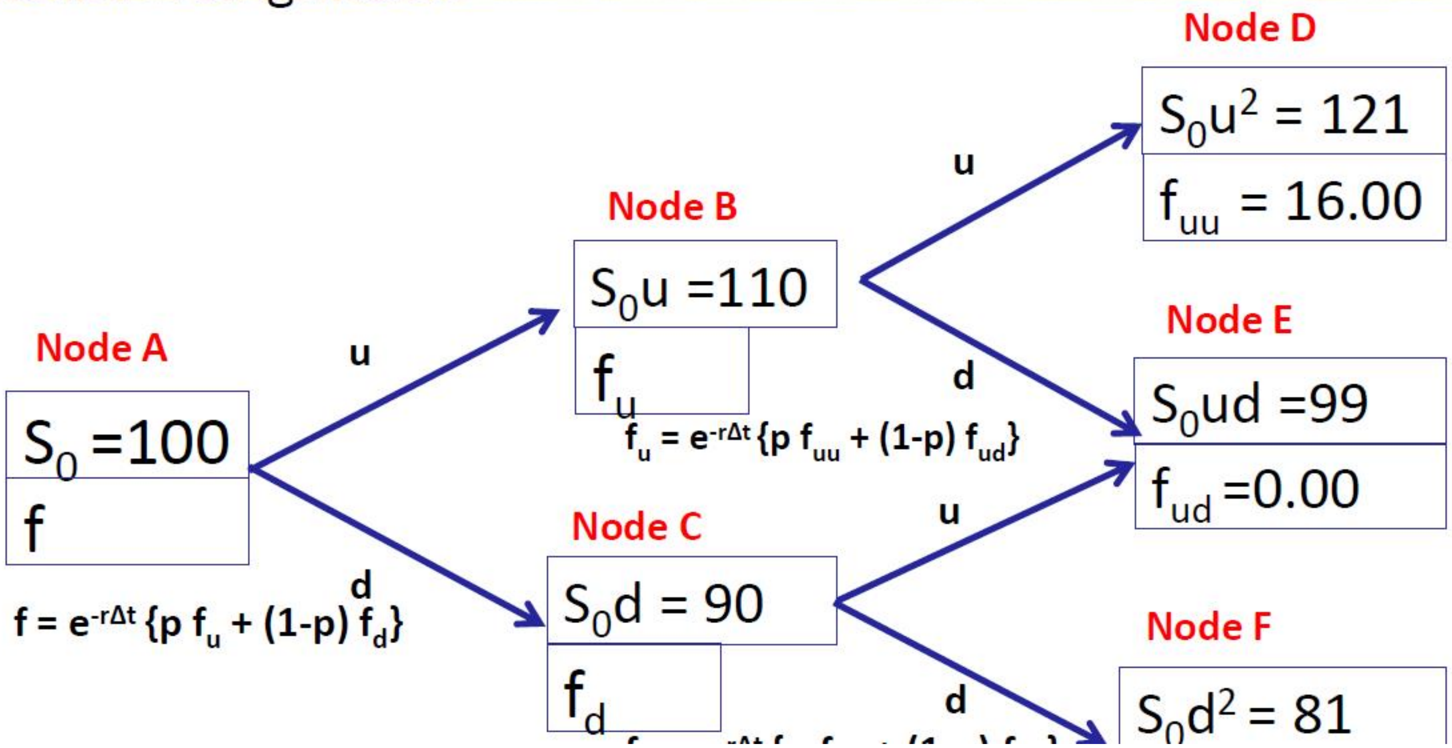
2 Stage American Call Option

S_0 = Rs 100/- ; X =Rs. 105/- ; T = 0.5 years (Δt =0.25); u = 1.10 ; d = 0.90; r_f=8%, Find the value of American Call option, using 2 stage Binomial Pricing model.



2 Stage American Call Option

Node B

$f_u = e^{-r\Delta t}\{p\, f_{uu} + (1-p)\, f_{ud}\}$	$f_u = e^{-0.08*0.25}\{0.60101*16 + (1-0.60101)*0\}$
	$f_u = 9.42575 = 9.43$
$f_u = Max(S_t - X,0)$	$f_u = Max(110 - 105,0) = 5$

Node C

$f_d = e^{-r\Delta t}\{p\, f_{ud} + (1-p)\, f_{dd}\}$	$f_d = e^{-0.08*0.25}\{0.60101*0 + (1-0.60101)*0\}$
	$f_d = 0.00$
$f_d = Max(S_t-X,0)$	$f_u = Max(90 - 105,0) = 0$

Node A

$f = e^{-r\Delta t}\{p\, f_u + (1-p)\, f_d\}$	$f = e^{-0.08*0.25}\{0.60101*9.43 + (1-0.60101)*0\}$
	$f = 5.55530 = 5.55$

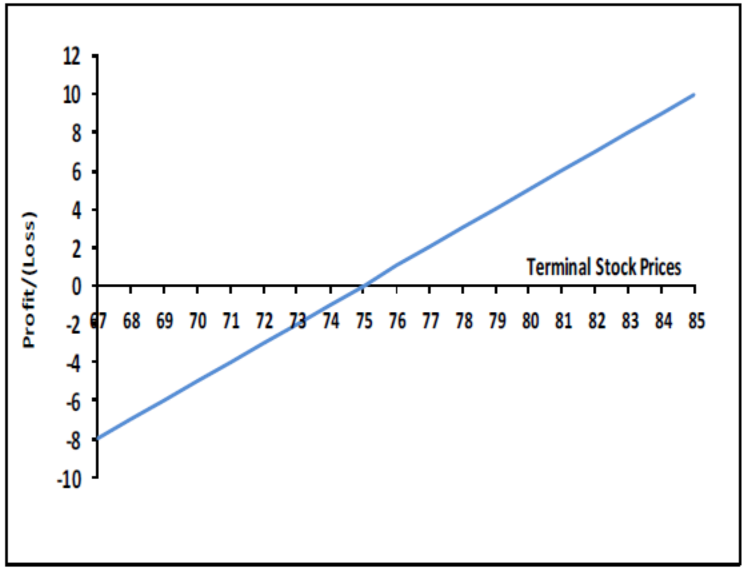
Trading Strategies using Options

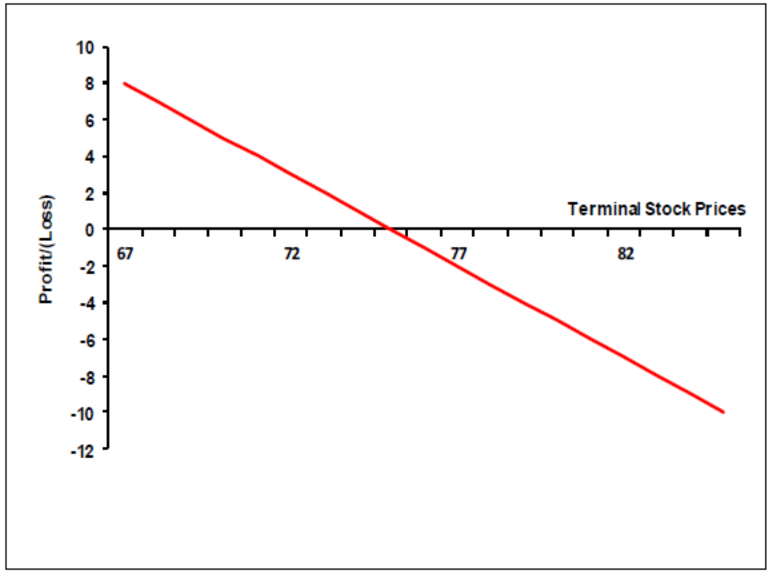
Several strategies involving Options and their underlying assets lead to unusual payoff patterns.

Various Strategies:

- Covered Call & Protective Put
- Spreads : Bullish; Bearish; Butterfly; Calendar
- Combinations : Straddles; Strangles; Strips; Straps.
- Others: Collars; Synthetic Stocks

Stock –Long & Short





Buyer of Stock is Bullish on the stock.

$\Pi = N_S(S_T - S_0)$

Short seller of Stock is Bearish on the stock.

$\Pi = -N_S(S_T - S_0)$

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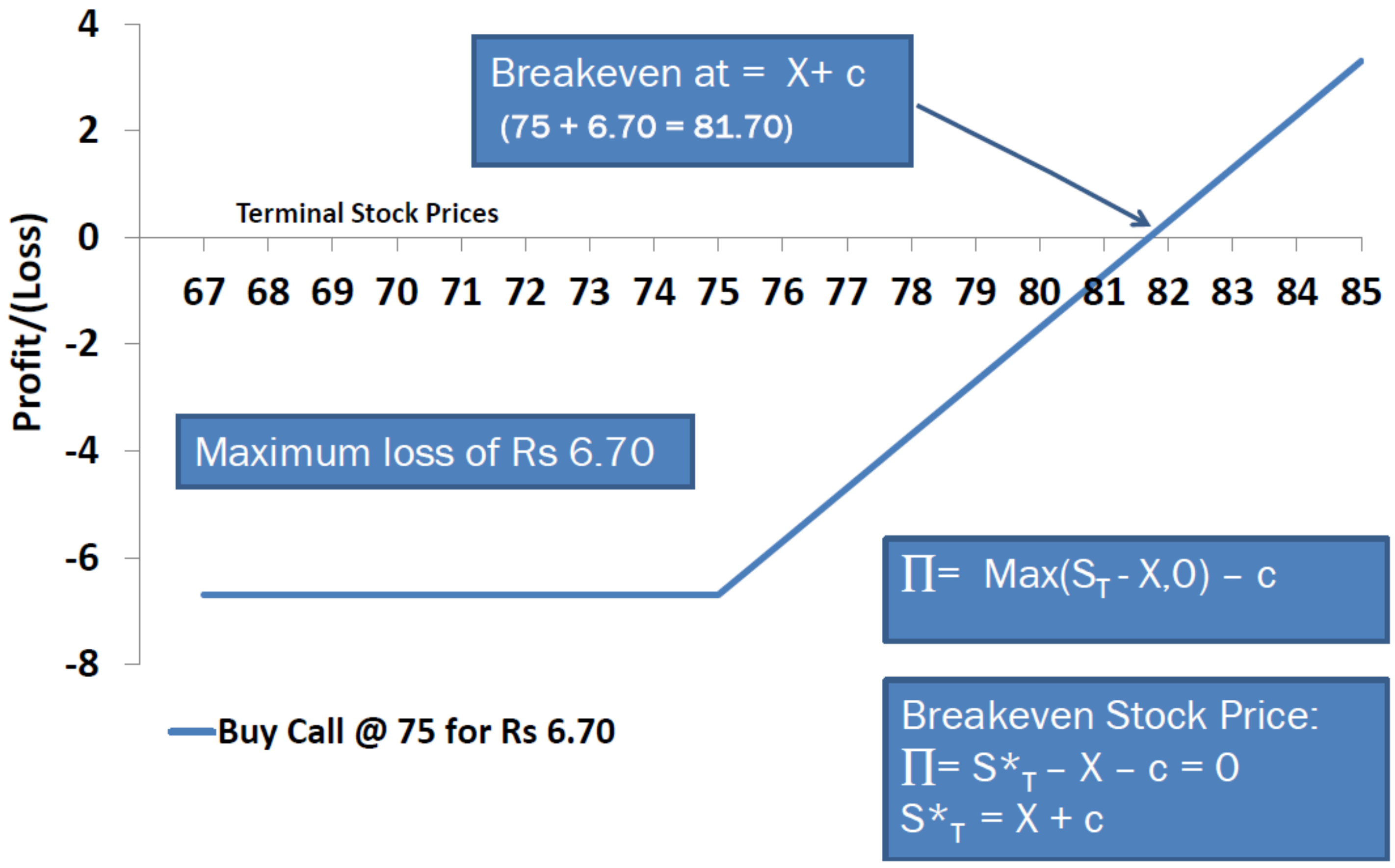
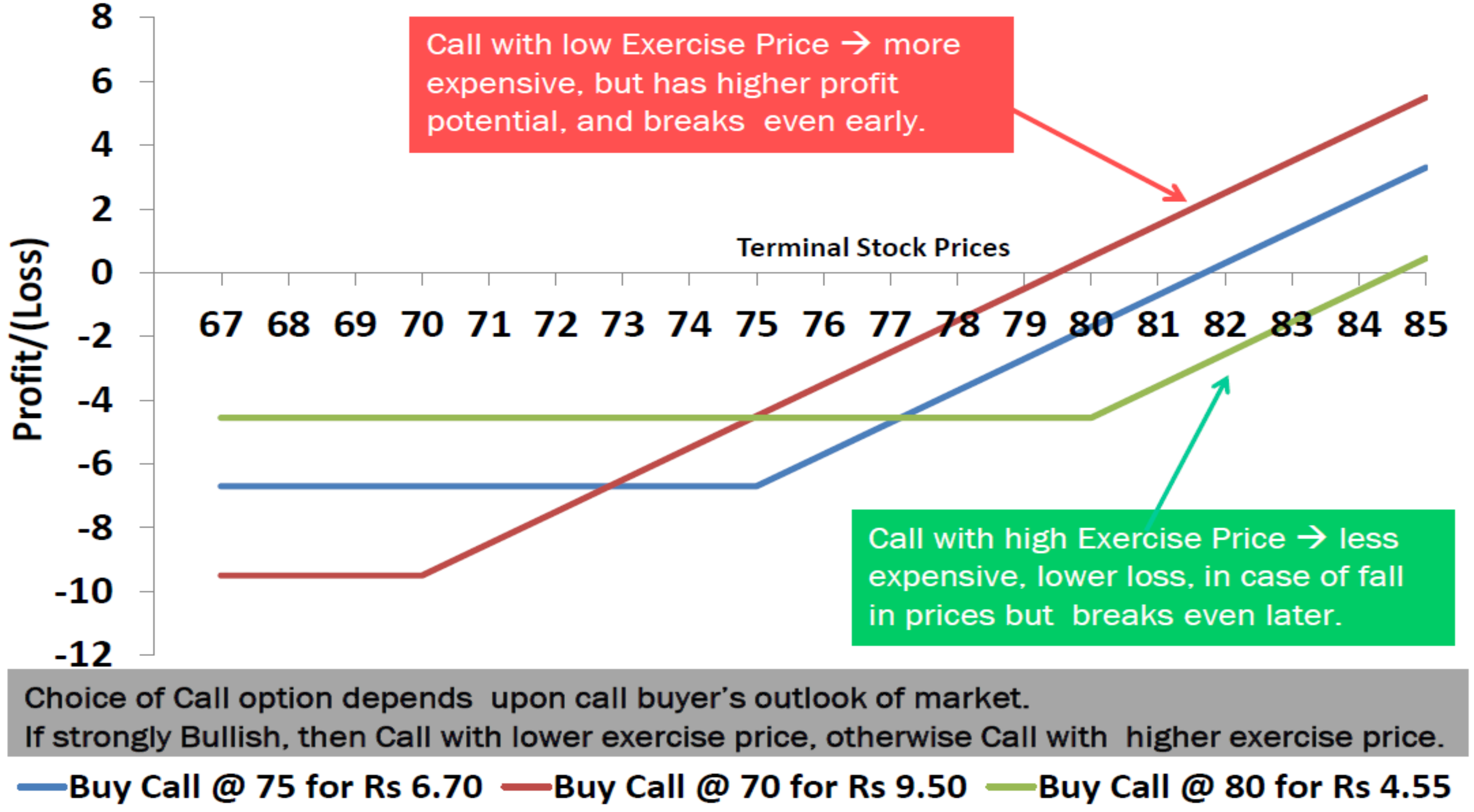
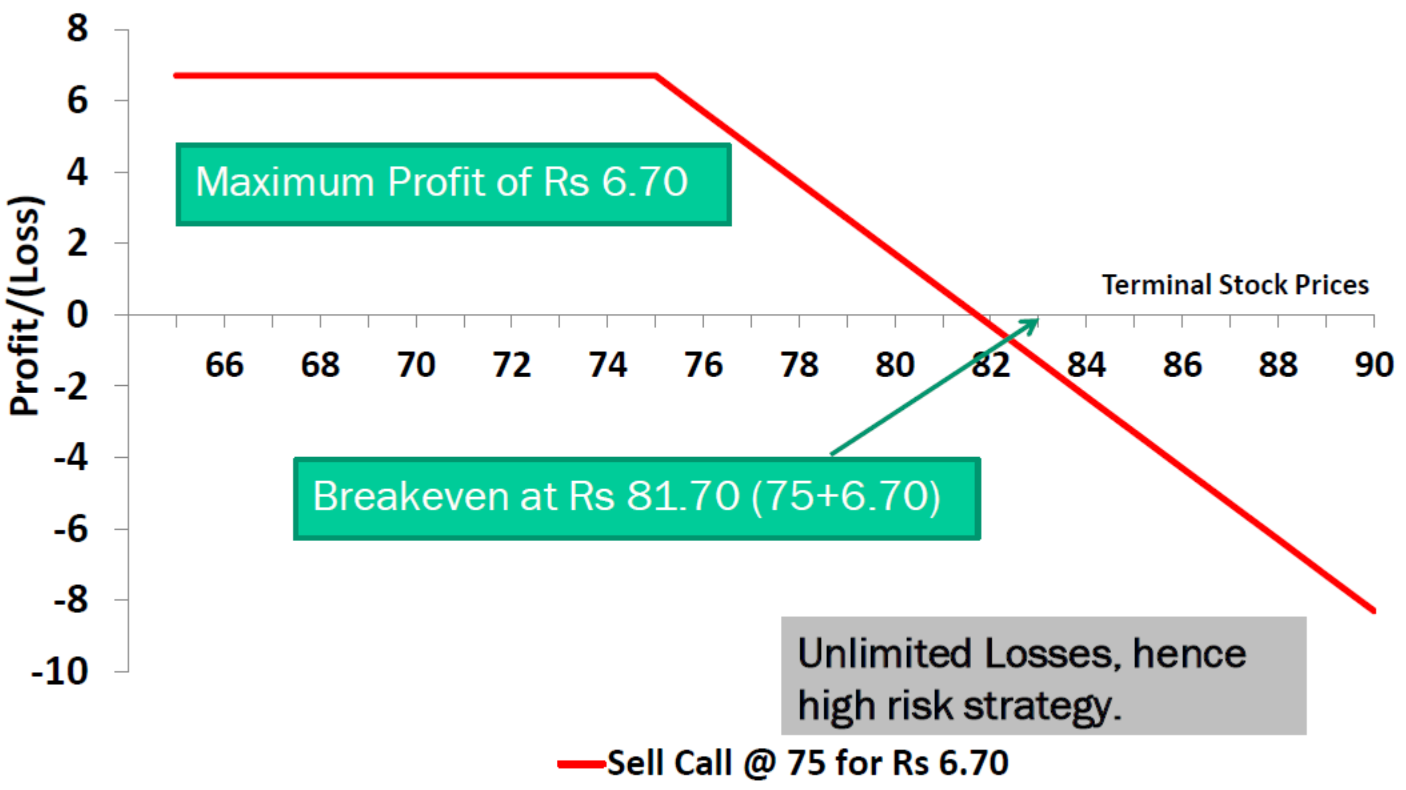
Long on Call Option (Buy Call Option)



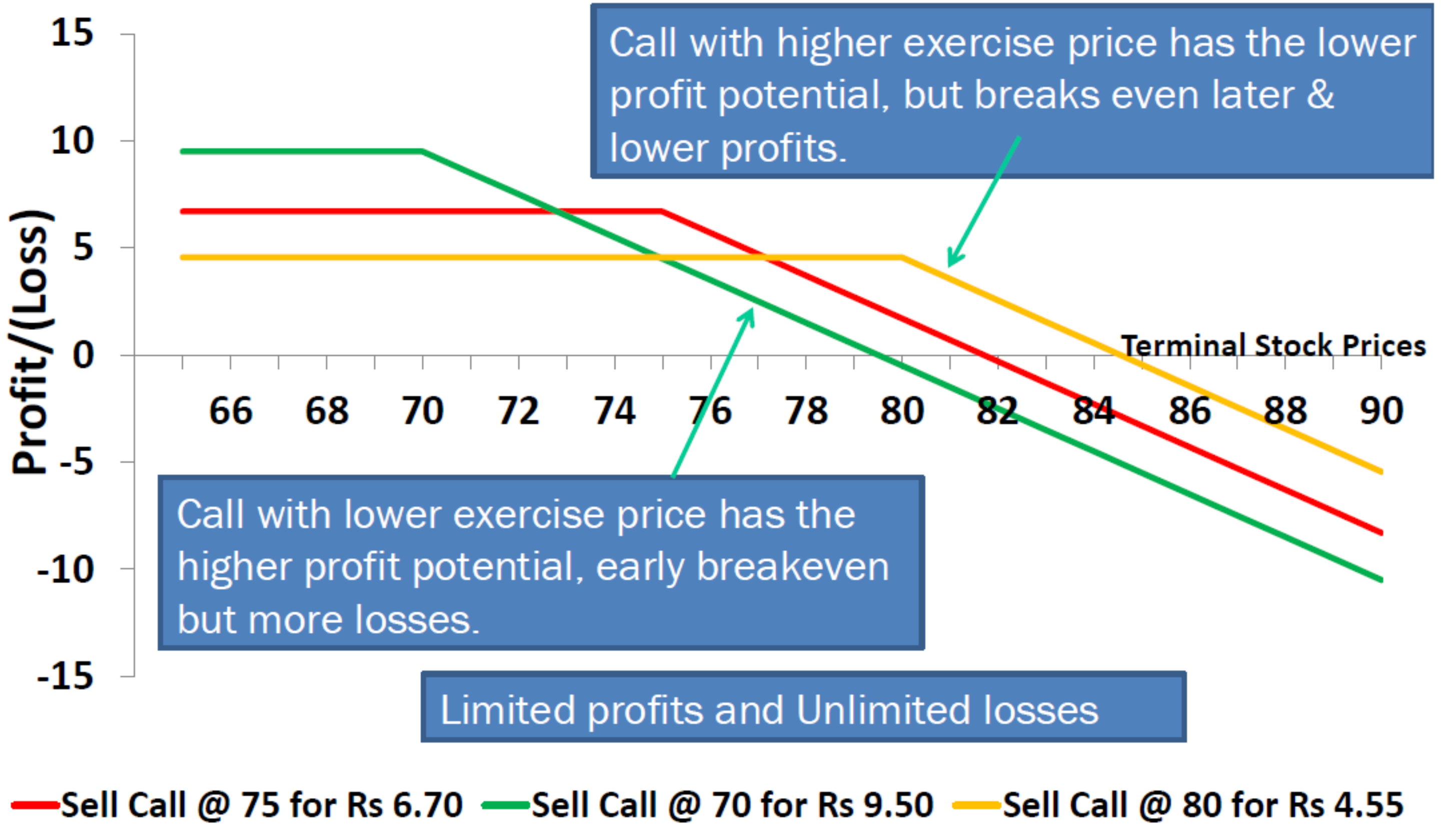
Long on Call Option (Choice of Exercise Price)



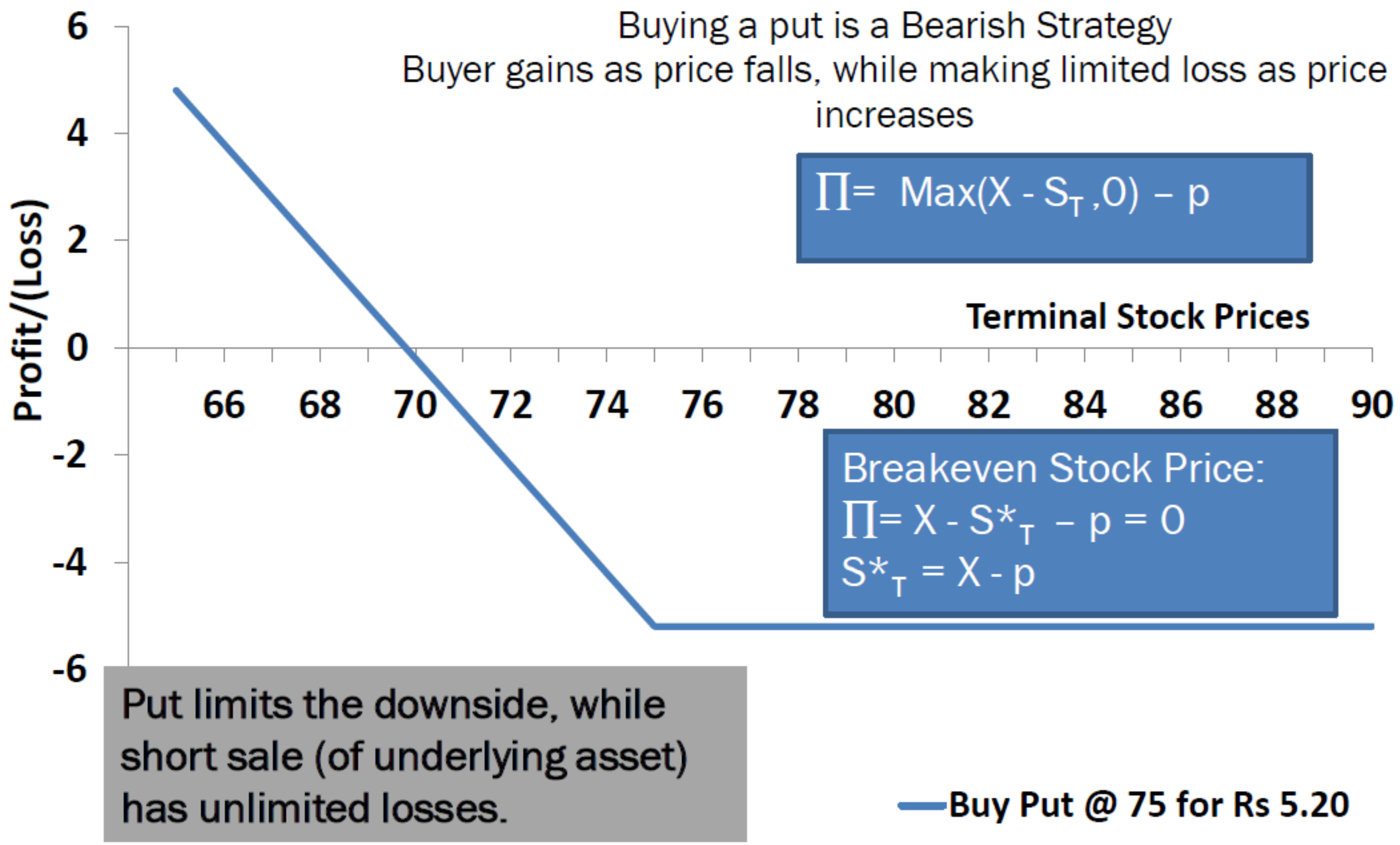
Short on Call Option (Sell Call Option)



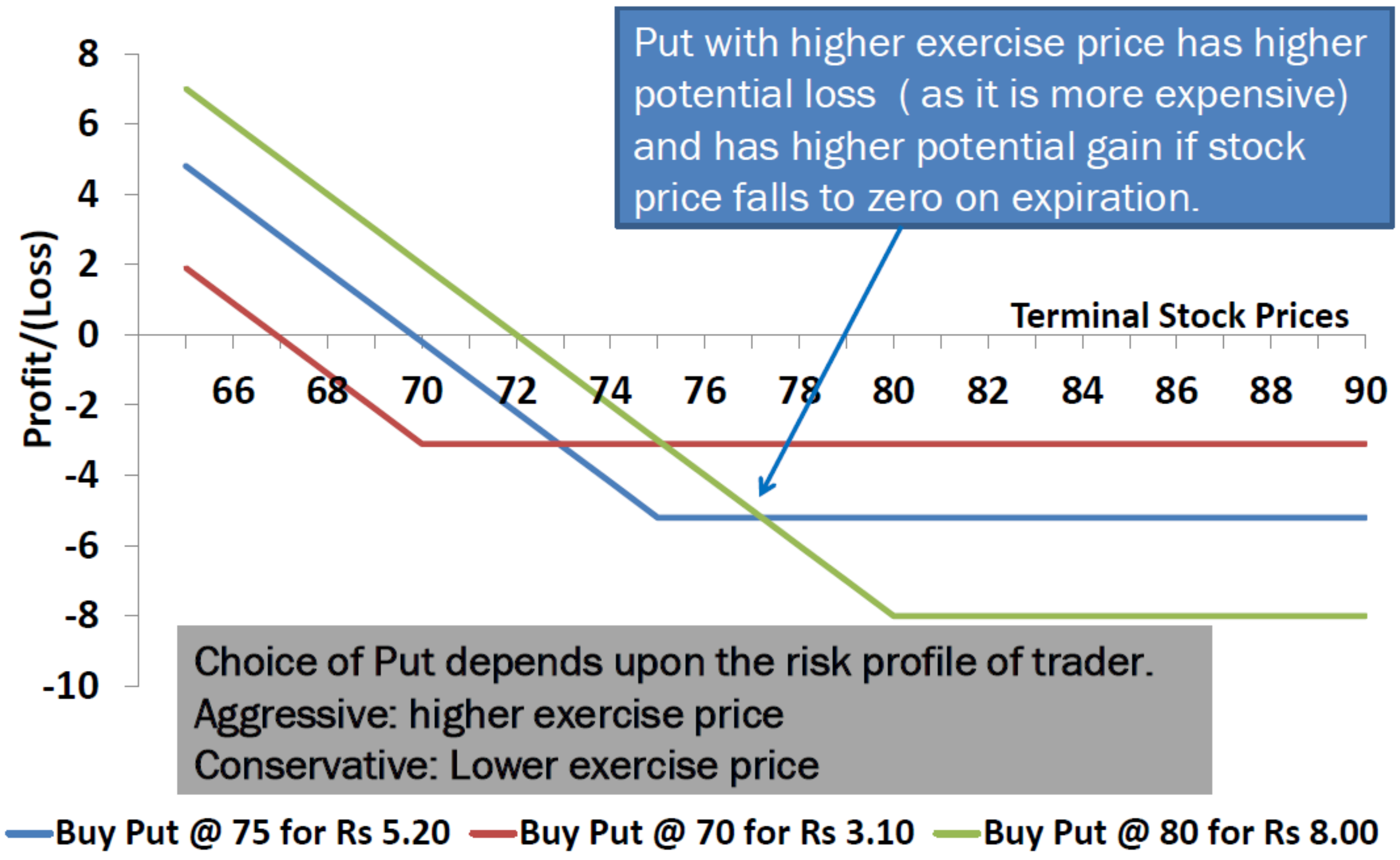
Short on Call Option (Choice of Exercise Price)



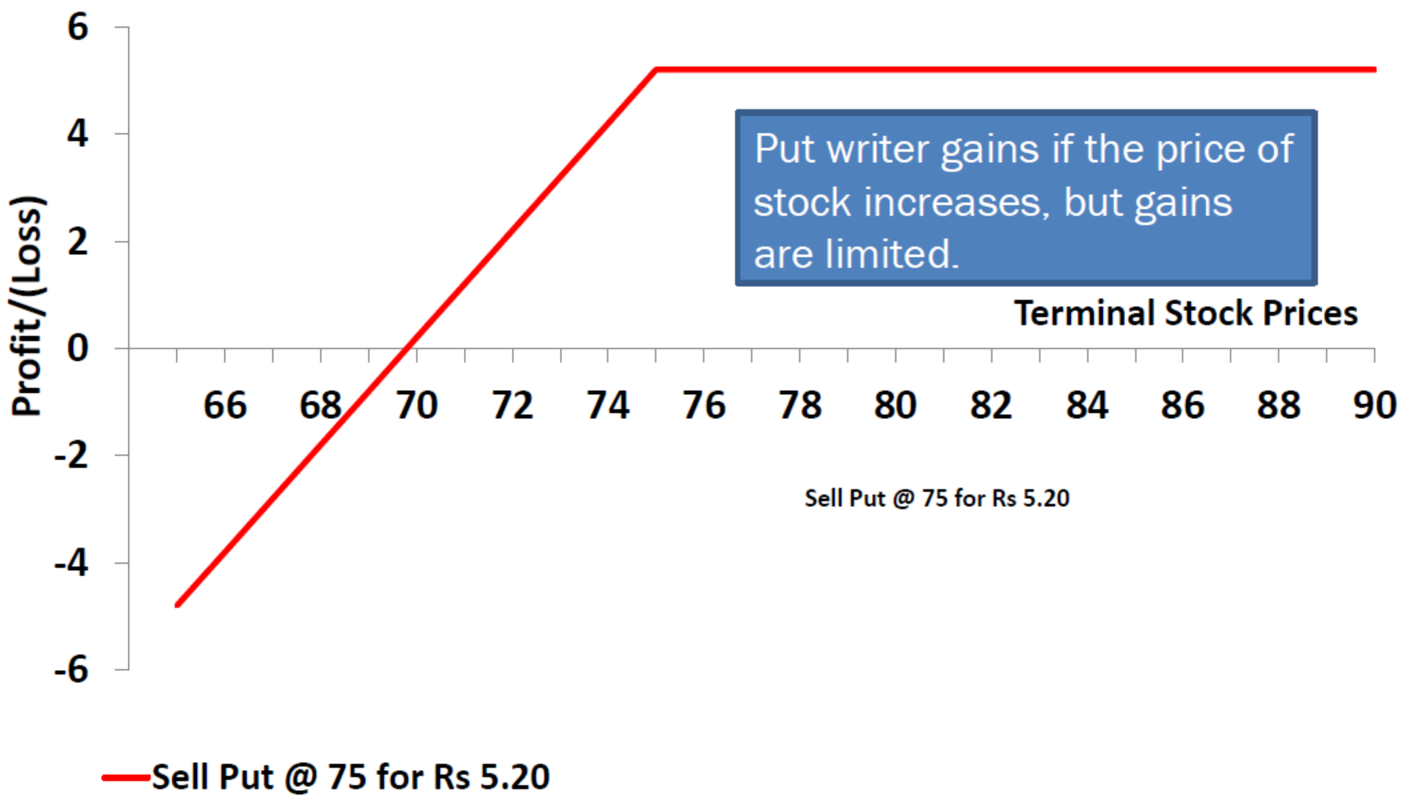
Long on Put Option (Buy Put Option)



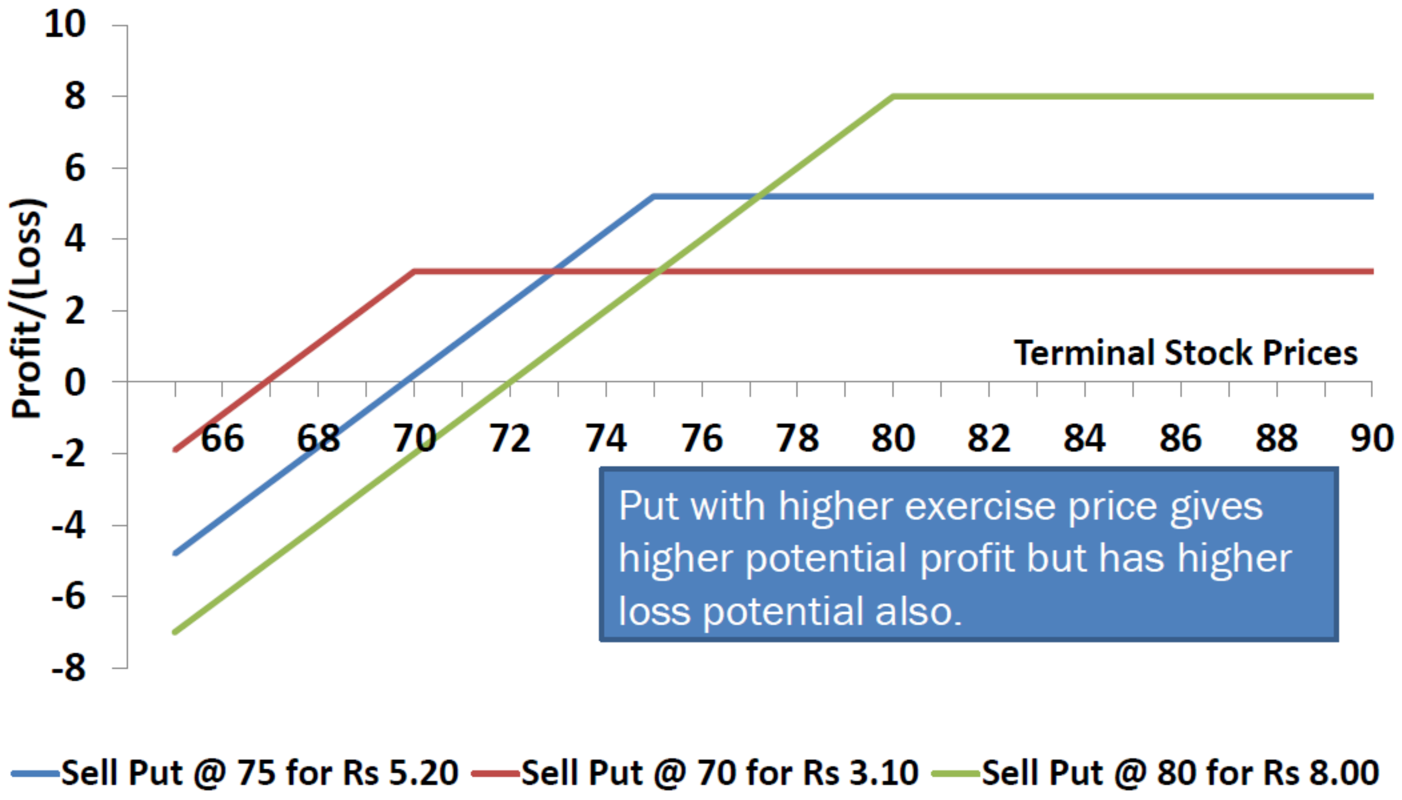
Long on Put Option (Choice of Exercise Price)



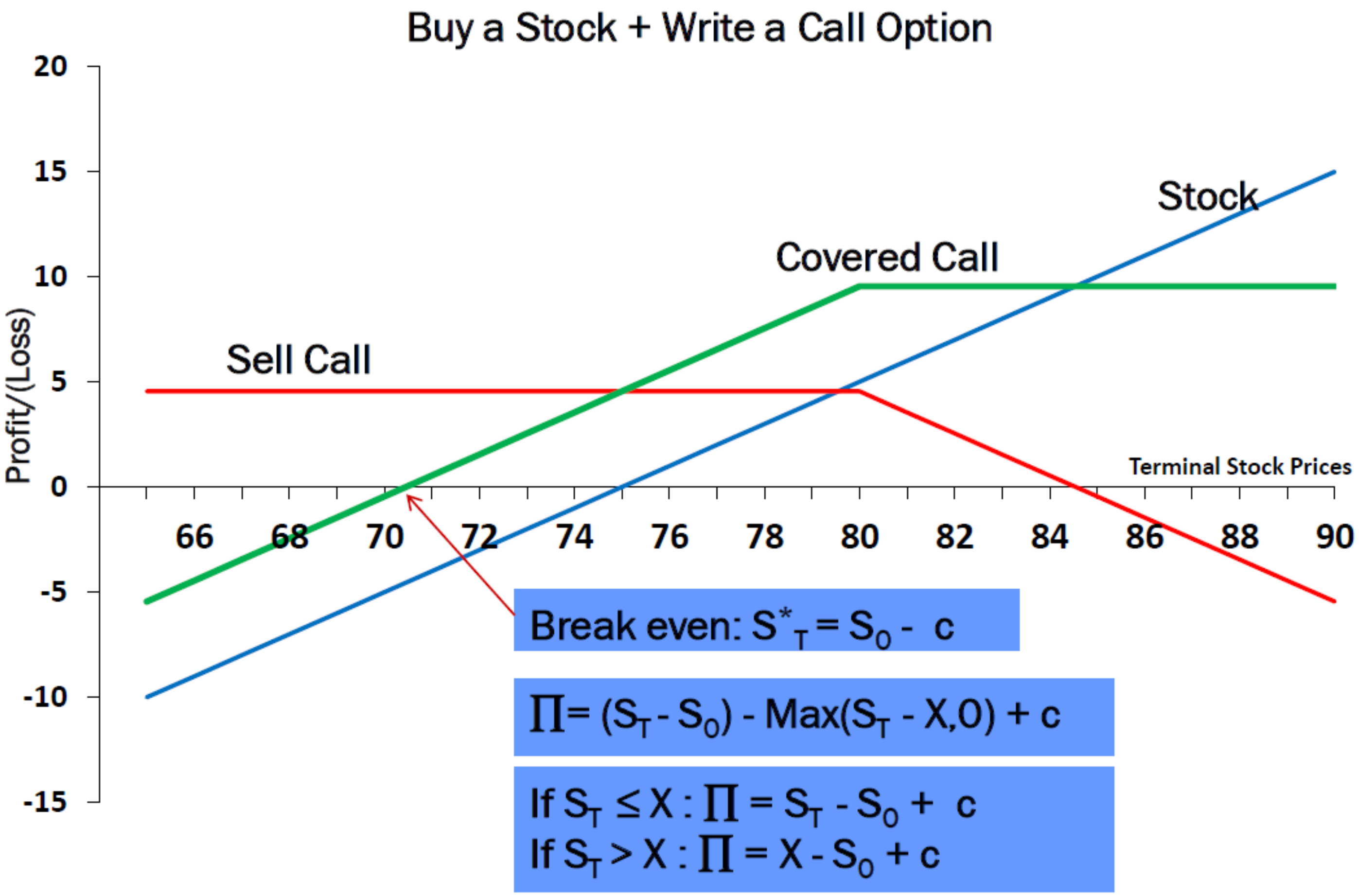
Short on Put Option (Sell a Put Option)



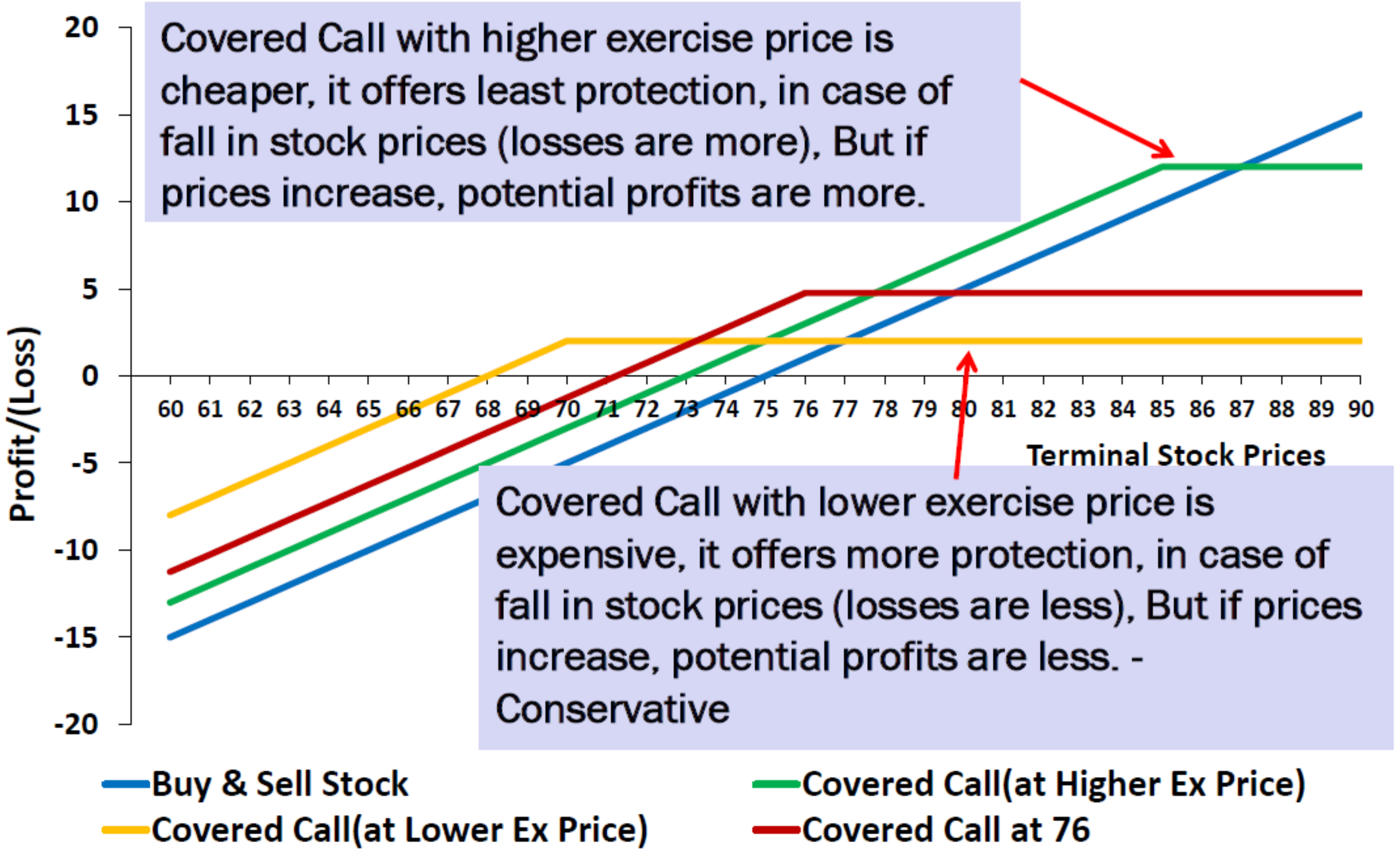
Short on Put Option (Choice of Exercise Price)



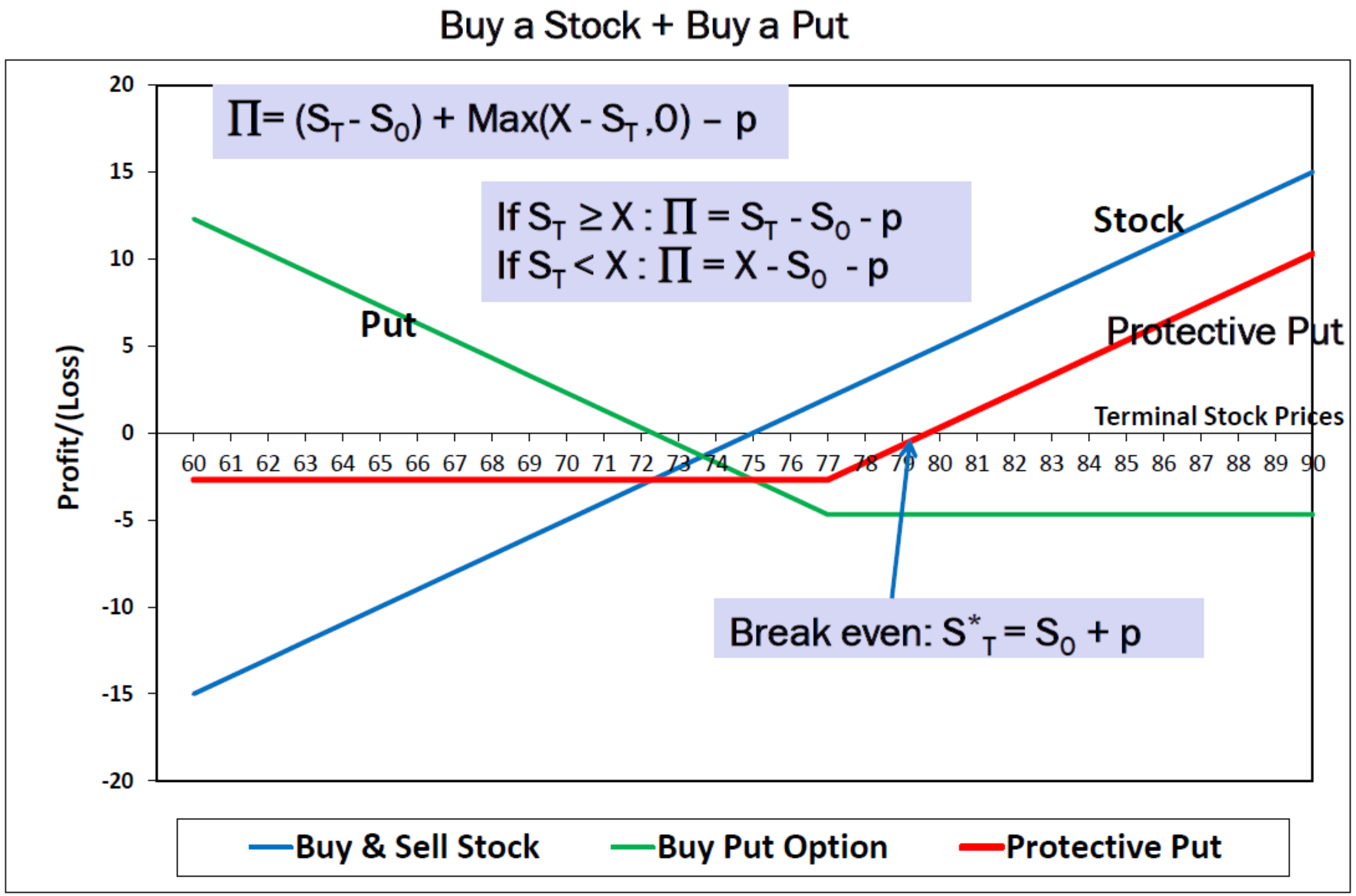
Writing a Covered Call



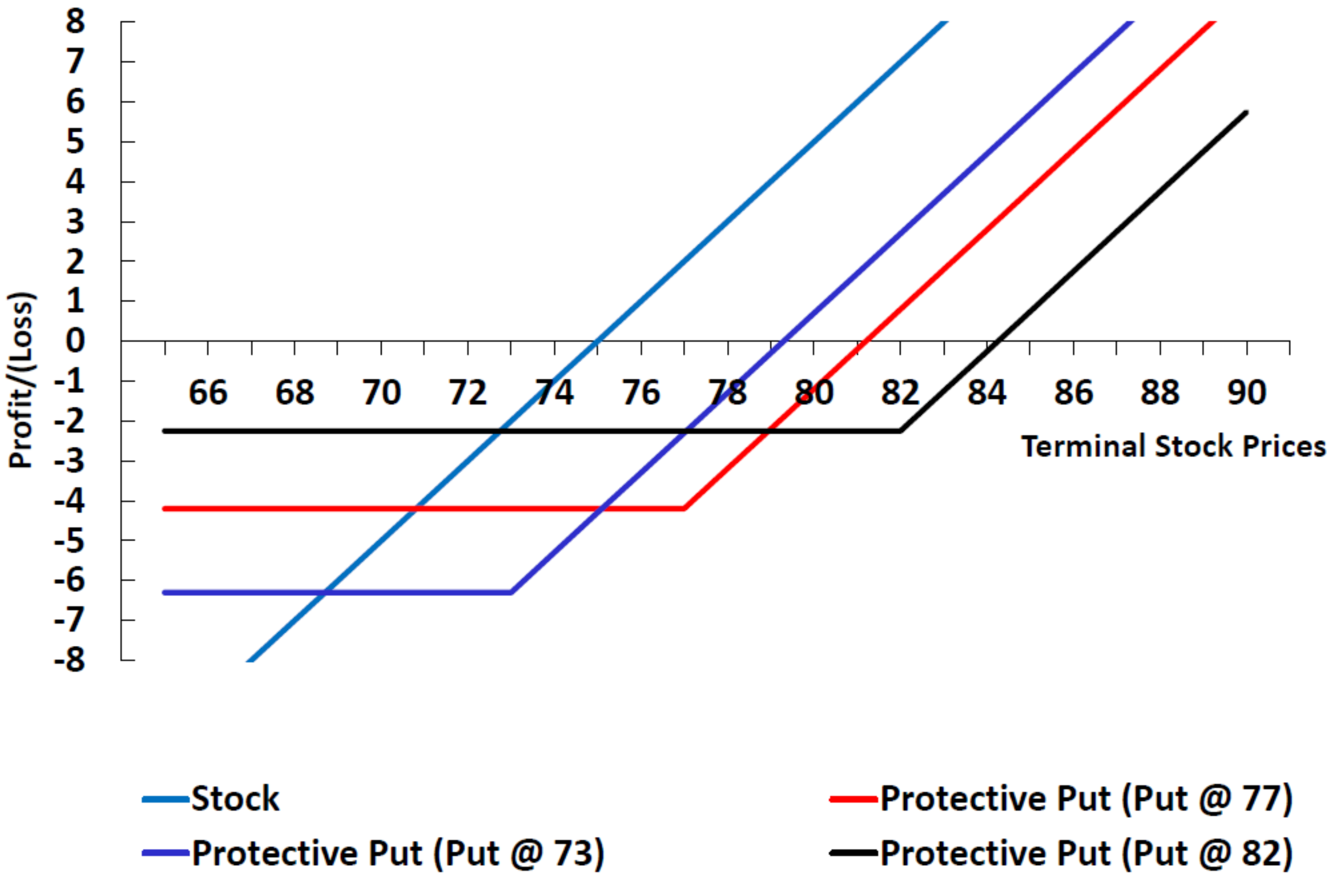
Covered Call -Choice of Exercise price



Protective Put



Protective Put- with different Exercise Prices

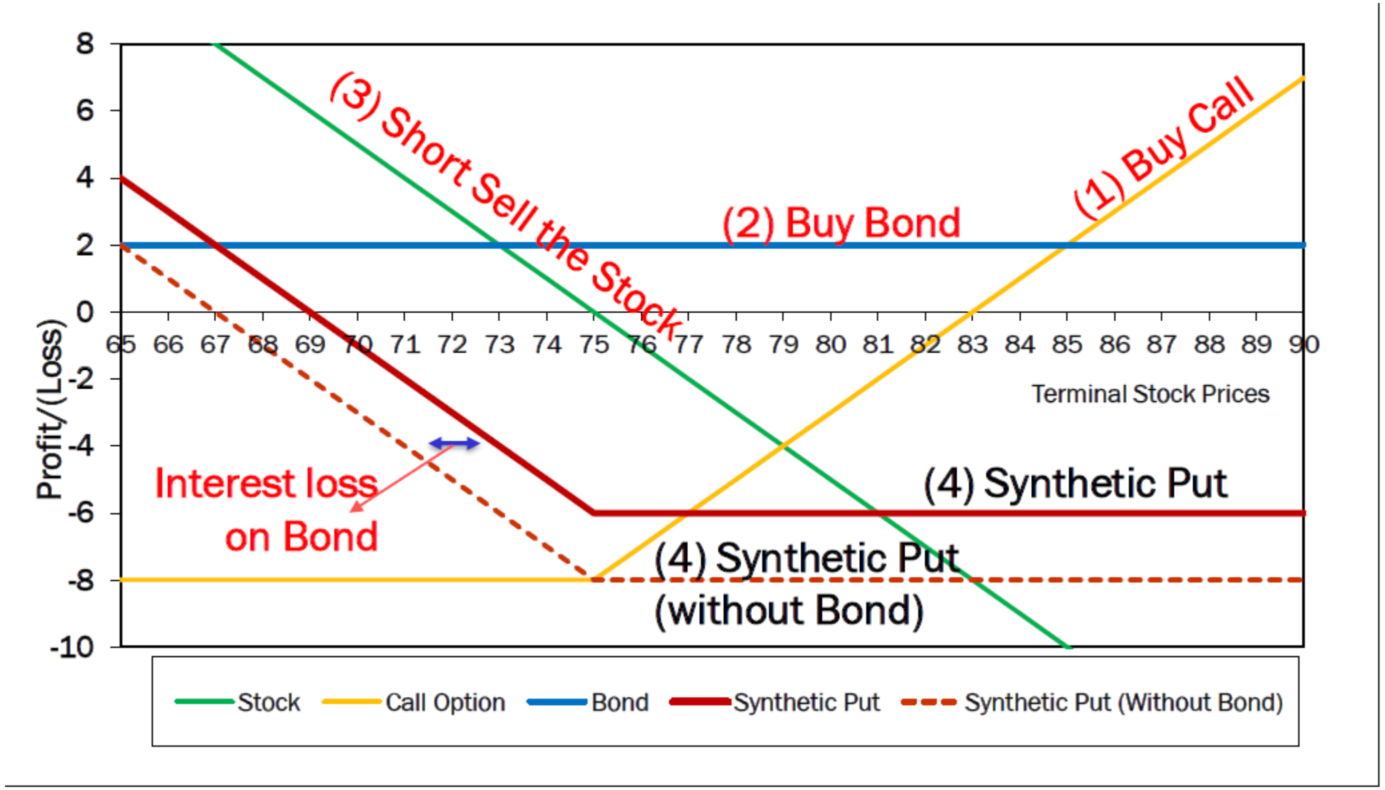


Synthetic Options

Using the Put Call Parity, we may create synthetic Options.

•Synthetic Put = $c + Xe^{-rT} - S_0$ (Buy Call, Buy Bond & Sell Short the stock)

But traders simply Buy Call & Short sell the stock.



Why create Synthetic Put

By creating a Synthetic put, we may take advantage of any mispricing in Puts & Calls.

Swaps

❖ **Literal meaning : “to exchange”.**

❖ **Swap** is a transaction which transforms one stream of future cash flows into another stream of future cash flows with different features.

❖ Does not involve legal swapping of actual debt but an agreement is made to meet certain cash flows.

❖ **Basic types:**

✓ Interest rate Swap
✓ Fixed to Floating Rate or
✓ Floating to Fixed Rate
✓ Basis Swap

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Interest Rate Swaps

Why do these spreads exist in fixed and floating rates????

Why some companies need fixed and some need floating.

Swaps

Company A and B have been offered the following rates per annum on a 20 Mn 5-year loan.

Company	Fixed Rate	Floating rate
Company A	5%	LIBOR +0.1%
Company B	6.4%	LIBOR +0.6%
Differential	1.4%	0.5%
A require loan at floating. Company B require at Fixed rate. Commission is 0.1%		

According to comparative advance(Swapping) = LIBOR+ 0.6%+5% = LIBOR +5.6

If they would have taken according to their Will = LIBOR +6.4+0.1 = LIBOR +6.5

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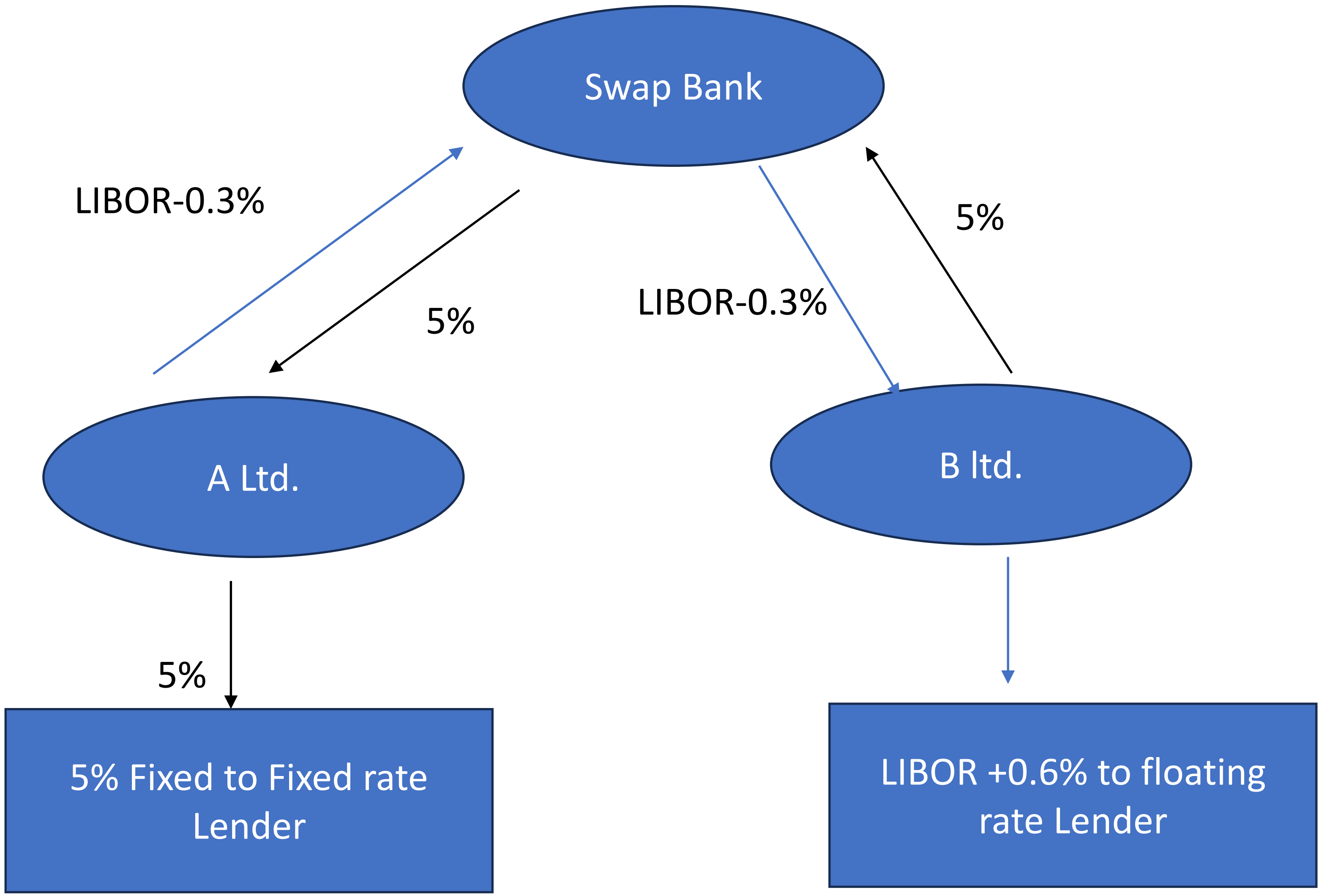
Interest Rate Swaps

- Fixed rate differential = 1.4%
- Floating rate = 0.5%
- Saving through swap = 0.9%(1.4%-0.5%)
- Commission to swap bank = 0.1%
- Net saving through swap = 0.8% (It needs to be equally distributed between both the parties)
- A saving = 0.4%
- B saving = 0.4%
- Hence floating rate that A will be willing to pay = LIBOR-0.3%

Swaps


Swap Bank
LIBOR-0.3%
5%
LIBOR-0.3%
5%
A Ltd.
B ltd.
5%
5% Fixed to Fixed rate Lender
LIBOR +0.6% to floating rate Lender