INDIRA GANDHI NATIONAL OPEN UNIVERSITY
School of Management Studies

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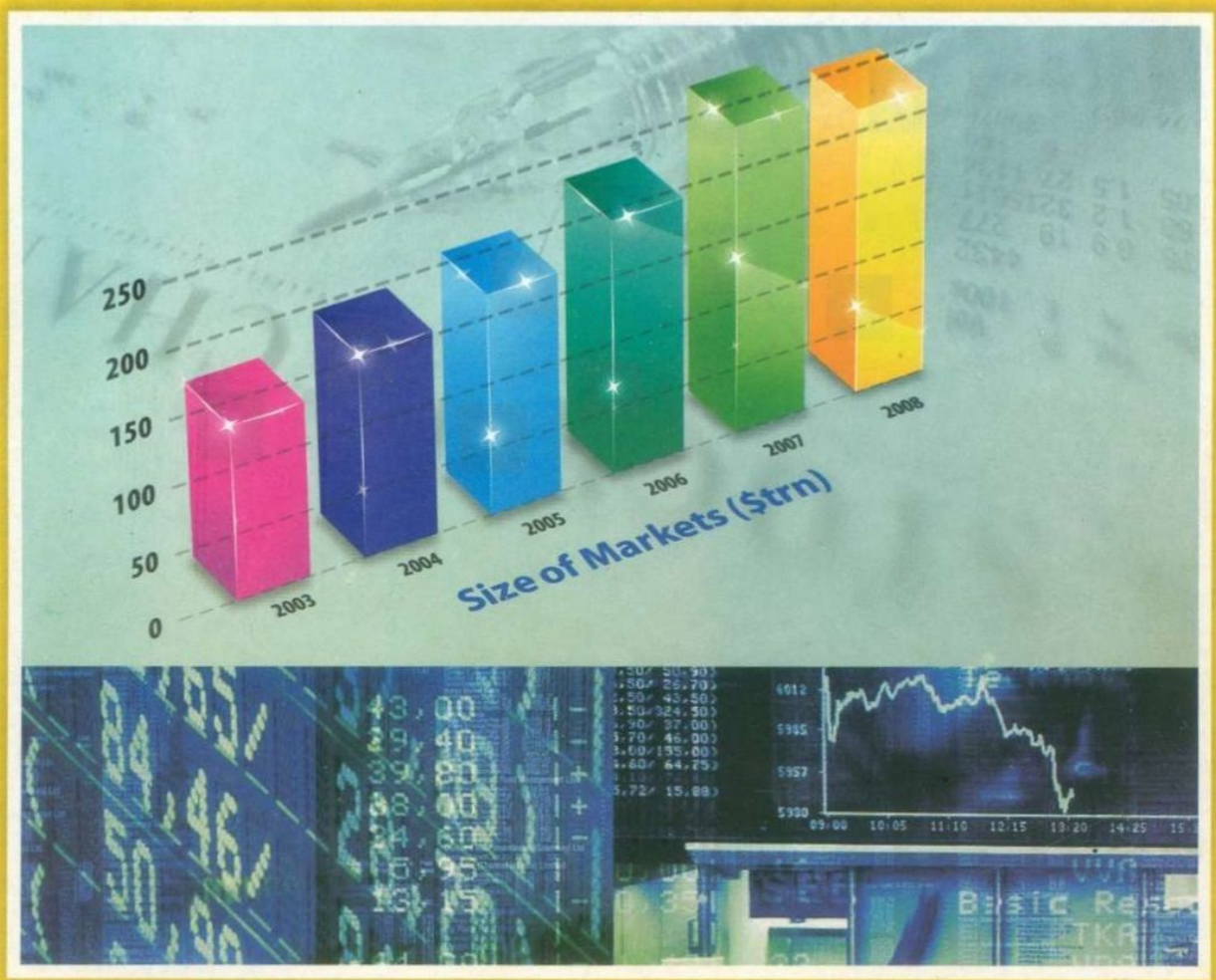
FINANCIAL TECHNOLOGIES KNOWLEDGE MANAGEMENT CO.

MFP-2 EQUITY DERIVATIVES



Equity Options

3

''शिक्षा मानव को बन्धनों से मुक्त करती है और आज के युग में तो यह लोकतंत्र की भावना का आधार भी है। जन्म तथा अन्य कारणों से उत्पन्न जाति एवं वर्गगत विषमताओं को दूर करते हुए मनुष्य को इन सबसे ऊपर उठाती है।''

— इन्दिरा गांधी

"Education is a liberating force, and in our age it is also a democratising force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances."

— Indira Gandhi

Block

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BLOCK 3 EQUITY OPTIONS

Options contracts are a kind of derivatives instruments which give the buyer a right but not the obligation to exercise the contract. Trading using Option Contracts had been prevalent in all markets since a long time now. In the year 2008, the world's exchanges executed 4.3 billion contracts in Single Stock Options, of which India contributed 11 million. In the previous year 2007, the world trade comprised of 3.7 billion contracts, of which India's share was 9 million. In Block 3, we will be learning Option Frame work and terms associated with it in detail, option pricing using various models and different trading strategies using options.

Unit 9 explains a broad perspective of world markets in exchange traded options. It also explains the concept and computation of Time Value and Intrinsic Value of an option. The unit also elaborates on the concepts of minimum price of an option and the rationale for making exercise window available and the pros and cons of exercise for the long option position holder.

Unit 10 elaborates different factors driving option prices. The unit will further develop an understanding on whether option prices will move upwards or downwards with movement in each determining factor, valuation of Call and put option and the necessity of formal mathematical option valuation models.

Unit 11 elaborates the different types of trading strategies using option contracts with examples. It provides in detail, different option strategies for speculative trading, hedging and arbitrage profits using different combinations.

UNIT 9 OPTION FRAMEWORK

Objectives

After studying this unit, you should be able to:

- appreciate a broad perspective of world markets in exchange traded options;
- explain the concept of Intrinsic value and Time value;
- compute these values for any given option;
- understand how several strikes are made available;
- identify what the minimum price of an option would be and why;
- discuss the rationale for making exercise window available and the pros and cons of exercise for the long option position holder; and
- identify which trader will use which strike and why.

Structure

9.1 Introduction

9.2 Intrinsic and Time Value Concept

9.3 Several Strike Prices

9.4 ATM, ITM and OTM Options

9.5 Minimum Price of an Option

9.6 When does Exercising an Option Make Sense

9.7 Time Value Revisited

9.8 Which Strikes would You Buy and Why

9.9 Summary

9.10 Self Assessment Questions

9.11 Further Readings

9.1 INTRODUCTION

In the previous unit, we discussed the basic definition and payoffs of Call and Puts and understood both long and short positions. Before delving into other concepts in this area, let us look at the world markets in the options industry – the size, traded volumes, countries and continents where this industry is popular and the Indian scene.

In the year 2008, the world's exchanges executed 4.3 billion contracts in Single Stock Options, of which India contributed 11 million. In the previous year 2007, the world trade comprised of 3.7 billion contracts, of which India's share was 9 million. In terms of notional value traded, 2008 saw trading of USD 9.3 trillion, against USD 10.1 trillion in 2007. India's traded volume was USD 51 billion in 2008 as against USD 85 billion in 2007. These figures do not include Index options

A detailed country wise breakdown of volumes (in terms of number of contracts, notional values and option premiums) for 2008 and 2007 is provided below for Single Stock Options and Stock Index Options.

Table 9.1: Single Stock Option

Contract Type	*2008 (volume Traded number of contracts)*	*2007 (volume Traded of contracts)*	*% change number*
Single stock options	4367855020	3729055699	17.13%
Stock index options	4077108052	3745337396	8.86%
Stock index futures	2285997467	1705686043	34.02%
Commodity futures	1541877930	1117693501	37.95%
Long term interest rate futures	1321697158	1530243302	-13.63%
Short term interest rate futures	1243366399	1521698092	-18.29%
Single stock options	1058862743	637859730	66.00%
Short term interest rate options	438970685	468705689	-6.34%
Currency futures	331711041	320430653	3.52%
Long term interest rate options	170666356	188307665	-9.37%
Commodity options	153688203	132009505	16.42%
Currency options	49905288	42803388	16.59%

Source: World Federation of Exchange

Table 9.2: Stock Index Option

Rank	*Instrument*	*Exchange*	*Jan-Dec 2008*	*Jan-Dec 2007*	*% Change*
1	Kospi 200 Options	KRX	2,766,474,404	2,709,844,077	2.10%
2	E-mini S&P 500	CME	633,889,466	415,348,228	52.60%
3	DJ Euro Stoxx 50 Futures	Eurex	432,298,342	327,034,149	32.20%
4	DJ Euro Stoxx 50 Options	Eurex	400,931,635	251,438,870	59.50%
5	SPDR S&P 500 ETF Options	*	321,454,795	141,614,736	127.00%
6	Powershares QQQ ETF Options	*	221,801,005	185,807,535	19.40%
7	S&P CNX Nifty Futures NSE	NSE	202,390,223	138,794,235	45.80%
8	S&P 500 Options	CBOE	179,019,155	158,019,723	13.30%
9	Shares Russell 2000 ETF Options	*	151,900,495	154,059,054	-1.40%
10	S&P CNX Nifty Options Nifty Futures NSE	NSE	150,916,778	52,707,150	186.30%

Source: Annual Volume Survey 2008 FIA

9.2 INTRINSIC AND TIME VALUE CONCEPT

The Option value at any point of time can be separated into two components, viz Intrinsic Value and Time Value. Intrinsic Value is defined as Stock Price minus Strike Price in the case of Call Options (if positive) and as Strike Price minus Stock Price in the case of Put Options (if positive). If this number is negative, then Intrinsic Value is zero.

You will observe that the computation of Intrinsic Value is the same as determination of payoff on expiry or exercise. The balance value of the Option is referred to as Time Value. If the total value of the option (as evident from the quoted market price of the option) is say Rs. 100 and you have determined the Intrinsic Value to be Rs. 81, then the balance value of Rs. 19 is designated as Time Value.

Thus, if you hold Reliance CA 25JUN2009 2250 (which you had bought for Rs. 80.50) and at this moment on June 9, 2009, you find that Reliance Equity is quoting at Rs. 2,425, the Intrinsic Value of this Option will be computed as Rs. 175 (Rs. 2,425 stock price

minus Rs. 2,250 strike price). If the Option is quoting at Rs. 202, the Time Value will be understood as Rs. 27 (total value of Rs. 202 minus Intrinsic Value of Rs. 175).

If you hold Bharti Airtel PA 25JUN2009 2250 (which you had bought for Rs. 37.65) and at this moment on June 9, 2009, you find that Bharti Airtel Equity is quoting at Rs. 682, the Intrinsic Value of this Option will be computed as Rs. 78 (Rs. 760 strike price minus Rs. 68 stock price). If this Option is quoting at Rs. 92, then Time Value will be understood as Rs. 14 (Rs. 92 minus Rs. 78).

Activity 1

Please fill up the gaps in the following table to help you understand Intrinsic and Time Value better.

Scrip Type	*Option Price*	*Strike Price*	*Stock Value*	*Total Value*	*Intrinsic Value*	*Time*
Reliance	Call	2250	2427	263		
Bharti Airtel	Put	760	673	95		
Reliance	Call	2300	2456			20
Bharti Airtel	Put	800			95	7
Reliance	Call	2200	2197			8
Bharti Airtel	Put	740			58	9
Reliance	Call	2200		104		12
Bharti Airtel	Put	720		45		4

What drives Intrinsic Value?

Intrinsic Value is driven by Stock Price. In Call Options, Intrinsic Value will increase if the underlying stock price increases and fall when the underlying stock price falls. If you have bought a Reliance 2250 strike Call Option when Reliance equity is quoting at Rs. 2,301, then the Intrinsic Value at the present moment is Rs. 51. As Reliance equity price increases say to Rs 2,325 (i.e., by Rs. 24), the Intrinsic Value also rises from Rs. 51 to Rs. 75 (that is by Rs 24). If Reliance equity falls to say Rs. 2,290 (i.e., by Rs. 11), the Intrinsic Value also falls to Rs. 40 (i.e., by Rs. 11). In this range of prices, the correlation of the change in equity prices to change in Intrinsic Value is 1:1.

However, if Reliance equity price were to fall below Rs. 2,250 (your strike price), the Intrinsic Value will fall to zero and then stay at zero (as option values cannot turn negative by basic concept). Thus, if Reliance equity price falls to Rs. 2,240, your Option Intrinsic Value becomes zero.

Similarly, in the case of Puts, Intrinsic Value will increase when the price of the underlying falls and decrease when the price of the underlying rises. For example, in our Bharti Airtel 760 strike Put Option, if the Bharti Airtel equity price is currently Rs. 723, your Intrinsic Value will be Rs. 37. If the Bharti Airtel equity price were to fall to Rs. 710 (i.e., by Rs. 13), your Put Option Intrinsic Value will rise to Rs. 50 (i.e., by Rs. 13).

If the Bharti Airtel equity price were to rise to Rs. 740 (i.e., by Rs. 17), your Put Option Intrinsic Value will fall to Rs. 20 (i.e., by Rs. 17). In this range of prices, the correlation between changes in equity prices and changes in Put Option Intrinsic Values is negative 1:1 (i.e., a one rupee rise in equity prices will cause a one rupee fall in Put Option Intrinsic Value and *vice versa*). However, beyond Rs. 760 (strike price), the Intrinsic Value of the Put Option becomes zero and stays at zero. Thus, if Bharti Airtel were to quote at Rs. 765, your Intrinsic Value is zero.

What drives Time Value?

Time Value is driven by time left for expiry. Higher the time left for expiry, higher the probability that the price of your underlying may see highs or lows that you are expecting. For example, if Reliance equity price is currently Rs. 2,301 and the strike price of your long call is Rs. 2,250, your desire would be that Reliance equity should move higher, much higher than the current level. For example, if Reliance equity were to move to Rs. 2,500 you would be delighted. The probability of Reliance equity moving up to say Rs. 2,500 depends on how much time is available for your Option to expire. If 30 days are left for expiry, there is a much stronger possibility of Reliance equity moving beyond Rs. 2,500 than another situation where only 3 days are left for expiry.

Therefore, the Time Value of an Option with 30 days to expire will be higher than with only 3 days to go. An Option with only 3 hours left for expiry will have a smaller Time Value than both of the above. With passage of time, the time value tends to decay. On expiry, the entire Time Value is eroded and only Intrinsic Value is left. Thus, on the day of expiry, you (as a long position holder), get back only Intrinsic Value (stock price minus strike price in the case of Calls and strike price minus stock price in the case of Puts).

Activity 2

1) List down the factors affecting intrinsic value of a call option.

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2) List down top 5 equity index futures and options worldwide.

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9.3 SEVERAL STRIKE PRICES

At any point of time, you will find that several Options have been designed by exchanges at various strike prices. As per regulations, at least seven strikes are required to be made available to traders / investors by the exchange on individual scrips. In practice, we find even more strikes are available due to underlying price movements from time to time. Each strike price will have a different option price. For example, Call options of a higher strike price will be available cheaper than those with lower strike prices. The logic of pricing is discussed in the next Unit in detail and not covered here.

Strike prices and related Option prices as of May 29, 2009 for Reliance June 25, 2009 expiry and July 30, 2009 expiry are provided based on data available from the National Stock Exchange in the Table 9.3. Please note that prices in the table should not be taken seriously as many of the strikes will be illiquid and hence provide unrealistic prices. The mathematical logic of pricing as will be developed in the next Unit in this Block may not be evident across all strikes due to liquidity constraints. Please also note that only strikes which were traded on May 29, 2009 have been included in this table and there are other strikes which are formally available but not traded and hence excluded. Reliance equity closing price on this day was Rs. 2,271.90.

Table 9.3: Strike Prices

Instrument Type	Expiry Date	Option Type	Strike Price	Last Price	Number of contracts traded	Turnover in Rs. Lakhs
FUTSTK	25-Jun-09	-	-	2,286.05	28,080.00	191,993.91
OPTSTK	25-Jun-09	CA	2310	117.30	1,015.00	7,390.55
OPTSTK	25-Jun-09	CA	2460	59.20	361.00	2,727.57
OPTSTK	25-Jun-09	CA	2250	145.55	355.00	2,545.55
OPTSTK	25-Jun-09	CA	2400	79.80	233.00	1,731.94
OPTSTK	25-Jun-09	PA	2250	108.50	244.00	1,724.10
OPTSTK	25-Jun-09	CA	2220	168.25	110.00	782.08
FUTSTK	30-Jul-09	-	-	2,290.10	103.00	709.49
OPTSTK	25-Jun-09	CA	2340	106.95	87.00	639.18
OPTSTK	25-Jun-09	CA	2280	136.70	77.00	556.36
OPTSTK	25-Jun-09	PA	2100	56.50	55.00	354.59
OPTSTK	25-Jun-09	PA	2220	94.30	48.00	332.99
OPTSTK	25-Jun-09	PA	2190	80.30	41.00	279.39
OPTSTK	25-Jun-09	CA	2370	92.90	35.00	257.57
OPTSTK	25-Jun-09	PA	2130	65.50	27.00	176.93
OPTSTK	25-Jun-09	CA	2190	186.00	24.00	170.14
OPTSTK	25-Jun-09	PA	1920	15.15	26.00	150.86
OPTSTK	25-Jun-09	CA	2430	76.35	15.00	112.50
OPTSTK	25-Jun-09	PA	2280	128.20	9.00	64.79
OPTSTK	25-Jun-09	PA	2310	138.35	8.00	58.60
OPTSTK	25-Jun-09	PA	1710	5.00	11.00	56.59
OPTSTK	25-Jun-09	PA	1950	18.10	8.00	47.21
OPTSTK	30-Jul-09	CA	2310	181.00	5.00	37.38
OPTSTK	25-Jun-09	PA	1980	24.00	6.00	36.07
OPTSTK	25-Jun-09	PA	2160	70.00	5.00	33.56
OPTSTK	25-Jun-09	PA	1830	4.40	6.00	33.02
OPTSTK	25-Jun-09	PA	2010	30.00	5.00	30.59
OPTSTK	25-Jun-09	CA	2160	217.00	4.00	28.24
OPTSTK	25-Jun-09	PA	2070	41.50	4.00	25.33
OPTSTK	25-Jun-09	CA	2100	219.95	2.00	13.92
OPTSTK	25-Jun-09	CA	1950	300.00	2.00	13.91
OPTSTK	30-Jul-09	CA	2340	157.30	1.00	7.49
OPTSTK	30-Jul-09	CA	2220	149.00	1.00	7.11
OPTSTK	25-Jun-09	CA	2130	195.00	1.00	6.98
OPTSTK	25-Jun-09	CA	2010	310.00	1.00	6.96
OPTSTK	25-Jun-09	CA	1980	340.00	1.00	6.96
OPTSTK	25-Jun-09	CA	2070	250.00	1.00	6.96
OPTSTK	25-Jun-09	CA	2040	280.00	1.00	6.96
FUTSTK	27-Aug-09	-	-	2,300.65	1.00	6.90
OPTSTK	25-Jun-09	PA	1890	11.00	1.00	5.70
OPTSTK	25-Jun-09	PA	1860	28.00	1.00	5.66
OPTSTK	25-Jun-09	PA	1800	15.00	1.00	5.40

Intervals of strike prices depend on the price range of the underlying. For example, a scrip trading at Rs. 75 is likely to have option strikes at intervals of Rs. 5 (say Rs. 75, Rs. 80, Rs. 85 and so on), while a scrip trading at Rs. 2,300 is likelty to have intervals of Rs. 30 (so strikes could be Rs 2,250, then Rs. 2,280, then Rs. 2,310 and so on).

Strike Price Intervals for individual scrips

Price of Underlying	Strike Price interval (Rs.)
Less than or equal to Rs. 50	2.5
> Rs.50 to less than or equal to Rs. 250	5
> Rs.250 to less than or equal to Rs. 500	10
> Rs.500 to less than or equal to Rs. 1000	20
> Rs.1000 to less than or equal to Rs. 2500	30
> Rs.2500	50

Option Strikes and Intervals in the US

A snapshot of Calls and Puts traded on the New York Stock Exchange on IBM and Citibank on May 28, 2009 is provided in the Tables 9.4 and 9.5. You will observe that several strikes are made available in the US markets too.

Table 9.4: Snapshot of Calls and Puts on IBM

INTERNATIONAL BUSINESS MACHINES CORP
Stock Exchange : NYSE

Price	Change (%)	52 wk High	52 wk Low	Stock Volume	Avg. options volume
104.69	↑ +1.76 (+1.71%)	130.93 24-Jul	69.50 21-Nov	6127885	30,640

Expiry: Jun09 Days: 23

Strike	Option Symbol		Bid/Ask Mean	Bid	Ask	Strike	Option Symbol		Bid/Ask Mean	Bid	Ask
	C	IBMFL	44.7	44.5	44.9		C	IBMFA	2.4	2.35	2.45
60	P	IBMRL	--	--	0.05	105	P	IBMRA	2.65	2.6	2.7
	C	IBMFM	39.7	39.5	39.9		C	IBMFB	0.625	0.6	0.65
65	P	IBMRM	--	--	0.05	110	P	IBMRB	5.9	5.8	6
	C	IBMFN	34.7	34.5	34.9		C	IBMFC	0.125	0.1	0.15
70	P	IBMRN	--	--	0.05	115	P	IBMRC	10.4	10.3	10.5
	C	IBMFO	29.75	29.6	29.9		C	IBMFD	--	--	0.05
75	P	IBMRO	--	--	0.05	120	P	IBMRD	15.3	15.2	15.4
	C	IBMFP	24.65	24.4	24.9		C	IBMFE	--	--	0.05
80	P	IBMRP	--	--	0.05	125	P	IBMRE	20.3	20.2	20.4
	C	IBMFQ	19.8	19.7	19.9		C	IBMFF	--	--	0.05
85	P	IBMRQ	0.075	0.05	0.1	130	P	IBMRF	25.3	25.1	25.5
	C	IBMFR	14.9	14.8	15		C	IBMFG	--	--	0.05
90	P	IBMRR	0.15	0.1	0.2	135	P	IBMRG	30.25	30.1	30.4
	C	IBMFS	10.15	10.1	10.2		C	IBMFH	--	--	0.05
95	P	IBMRS	0.4	0.35	0.45	140	P	IBMRH	35.25	35.1	35.4
	C	IBMFT	5.75	5.7	5.8						
100	P	IBMRT	1.05	1	1.1						

Expiry: Jul09 Days: 51											
Strike	Option Symbol		Bid/Ask Mean	Bid	Ask	Strike	Option Symbol		Bid/Ask Mean	Bid	Ask
	C	IBMGW	64.7	64.5	64.9		C	IBMGR	15.5	15.4	15.6
40	P	IBMSW	--	--	0.05	90	P	IBMSR	0.75	0.7	0.8
	C	IBMGX	59.7	59.5	59.9		C	IBMGS	11.2	11.1	11.3
45	P	IBMSX	--	--	0.05	95	P	IBMSS	1.4	1.35	1.45
	C	IBMGU	54.7	54.5	54.9		C	IBMGT	7.35	7.3	7.4
50	P	IBMSU	--	--	0.05	100	P	IBMST	2.55	2.5	2.6
	C	IBMGV	49.65	49.4	49.9		C	IBMGA	4.3	4.2	4.4
55	P	IBMSV	--	--	0.05	105	P	IBMSA	4.5	4.4	4.6
	C	IBMGL	44.7	44.5	44.9		C	IBMGB	2.1	2.05	2.15
60	P	IBMSL	--	--	0.05	110	P	IBMSB	7.35	7.3	7.4
	C	IBMGM	39.65	39.4	39.9		C	IBMGC	0.9	0.85	0.95
65	P	IBMSM	--	--	0.05	115	P	IBMSC	11.15	11	11.3
	C	IBMGN	34.75	34.6	34.9		C	IBMGD	0.325	0.3	0.35
70	P	IBMSN	0.075	0.05	0.1	120	P	IBMSD	15.55	15.4	15.7
	C	IBMGO	29.8	29.6	30		C	IBMGE	0.125	0.1	0.15
75	P	IBMSO	0.125	0.1	0.15	125	P	IBMSE	20.35	20.2	20.5
	C	IBMGP	24.85	24.6	25.1		C	IBMGF	--	--	0.1
80	P	IBMSP	0.2	0.15	0.25	130	P	IBMSF	25.3	25.2	25.4
	C	IBMGQ	20.2	20.1	20.3		C	IBMGG	--	--	0.1
85	P	IBMSQ	0.4	0.35	0.45	135	P	IBMSG	30.3	30.1	30.5

Table 9.5: Snapshot of Calls and Puts on CITI

CITIGROUP INC
Stock Exchange : NYSE

Price	Change (%)	52 wk High	52 wk Low	Stock Volume	Avg. options volume
3.67	-0.03 (-0.81%)	23.50 02-Oct	0.97 05-Mar	1.57E+08	990,160

Expiry: Jun09 Days: 23

Strike	Option Symbol		Bid/Ask Mean	Bid	Ask	Strike	Option Symbol		Bid/Ask Mean	Bid	Ask
	C	CFT	2.705	2.68	2.73		C	CFK	--	--	0.01
1	P	CRT	--	--	0.01	11	P	CRK	7.5	7.45	7.55
	C	CFY	1.19	1.18	1.2		C	CFZ	--	--	0.01
2.5	P	CRY	0.035	0.03	0.04	12.5	P	CRZ	8.975	8.9	9.05
	C	CFW	0.145	0.14	0.15		C	CFC	--	--	0.01
4	P	CRW	0.61	0.6	0.62	15	P	CRC	11.475	11.4	11.55
	C	CFP	0.045	0.04	0.05		C	CFR	--	--	0.01
5	P	CRP	1.52	1.5	1.54	17.5	P	CRR	13.975	13.9	14.05
	C	CFX	0.025	0.02	0.03		C	CFD	--	--	0.01
6	P	CRX	2.5	2.47	2.53	20	P	CRD	16.5	16.45	16.55
	C	CFQ	0.015	0.01	0.02		C	CFA	--	--	0.01
7.5	P	CRQ	3.975	3.95	4	22.5	P	CRA	18.975	18.9	19.05
	C	CFI	--	--	0.01		C	CFE	--	--	0.01
9	P	CRI	5.5	5.45	5.55	25	P	CRE	21.45	21.4	21.5
	C	CFB	--	--	0.01		C	CFS	--	--	0.01
10	P	CRB	6.5	6.45	6.55	27.5	P	CRS	23.95	23.9	24
							C	CFF	--	--	0.01
						30	P	CRF	26.45	26.4	26.5

Expiry: Jul09 Days: 51

Strike	Option Symbol		Bid/Ask Mean	Bid	Ask	Strike	Option Symbol		Bid/Ask Mean	Bid	Ask
	C	CGT	2.69	2.67	2.71		C	CGX	0.045	0.04	0.05
1	P	CST	0.015	0.01	0.02	6	P	CSX	2.785	2.77	2.8
	C	CGU	1.685	1.67	1.7		C	CGG	0.035	0.03	0.04
2	P	CSU	0.055	0.05	0.06	7	P	CSG	3.775	3.75	3.8
	C	CGV	0.705	0.69	0.72		C	CGH	0.02	0.01	0.03
3	P	CSV	0.28	0.27	0.29	8	P	CSH	4.75	4.7	4.8
	C	CGW	0.235	0.23	0.24		C	CGB	0.015	0.01	0.02
4	P	CSW	0.94	0.93	0.95	10	P	CSB	6.775	6.7	6.85
	C	CGP	0.095	0.09	0.1						
5	P	CSP	1.835	1.83	1.84						

Strikes and Intervals Rules in the US

Some extracts from the Chicgo Board of Options Exchange (CBOE) will provide you with a good perspective of practices in US markets. Please note that other exchanges may have similar but not identical rules. These rules may change from time to time and reflect the position as of now, i.e., May, 2009.

Intervals

The CBOE rules provide that the intervals between strike prices of series of options for stock options shall be:

i) $1.00 under a Special $ 1 Program when the strike price is $50.00 or less (this is after a recent amendment on March 17, 2009 discussed in subsequent paragraphs in this Unit).

ii) $2.50 when the strike price is less than $25.00.

iii) $5.00 when the strike price is greater than $25.00.

iv) $10.00 when the strike price is greater than $200.00.

Number of Strikes

The CBOE rules specify that the number of strikes below the current price shall equal those above the current price. For example, if seven strikes are opened, three shall be below the current price, one shall be at the current price and the other three shall be above the current price.

Additional Series: If the CBOE has opened less than twenty Short Term Option Series for a Short Term Option Expiration Date, additional series may be opened for trading on the CBOE when the CBOE deems it necessary to maintain an orderly market, to meet customer demand or when the current value of the underlying index moves substantially from the exercise price or prices of the series already opened. Any additional strike prices listed by the CBOE shall be within thirty percent (30%) above or below the current value of the underlying index. The CBOE may also open additional strike prices of Short Term Option Series that are more than 30% above or below the current value of the underlying index provided that demonstrated customer interest exists for such series, as expressed by institutional, corporate or individual customers or their brokers. Market-Makers trading for their own account shall not be considered when determining customer interest under this provision. The opening of the new Short Term Option Series shall not affect the series of options of the same class previously opened.

New Development in Option Strikes in the US

The recent meltdown has seen many stock prices struggling at low levels which were difficult to imagine some years ago. As a result, traders have found that relevant option strikes were not available to hedge their exposures. The SEC has found it expedient to amend rules relating to Option Strikes and allowed exchanges to offer more strikes at lower levels than before. A recent order of the SEC dated March 17, 2009 applicable to four exchanges (International Securities Exchange, Chicago Board Options Exchange, NYSE Arca and NYSE Alternext) makes interesting reading.

The earlier framework allowed these exchanges to offer strike intervals of $ 1 each on stocks which closed below $ 50 price. The strikes could range between $ 3 and $ 50. The highest strike allowed was $ 5 above the last closing price and the exchanges could select only 10 stocks for this purpose.

The rule of March 17, 2009 now allows exchanges to select as many as 55 stocks for this purpose. Further, the strikes are now allowed to start from as low as $ 1 (in place of $ 3).

9.4 ATM, ITM & OTM OPTIONS

The option strike which is close to the current price of the underlying is popularly referred to as At The Money Strike (ATM). For example, if Reliance equity is quoting at Rs. 2,253, the nearest strike of Rs. 2,250 will be the ATM strike. Sometimes, the ATM is also referred as Near The Money. You will observe that trading volumes of the ATM strike are much higher than the other strikes and hence ATMs are popular with the fast paced trading community.

Options which carry some Intrinsic Value are called In The Money (ITM). In the case of Call Options, strikes which are lower than the current equity price carry Intrinsic Value. For example, if Reliance equity is currently quoting at Rs. 2,253, then the Rs. 2,220 and Rs. 2,190 Call Options will carry Intrinsic Values of Rs. 33 and Rs. 63 respectively. These are referred to as ITM options.

Options which carry zero Intrinsic Values are called Out of The Money (OTM). In the case of Call Options, strikes which are higher than the current equity price zero carry Intrinsic Value. For example, if Reliance equity is currently quoting at Rs. 2,253, then the Rs. 2,280 and Rs. 2,310 Call Options will carry only Time Values with zero Intrinsic Values. These are referred to as OTM options.

In the case of Put Options, strikes which are higher than the current equity price carry Intrinsic Value. For example, if Bharti Airtel equity is currently quoting at Rs. 772, then the Rs. 780 and Rs. 800 Put Options will carry Intrinsic Values of Rs. 8 and Rs. 28 respectively. These are referred to as ITM options.

Options which carry zero Intrinsic Values are called Out of The Money (OTM). In the case of Put Options, strikes which are lower than the current equity price zero carry Intrinsic Value. For example, if Bharti Airtel equity is currently quoting at Rs. 772, then the Rs. 760 and Rs. 740 Put Options will carry only Time Values with zero Intrinsic Values. These are referred to as OTM options.

ITM options are expensive as the buyer will pay for Intrinsic and Time values, while OTM options are cheap as the buyer only pays Time value. However, the probability of getting a payoff is higher in ITM options while the probability of 'winning your bet' is lower in OTM. We will discuss the nuances of these Options in the next Unit on pricing of options.

Activity 3

Fill in the blanks in the following table to sharpen your understanding of ATM, ITM and OTM options. For this purpose, consider Near The Money as ATM.

Stock Price	*Strike Price*	*Strike Interval*	*Option Type*	*ATM, ITM, OTM*
772	780	20	Call	
772	780	20	Put	
781	780	20	Call	
781	780	20	Put	
781	760	20	Call	
781	760	20	Put	
2253	2250	30	Call	
2253	2250	30	Put	
2253	2400	30	Call	
2253	2200	30	Call	
2253	2200	30	Put	
2253	2400	30	Put	

9.5 MINIMUM PRICE OF AN OPTION

The minimum price of an Option is its Intrinsic Value. For example, when Bharti Airtel equity quotes at Rs. 772, a 760 Strike Call Option has to trade at least at Rs.12. This is because, the Option holder can buy this Option and exercise it immediately and be assured of getting a return of at least Rs.12. Now, the option contains a right to receive appreciation above 760, as we have discussed earlier. Therefore this right needs to be valued (at some positive value) which will add to the minimum price of Rs.12. Thus, the 760 Call is likely to quote at some price above Rs.12, this excess over Rs.12 being designated as Time Value.

If this option quotes below Rs.12, smart traders can indulge in arbitrage. Let us assume this option quotes at Rs. 9 for the purpose of argument. Let us also assume that Bharti Airtel Futures (of June expiry) quote at Rs. 773. A smart option trader can buy this option for Rs. 9 and simultaneously sell Futures at Rs. 773. The option trader is now assured of a gain of Rs. 4 irrespective of the closing price of Bharti Airtel equity on the day of expiry. Let us examine how this will happen.

On the day of expiry, Futures as well as Options will be settled on the basis of closing price of Bharti Airtel equity as we have discussed in earlier Blocks in this Course. Let us assume Bharti Airtel equity closes at Rs. 800 on the day of expiry. The trader will realize a payoff of Rs. 40 (800 minus 760) on the Call and will have to pay Rs. 27 (800 minus 773) on his Futures position. Thus, he realizes a net of Rs.13 on the day of expiry. If you deduct his cost of Rs. 9 which he paid on day of entering into his positions, his net gain is Rs. 4.

If Bharti Airtel equity floats downwards and closes at Rs. 750, he realizes nothing on the Call as it has closed below his strike price. On Futures, he make a profit of Rs. 23 (773 minus 750). Thus, his gain is more than Rs. 4.

Activity 4

Work out the numbers in the following table and check for yourself his minimum gain under various scenarios.

Bharti Airtel Equity Closing Price	*Gain /(Loss) on Futures*	*Payoff on Call*	*Cost on day one*	*Net Gain / (Loss)*
850				
825				
800				
775				
772				
760				
750				
740				
700				

The market in general will not allow any trader to generate super normal profits without assuming risk. Thus, the market will ensure that any point of time, the minimum price of an Option is at least equal to its Intrinsic Value.

9.6 WHEN DOES EXERCISE MAKE SENSE?

We covered the concept of Exercise and Assignment in the previous Unit along with the discussions on American and European options. At that time, we did not discuss why the trader may prefer to exercise and under what circumstances, it makes sense for him to do because this discussion required the concept of Intrinsic and Time value to be understood (which had by then not been covered).

In the normal course of exiting a long position in an Option, any trader would prefer to "sell" rather than "exercise" the option. This is because, the trader would receive Total value of the option on sale (which comprises of Intrinsic value and Time value), while on exercise, he would receive only the Intrinsic value and no Time value. However, as time passes and the option heads closer to expiry, the Time value component diminishes in value as we discussed earlier. Therefore, there is a slightly higher propensity to exercise closer to expiry than in earlier days.

Under what circumstances then does exercise become interesting? Sometimes, there is 'news flow' post market hours. The market closes at 330 pm while the exercise window remains open till 415 pm. During these 45 minutes, if there is positive news on a scrip, there is a strong likelihood that the opening price tomorrow morning may be significantly higher than today afternoon's closing price. In such a situation, all Put holders will be adversely impacted. Remember, the price of a Put will vary inversely with the price of equity. If equity rises, then Put prices will fall. Thus, the Put holder may well prefer to exercise the Put today itself and realize his payoff based on today's closing prices.

Example - the price of Bharti Airtel today is Rs. 772 at close and you are holding an 800 strike Put. The Put closing price was Rs. 32, which can be analyzed as Rs. 28 Intrinsic Value and Rs. 4 Time Value. There is great positive news on Bharti post closing hours and you expect that the scrip will open upwards tomorrow morning. You do not know the exact opening price, but estimate that it will be at least in the region of Rs. 790. Now, the Intrinsic Value of the Put would work out to only Rs.10 tomorrow morning and even if you add a liberal Time Value of Rs. 6, the total price is unlikely to open beyond Rs.16. At the moment, if you exercise, you are assured of receiving at Rs. 28. You may well prefer to exercise, the Put today afternoon instead of holding on for tomorrow and the future.

Similarly, if there is adverse news post closing hours, the holders of Call options will be tempted to exercise their Calls, as the Call value will fall with fall in the price of underlying equity.

You may also find in the market that some scrip prices have suddenly floated upwards or downwards due to technical positions being taken rather rapidly in the course of day trading. In such cases, you may read the market as being overbought or oversold and may expect a rapid reversal in the morning on the next day. In many of these situations, you may even find that equity prices float above futures prices (this phenomenon is rather strange and economically difficult to justify). In such situations, you may well be tempted to exercise your calls as your belief would be such that the opening price tomorrow will be much lower than today's close.

The most common reason for exercise however, continues to be lack of liquidity. Due to the availability of multiple strikes, it is difficult to find enough trading volumes in all the strikes. You will generally find better liquidity in those strikes which are near the current equity price. The liquidity in far away strikes on both sides is much lower. Thus, if Reliance is quoting at Rs. 2,253 and there is a 2000 Strike Call available, it may not have enough trading interest and hence you may find that the prices that are being asked or offered are not reasonable.

9.7 TIME VALUE RIVISITED

We discussed above that the Total Value of an option comprises of Intrinsic Value and Time Value. We also discussed that Time Value of an option depends on the time left for expiry. Options with longer times left will carry higher Time Value and that time value decays with passage of time. Let us examine this proposition in the light of practical market data.

If you examine the IBM June 105 Call Option you find that the price is $ 2.40 (mean price of bid and ask), while the same strike 105 for July series quotes at $ 4.30. IBM equity price is $ 104.69, which makes the 105 Call out of the money. Thus, this price comprises of zero intrinsic value and the entire value is time alone. The July series which has a longer time to expiry is quoting higher by $ 1.90 (than the June series), as the one month extra time available makes it more probable for IBM to move upward during July than during June (as the call buyer would desire).

Activity 5

Please continue this exercise for other strikes for IBM and Citibank and fill up the following table to sharpen your understanding of time value.

Scrip IBM

Please use mean prices for this purpose

Strike	*Series*	*Call Price*	*Intrinsic*	*Time*
60	June			
	July			
	Difference			
65	June			
	July			
	Difference			
70	June			
	July			
	Difference			
75	June			
	July			
	Difference			
80	June			
	July			
	Difference			
85	June			
	July			
	Difference			
90	June			
	July			
	Difference			
95	June			
	July			
	Difference			
100	June			
	July			
	Difference			
105	June			
	July			
	Difference			

110	June			
	July			
	Difference			
115	June			
	July			
	Difference			
120	June			
	July			
	Difference			
125	June			
	July			
	Difference			
130	June			
	July			
	Difference			
135	June			
	July			
	Difference			

In some cases, prices may not be available (due to illiquidity) and the above table may not be filled up.

9.8 WHICH STRIKES WOULD YOU BUY & WHY?

In the universe of several strikes, some OTM, some ITM and one ATM, it makes sense to understand which kind of investor or trader will buy which strike and why. We have already understood that ITM strikes are expensive as they include an element of Intrinsic Value and OTM strikes are cheap as they comprise only Time Value.

Let us take the example of Reliance on May 29, 2009 where the equity closing price was Rs. 2,271.90. Relevant Calls around this price were quoting as follows (all of June expiry)

Strike	*Option Price*	*Strike*	*Option Price*
2220	168.25	2280	136.70
2310	117.30	2340	106.95
2370	92.90	2400	79.80

Let us remember that all Call Option buyers are bullish in their view (leaving aside those buyers who are executing complicated combinations or mathematical strategies that we will cover in subsequent Units). The strike to be chosen then becomes a question of how much bullish each trader is, rather than whether he is bullish or not.

If you are very bullish on this stock and believe for example that Reliance will cross Rs. 2,650 by June expiry, which strike would you prefer to buy? Let us compute the net gain or loss in absolute amounts and as a percentage of return if Reliance indeed touches Rs. 2,650 by June expiry for the above positions.

Strike	OptionCost	Payoff	NetGain	RoI %
2,220	168.25	430.00	261.75	156%
2,280	136.70	370.00	233.30	171%
2,310	117.30	340.00	222.70	190%
2,340	106.95	310.00	203.05	190%
2,370	92.90	280.00	187.10	201%
2,400	79.80	250.00	170.20	213%

You find that though all strikes have generated brilliant returns, the far Out of The Money Option has generated the highest return relative to amount invested. If you are extravagantly bullish, it would make sense to buy the Out of the Money Option which is relatively cheap and if the underlying moves up, the payout will be much higher than the amount invested.

Conversely if you are moderately bullish, and you believe that Reliance will move up from the current level of Rs 2,271.90 to around Rs 2,400 by June expiry (and indeed Reliance moves up exactly to Rs 2,400), what kind of returns would accrue to you, for these strikes?

Strike	OptionCost	Payoff	NetGain	RoI %
2,220	168.25	180.00	11.75	7%
2,280	136.70	120.00	(16.70)	-12%
2,310	117.30	90.00	(27.30)	-23%
2,340	106.95	60.00	(46.95)	-44%
2,370	92.90	30.00	(62.90)	-68%
2,400	79.80	-	(79.80)	-100%

As you would have intuitively guessed, this time it is the In the Money Option that provides bang for the buck and the 2220 Strike generates a reasonable return. Therefore, investors and traders who are moderately bullish would buy ITM options. We will discuss the nuances of pricing mathematics in the next Unit where we will discover that those investors who prefer to exit before expiry will also find ITM options attractive as the change in the value of ITM options (relative to daily changes in the value of the underlying equity) will be higher than ATM or OTM options.

The ATM strike has the largest trading interest. You can observe in the Reliance example that the 2310 Call strike generated a volume of 1,015 contracts on May 29, 2009 as against only 48 contracts in the 2220 Put. This is because Reliance was trading in the 2300 plus range most of the time during the day and the 2310 Call was nearest to this price range and generated maximum trader attention. Thus, if you are an active trader and you prefer to enter and exit your option positions frequently (many times during a single day itself), you would prefer a product where trading frequency and volumes are high. The ATM would be the strike of your choice.

To summarize, very bullish traders would prefer OTM strikes, moderately bullish traders would prefer ITM strikes and active traders would target ATM.

9.9 SUMMARY

In the unit, we have seen the prominence of exchange traded options in the world markets where around 4.3 billion contracts are executed in Single Stock Options, of which India contributed 11 million. India's traded volume was USD 51 billion in 2008 as against USD 85 billion in 2007. Further, the concept and computation of intrinsic value and time value of any option is explained along with the factors driving them.

The Strike Price of an option contract is the price at which a trader trades that option contract, as explained in unit. At any point of time, as per regulations, at least seven strikes are required to be made available to traders / investors by the exchange on individual scrips. In practice, we find even more strikes are available due to underlying price movements from time to time. A snapshot of Calls and Puts traded on the New York Stock Exchange on IBM and Citibank on May 28, 2009 is also provided.

Few concepts like ITM, ATM and OTM are also discussed. The option strike which is close to the current price of the underlying is popularly referred to as At The Money Strike (ATM). Options which carry some Intrinsic Value are called In The Money (ITM). Options which carry zero Intrinsic Values are called Out of The Money (OTM). The minimum price of an Option is its Intrinsic Value as the Option holder can buy this Option and exercise it immediately and be assured of getting a return.

The chapter also elaborates on exercising and selling an option contract. In the normal course of exiting a long position in an Option, any trader would prefer to "sell" rather than "exercise" the option. This is because, the trader would receive total value of the option on sale (which comprises of intrinsic value and time value), while on exercise, he would receive only the intrinsic value and no time value. However, as time passes and the option heads closer to expiry, the time value component diminishes in value as we discussed earlier. Therefore, there is a slightly higher propensity to exercise closer to expiry than in earlier days.

9.10 SELF ASSESSMENT QUESTIONS

1) What is intrinsic value? What drives this value?
2) What is time value and what is it driven by?
3) Why exchanges should provide several strikes for trading?
4) What are options considered to be in the money?
5) When would you buy an at the money option?
6) What is the minimum price for any call option? What about put options?
7) When is it advisable to exercise options in the Indian markets?

9.11 FURTHER READINGS

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UNIT 10 OPTION PRICING

Objectives

After studying this unit, you should be able to:

- identify factors which drive option prices;
- appreciate which factors are responsible to what extent;
- understand whether option prices will move upwards or downwards with movement in each determining factor;
- discuss how valuations of calls and puts differ; and
- explain the necessity of formal mathematical option valuation models.

Structure

10.1 Introduction

10.2 Call Option Pricing

10.3 Put Option Pricing

10.4 Valuation Models

10.5 Summary

10.6 Self Assessment Questions

10.7 Further Readings

10.1 INTRODUCTION

This unit describes the factors that define option prices and how different determining factors make index move upwards and downwards.

10.2 CALL OPTION PRICING

In the earlier unit, we had examined a Reliance Call Option in detail from the point of view of payoffs and potential gains and losses. Now let us consider the same option and examine it further to understand how the option price of Rs. 80.50 is derived and what factors drive this price. You will recall our option, viz., Reliance CA 25JUN2009 2250 quoting at Rs. 80.50. Please keep in mind that the Reliance Equity price at this time was Rs. 2,142.70 and the Reliance June Futures price was Rs. 2,155.75.

Stock Price

The two basic factors that first and foremost impact the option price are the stock price and the strike price. In our example, the stock price is Rs. 2,142.70 and the strike price is Rs. 2,250.00. If these numbers were to change, the price of the option (currently Rs. 80.50) would also immediately react. Let us keep the other factors constant and understand the implications of changes in the stock price to begin with.

If the stock price moves up by say Rs. 10 (to Rs. 2,152.70), what do you think should happen to the price of the option? We know that the option promises to generate unlimited gains for the buyer and these gains are computed as the stock price minus the strike price (appreciation above strike price) on the day of expiry. As the stock price moves upwards, there is a higher and higher probability that it will generate a higher and higher potential gain for the buyer on the day of expiry. The probability of Reliance closing on expiry day at say Rs. 2,500 is higher when the Reliance price is Rs. 2,152.70 than the

situation when the price is Rs. 2,142.70. Therefore, all upward movements on equity will positively impact the price of the Call.

You will recall the concepts of intrinsic value and Time value. At the moment, this option carries zero intrinsic value as Reliance equity price is below the strike price of Rs. 2,250.

If the price moves beyond the strike price of Rs. 2,250, the option will carry an Intrinsic value (of the appreciation above Rs. 2,250) and this value will increase in the ratio of 1:1 for any increase in the price of Reliance equity itself. For example, if the price of Reliance equity moves up to Rs. 2,300 after 3 days, the Intrinsic value of this option will work out to Rs. 50. After this point, if Reliance were to move up by Re.1.00, the intrinsic value of the option will also move up by Re.1.00.

Strike Price

In our example, the strike price was Rs 2,250. If we were to examine a higher strike price (say Rs. 2,280), what do you think the price of that call (at the same moment of time) will be?

The 2280 call will provide a payoff of appreciation above 2280. In comparison to the 2250 call, the payoff from this call (or the potential payoff from this call) will always be lower. Assume Reliance equity closes at Rs 2,500 on the day of expiry. How much will the holders of both calls receive? The holder of the 2250 Call will receive Rs. 250, while the holder of the 2280 Call will receive Rs. 220. This will always be the case – the holder of the 2280 Call will always receive less than the holder of the 2250 Call in situations where Reliance equity closes above Rs 2m280. In situations where Reliance equity closes below Rs. 2,280 but above Rs. 2,250, the holder of the 2280 call will receive no payoff, while the holder of the 2250 call will receive some appreciation above 2250. In situations where Reliance equity were to close below 2250, both call holders will receive no payoff.

Thus, you can understand that the payoff from the 2280 Call will be lower than that from the 2250 Call. It stands to economic rationale that the 2280 Call will be cheaper than the 2250 Call.

In general, we can summarize that higher strikes will be cheaper in Call options and lower strikes will be expensive.

Volatility

Volatility refers to the fluctuation in the price of a scrip. A scrip which fluctuates a lot is more volatile than another whose prices do not move up and down wildly. A more volatile scrip carries more risk (of losses) and more potential (of gains) than a less volatile alternate. Volatility is also referred to as standard deviation, risk or sigma.

Standard Deviation

Let us understand how standard deviation is computed, on what base numbers and what the interpretation of the result is. Let us consider quoted market prices of Reliance for the month of May 2009 and work out the standard deviation of this scrip. Please note that the methodology suggested here to begin with is a very simple one and we can improvise and refine it as we go further in the discussion.

We calculate from the daily closing prices above the daily change in prices. For example, on May 5, 2009 the price change (over the closing price of May 4, 2009) was negative Rs. 3.45 (and so on for each day). We then express this daily change in terms of a percentage over the previous closing price. Thus for May 5, 2009, the percentage would be computed as negative 0.18% (-3.45 / 1887.10), which is then repeated for each day thereafter.

Date	Close Price
04-May-09	1,887.10
05-May-09	1,883.65
06-May-09	1,881.50
07-May-09	1,915.55
08-May-09	1,900.30
11-May-09	1,861.60
12-May-09	1,959.90
13-May-09	1,933.00
14-May-09	1,908.95
15-May-09	1,950.70
18-May-09	2,367.55
19-May-09	2,230.90
20-May-09	2,152.45
21-May-09	2,160.00
21-May-09	2,115.45
22-May-09	2,185.75
25-May-09	2,194.75
26-May-09	2,142.70
27-May-09	2,186.35
28-May-09	2,220.55
29-May-09	2,271.90

The data table would then appear as under:

Date	Close Price	Daily Change	Daily Return
04-May-09	1,887.10		
05-May-09	1,883.65	-3.45	-0.18%
06-May-09	1,881.50	-2.15	-0.11%
07-May-09	1,915.55	34.05	1.81%
08-May-09	1,900.30	-15.25	-0.80%
11-May-09	1,861.60	-38.70	-2.04%
12-May-09	1,959.90	98.30	5.28%
13-May-09	1,933.00	-26.90	-1.37%
14-May-09	1,908.95	-24.05	-1.24%
15-May-09	1,950.70	41.75	2.19%
18-May-09	2,367.55	416.85	21.37%
19-May-09	2,230.90	-136.65	-5.77%
20-May-09	2,152.45	-78.45	-3.52%
21-May-09	2,160.00	7.55	0.35%
21-May-09	2,115.45	-44.55	-2.06%
22-May-09	2,185.75	70.30	3.32%
25-May-09	2,194.75	9.00	0.41%
26-May-09	2,142.70	-52.05	-2.37%
27-May-09	2,186.35	43.65	2.04%
28-May-09	2,220.55	34.20	1.56%
29-May-09	2,271.90	51.35	2.31%

We then calculate the standard deviation of the last column above, i.e., the daily return. In Excel, you could use the formula STDEVA for this purpose. Please refer to a statistics text book for a detailed understanding of the computation of standard deviation. When we work out the Standard Deviation for the above data sample, we get 5.42%. This figure of 5.42% represents the daily standard deviation (or risk or sigma or volatility).

You will appreciate that if the daily closing prices were to vary more than shown in the table, volatility would have worked out higher. For example, if price on May 21, 2009 is changed from the current level of Rs. 2,160.00 to Rs. 2,220.00 (thus, the price rises on May 21 only to fall steeply on May 22), the volatility works out to 5.55% (in place of 5.42% above).

How does volatility impact Call Prices?

A high volatility implies that the underlying equity prices (say Reliance) can move up (and down) quite rapidly and substantially. Thus, if the strike price is Rs. 2,250 and the current equity price is Rs. 2,142.70 and you have bought this Call because you believe the price will reach Rs. 2,500 by expiry, the probability that it could indeed reach Rs. 2,500 is higher if the volatility is higher. Thus, a daily volatility of 5.42% will make it more probable that the price will reach Rs. 2,500 than a daily volatility of say 3.42%.

We should understand that a high volatility also indicates that the price of the scrip may crash more than low volatile scrip. However, as a buyer of the Call, we are interested in the probability of success and are willing to pay for it.

Volatility for longer horizons

Way back, more than 85 years ago, a French physicist Louis Bachelior helped establish an important theorem called Root Square Mean Theorem which even today sits at the heart of many mathematical calculations in financial markets. After researching stock price movements for over a decade he concluded that stock prices movements can be correlated to square root of time and not time itself. In simple words, if Reliance price moved by Rs. 10 in one day, how much will it move in 5 days? The answer is not a simple Rs. 50.

But if we know that the standard deviation of the daily returns in Reliance was 5.42% computed over daily price data, then the one sigma number for a 2 day period will be 5.42% multiplied by square root of 2 and the one sigma number for a 20 day period will be 5.42% multiplied by square root of 20 and so on.

Thus, if you are interested in volatility of Reliance from today till the day of expiry and this period comprises of 22 trading days, you can compute the volatility for the period remaining to expiry as 5.42% multiplied by square root of 22, i.e., 25.40%.

Probability of Success

In statistical terms, the concept of sigma can be understood in conjunction with concepts of normal distribution. The normal curve states that area under the curve for one standard deviation is 68.27%, two standard deviations is 95.45% and three standard deviations is 99.73%.

Consider the potential price of Rs. 2,500 in the light of the current equity price being Rs. 2,142.70. You need an appreciation of 16.68% (2,500 / 2,142.70) and your standard deviation is 25.40% (for the relevant period to expiry) as determined above. Thus, you need an upward movement of 0.657 standard deviations (16.68 / 25.40) to reach your target.

What is the probability of achieving this upward movement? The Normsdist function in Excel (=normsdist(0.657)) gives a response of 0.7444.

The implication is that the probability of the price of Reliance being anywhere from zero to Rs. 2,500 is 74.44% and therefore the probability of the price being higher than Rs. 2,500 is 25.56%. You have a 25.56% probability of being right in your prediction.

There are more sophisticated methods of analyzing probabilities (including logarithmic returns and weightages), which are not explored in a basic text like this one.

Now, if the volatility were not 5.42%, but 6.42%, how would the probability of success change? The probability for 22 trading days would work out to 6.42% multiplied by square root of 22, i.e., 30.11%. The required upward movement of 16.68% would translate to 0.5537 standard deviations. Using the 'normsdist' function, the probability of success for this situation comes to 28.99%.

You can appreciate that the probability of Reliance touching Rs, 2,500 has increased from 25.56% to 28.99% and hence a rational option buyer would be willing to pay a higher price for the option if the volatility were indeed higher than before.

Time to Expiry

The number of days left for expiry is important in pricing the option. The probability of the underlying's price moving up (or down) is higher with the time available being higher. A three year option will be more expensive than a three month option (other factors remaining constant).

Continuing the above example, we observed that the daily volatility of the scrip is 5.42%. If 22 days are left for expiry, the volatility (one sigma) of the scrip for 22 days worked out to 25.40%. If 10 days pass and only 12 days are left, the volatility fo 12 days would work out to 5.42% multiplied by square root of 12, i.e., 18.71%.

The probability of any upward movement is now restricted to this probability level of 18.71% (as against 25.40% ten days ago). As the upward movement potential has now been diluted, the price of the option will now be lower than before. As more time passes, the time value of the option will erode or decay. At point of expiry, the option price will carry no impact of time (as no time is left) and the only value left will be the Intrinsic value (i.e., stock price minus strike price).

To conclude, options will a longer time left for expiry will be more expensive. As time passes, time value will decay.

Risk Free Interest Rate

As interest rates in the economy rise, investors expectations of stock market returns rise. Further, the present values of future cash flows expected from options (when discounted) decrease when interest rates used for this discounting process are higher. The combined impact of these two factors is to increase the price of Calls.

Dividends

Dividends reduce stock price on the ex-dividend date. Hence, the effect on call option prices will be similar to reduction in stock prices. As we have discussed earlier, if stock prices rise, call prices will rise and vice-versa. Hence, dividends decrease call prices.

Summary

Factors affecting Call option price	*Impact on Call option price*
Higher stock price	Increases the price of the Call
Higher strike price	Lower the price of the Call
Higher volatility	Increases the price of the Call
Longer time to expiry	Higher the price of the Call
Higher interest rates	Higher the price of the Call
Higher dividends	Decrease the price of the Call

Activity1

1) Give Differences between Stock Price and Strike Price?

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2) As per Current market scenario what will be the risk free rate of return?

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10.3 PUT OPTION PRICING

On May 26, 2009 Bharti Airtel Equity closed at Rs. 771.20 and Bharti Telecom June Futures closed at Rs. 775.60. The BHARTIARTL PA 25JUN2009 760 closed at Rs. 37.65.

In the earlier Unit, we had examined this Put Option in detail from the point of view of payoffs and potential gains and losses. Now let us consider the same option and examine it further to understand how the option price of Rs. 37.65 is derived and what factors drive this price.

Stock Price

The two basic factors that first and foremost impact the option price are the stock price and the strike price. In our example, the stock price is Rs. 771.20 and the strike price is Rs. 760.00. If these numbers were to change, the price of the option (currently Rs. 37.65) would also immediately react. Let us keep the other factors constant and understand the implications of changes in the stock price to begin with.

If the stock price moves up by say Rs. 10 (to Rs. 781.20), what do you think should happen to the price of the option? We know that the option promises to generate unlimited gains for the buyer and these gains are computed as the strike price minus the stock price (depreciation below strike price) on the day of expiry. As the stock price moves downwards, there is a higher and higher probability that it will generate a higher and higher potential gain for the buyer on the day of expiry. The probability of Bharti Airtel closing on expiry day at say Rs. 700 is higher when the Reliance price is Rs. 771.20 than the situation when the price is Rs. 781.20. Therefore, all upward movements on equity will negatively impact the price of the Put.

You will recall the concepts of intrinsic value and Time value. At the moment, this option carries zero intrinsic value as Bharti Airtel equity price is above the strike price of Rs. 760.

If the price moves below the strike price of Rs. 760, the option will carry an Intrinsic value (of the depreciation below Rs. 760) and this value will increase in the ratio of 1:1 for any decrease in the price of Bharti Airtel equity itself. For example, if the price of Reliance equity moves up to Rs. 750 after 3 days, the Intrinsic value of this option will work out to Rs.10. After this point, if Reliance were to move down by Re.1.00, the intrinsic value of the option will move up by Re 1.00.

Strike Price

In our example, the strike price was Rs. 760. If we were to examine a higher strike price (says Rs. 780), what do you think the price of that Put (at the same moment of time) will be?

The 780 Put will provide a payoff of depreciation below 780. In comparison to the 760 Put, the payoff from this Put (or the potential payoff from this Put) will always be higher. Assume Bharti Airtel equity closes at Rs. 700 on the day of expiry. How much will the holders of both Puts receive? The holder of the 760 Put will receive Rs. 60, while the holder of the 780 Put will receive Rs. 80. This will always be the case – the holder of the 760 Put will always receive less than the holder of the 780 Put in situations where Bharti Airtel equity closes below Rs 760. In situations where Reliance equity closes below Rs 780 but above Rs. 760, the holder of the 760 Put will receive no payoff, while the holder of the 780 Put will receive some depreciation below 780. In situations where Reliance equity was to close above 780, both Put holders will receive no payoff.

Thus, you can understand that the payoff from the 760 Put will be lower than that from the 780 Put. It stands to economic rationale that the 760 Put will be cheaper than the 780 Put.

In general, we can summarize that higher strikes will be more expensive in Put options and lower strikes will be cheaper.

Volatility

We discussed the concepts of volatility and standard deviation computation in the valuation of Calls. Scrip which fluctuates a lot is more volatile than another whose prices do not move up and down wildly. More volatile scrip carries more risk (of losses) and more potential (of gains) than a less volatile alternate. Applying mathematical concepts like we did in the case of Reliance, we can determine the daily volatility of Bharti Airtel – this works out to 7.18%.

How does volatility impact Put prices

A high volatility implies that the underlying equity prices (say Bharti Airtel) can move up (and down) quite rapidly and substantially. Thus, if the strike price is Rs. 760 and the current equity price is Rs 771.20 and you have bought this Put because you believe the price will reach Rs. 700 by expiry, the probability that it could indeed reach Rs 700 is higher if the volatility is higher. Thus, a daily volatility of 7.18% will make it more probable that the price will reach Rs. 700 than a daily volatility of say 5.18%.

We should understand that a high volatility also indicates that the price of the rise more than a low volatile scrip. However, as a buyer of the Put, we are interested in the probability of success and are willing to pay for it.

Probability of Success

In statistical terms, the concept of sigma can be understood in conjunction with concepts of normal distribution. The normal curve states that area under the curve for one standard deviation is 68.27%, two standard deviations is 95.45% and three standard deviations is 99.73%.

The volatility of 22 trading days works out to 7.18% multiplied by square root of 22, i.e., 33.68%. Consider the potential price of Rs. 700 in the light of the current equity price being Rs. 771.20. You need a fall of 9.23% (71.20 / 771.20) and your standard deviation is 33.68% (for the relevant period to expiry) as determined above. Thus, you need an downward movement of 0.27 standard deviations (9.23 / 33.68) to reach your target.

What is the probability of achieving this downward movement? The Normsdist function in Excel (=normsdist(-0.27)) gives a response of 0.3920. This will translate into a probability of 39.20% that the price of Bharti Airtel on the day of expiry will be Rs. 700 or lower.

You have a 39.20% probability of being right in your prediction.

There are more sophisticated methods of analyzing probabilities (including logarithmic returns and weightages), which are not explored in a basic text like this one.

Now, if the volatility were not 7.18%, but 8.18%, how would the probability of success change? The probability for 22 trading days would work out to 8.42% multiplied by square root of 22, i.e., 38.37%. The required downward movement of 9.23% would translate to 0.24 standard deviations. Using the'normsdist' function, the probability of success for this situation comes to 40.49%.

You can appreciate that the probability of Bharti Airtel touching Rs. 700 has increased from 39.20% to 40.49% and hence a rational option buyer would be willing to pay a higher price for the option if the volatility were indeed higher than before.

Time to Expiry

The number of days left for expiry is important in pricing the option. The probability of the underlying's price moving up (or down) is higher with the time available being higher. A three year option (both Calls and Puts) will be more expensive than a three month option (other factors remaining constant).

Continuing the above example, we observed that the daily volatility of the scrip is 7.18%. If 22 days are left for expiry, the volatility (one sigma) of the scrip for 22 days worked out to 33.68%. If 10 days pass and only 12 days are left, the volatility for 12 days would work out to 7.18% multiplied by square root of 12, i.e., 28.34%.

The probability of any downward movement is now restricted to this volatility level of 28.34% (as against 33.68% ten days ago). As the downward movement potential has now been diluted, the price of the option will now be lower than before. As more time passes, the time value of the option will erode or decay. At point of expiry, the option price will carry no impact of time (as no time is left) and the only value left will be the Intrinsic value (i.e., stock price minus strike price).

To conclude, options will a longer time left for expiry will be more expensive. As time passes, time value will decay.

Risk Free Interest Rate

As interest rates in the economy rise, investors expectations of stock market returns rise. Further, the present values of future cash flows expected from options (when discounted) decrease when interest rates used for this discounting process are higher. The combined impact of these two factors is to decrease the price of Calls.

Dividends

Dividends reduce stock price on the ex-dividend date. Hence, the effect on Put option prices will be similar to reduction in stock prices. As we have discussed earlier, if stock prices rise, Put prices will fall and *vice versa*. Hence, dividends increase Put prices.

Summary

Factors affecting Put option price	*Impact on Put option price*
Higher stock price	Decreases the price of the Put
Higher strike price	Higher the price of the Put
Higher volatility	Increases the price of the Put
Longer time to expiry	Higher the price of the Put
Higher interest rates	Lower the price of the Put
Higher dividends	Increase the price of the Put

Activity 2

What are the factors affecting put option Price?

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10.4 VALUATION MODELS

You will appreciate that the above discussion was non-mathematical in nature (inspite of some mathematics in volatility). The formalization of the above framework in terms of differential mathematical equations leads to valuation models. These models are immensely helpful in pricing of options in the real world. Most practitioners are not aware of the intricate mathematics involved in the models. But they use these models straight off Excel or off specialized software programs and understand implications on market prices (or potential prices) even without knowledge of intricate mathematics. While the academicians design models and proves them to be efficient, it is the practitioners who apply them to real life situations and help them in becoming popular and useful. Practical insights and queries lead to better quality and more complex modeling which keep academicians of the second round busy. A good practitioner knows what the right inputs are and how to get or estimate them. He also knows what the result from the model implies and how these results can be applied to daily trading.

The most popular of these models is the Black Scholes Merton model (more commonly known as the Black Scholes model). This model was developed in the early seventies by Professors Fischer Black, Myron Scholes and Robert Merton.

The model has been pivotal to the growth and success of financial engineering since then. In 1997, the importance of the model was recognized when Professors Robert Merton and Myron Scholes were awarded the Nobel Prize for economics. Professor Fischer Black expired in 1995, else he would have also been a recipient.

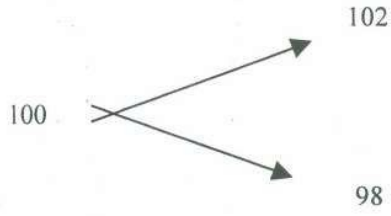
Another popular technique for pricing an option involves constructing a binomial tree. This is a diagram which throws up several different paths that might be followed by the stock price over the life of an option. The underlying assumption is that stock prices follow an unpredictable random walk. In each step, the stock could either move up or down and both of these can be computed by estimating probabilities for each movement. As the time step becomes smaller and smaller, the solutions of the binomial model approach that of the Black Scholes model. The binomial model was designed by Messrs Cox, Ross and Rubinstein in 1979 and is quite popular in the current derivatives world.

Let us discuss the Binomial model in some detail without getting too much into the mathematics of the model itself. Let us consider the derivation of the value of a call

option. The Binomial model considers that the underlying equity price would either move or down with each time step. If the share price moves up, the call option would begin to acquire more value and if the share price moves down, the option would begin to lose value (or may even tend to zero). The tenor of the option could be sub-divided into several time steps. For example, if the option has a 10 day tenor, it could be conceptually defined as 10 steps of 1 day each.

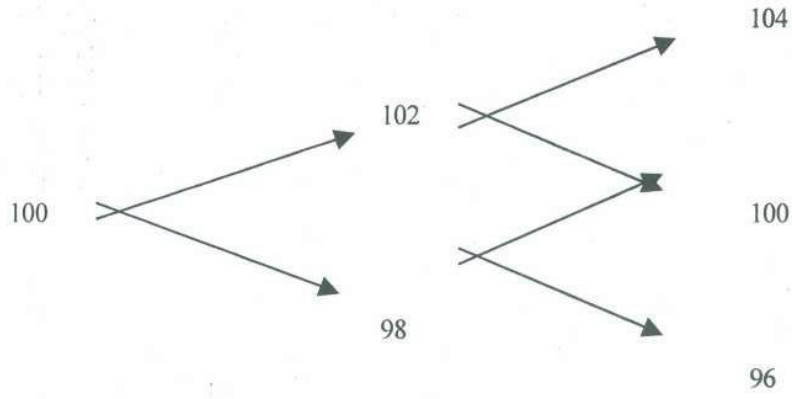
If the current price of the share is say Rs.100, then the share price path could be modeled as a series of 10 steps that the price could take on each of these days. Let us assume that the price could move by Rs. 2 per day.

Thus, at the end of day one, the price would either become Rs. 102 or Rs. 98.



Now, what happens at the end of day two?

You could have three possibilities in the path as follows:



The number of paths at the end of day 2 will be 4 paths (2^2) and the possible number of end points in the path will be 3 (2 + 1). If you continue on this model for 10 days, what is the result? You would be able to model 1,024 paths (2^{10}) and you would have 11 end points (10 + 1).

Assuming that for each day the price could either rise or fall 2% of the previous day's close, the 11 price points at the end of the 10th day would be computed by applying the above logical framework as under:

Path	*Price at end of 10th day*
1	121.90
2	117.12
3	112.53
4	108.11
5	103.87
6	99.80
7	95.89
8	92.13
9	88.51
10	85.04
11	81.71

Please note that the earlier example assumed a flat Rs 2 increase or decrease while a more advanced example (like the above) would assume a percentage increase or decrease (for example 2%).

You can imagine that if you model around 200 steps, the number of paths will be many many trillions and you will have 201 possibilities of where the share price will end up.

Once you modeled the share price paths in this manner, the next step is to work out the price of the option at each point in the path and then to compute the present values of each of those option prices by discounting these option values using the risk free rate.

The number of steps is decided by the model expert and generally models use 200 or more steps. The size of the move in the equity price is based on volatility of the stock. A highly volatile stock would move more than a stock is not so volatile.

This model is popular for option valuation and can incorporate path constraints better than the Black Scholes model which is simpler to use.

10.5 SUMMARY

In this unit, we have understood various factors impacting the call and put option price along with option valuation concept. Broadly speaking, options can be classified as 'call' options and 'put' options. When you buy a 'call' option, on a stock, you acquire a right to buy the stock and when you buy a 'put' option, you acquire a right to sell the stock. You can also sell a 'call' option, in which, you will acquire an obligation to deliver the stock and when you sell a 'put' option, you acquire an obligation to buy the stock.

The right or obligation to buy or sell the underlying asset is always at a pre-decided price known as the 'strike price' or 'exercise price', which is linked to the prevailing price of the underlying asset in the cash market. Usually, option contracts are available on the underlying asset on various strike prices (generally, five or more)-divided equally on either side of its spot price.

Every financial option is a contract between the two counterparties with the terms of the option specified in a term sheet. Option contracts may be quite complicated; however, at minimum, they usually contain the following specifications:

- Whether the option holder has the right to buy (a call option) or the right to sell (a put option).
- The quantity and class of the underlying asset(s) (e.g., 100 shares of XYZ Co. B stock).
- The strike price, also known as the exercise price, which is the price at which the underlying transaction will occur upon exercise
- The expiration date, or expiry, which is the last date the option can be exercised.
- The settlement terms, for instance whether the writer must deliver the actual asset on exercise, or may simply tender the equivalent cash amount.
- The terms by which the option is quoted in the market to convert the quoted price into the actual premium–the total amount paid by the holder to the writer of the option.

In the next unit, we would be discussing various option trading strategies that can be applied in different market situations to be in a profitable zone.

10.6 SELF ASSESSMENT QUESTIONS

1) Explain the factors affecting option premium?
2) How is volatility computed?
3) What is standard deviation?
4) How is volatility for longer horizons computed?
5) What is probability of success?
6) Which option valuation models are popular?
7) What is a binomial path and how is it constructed?

10.7 FURTHER READINGS

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UNIT 11 TRADING STRATEGIES USING OPTIONS

Objectives

After studying this unit, you should be able to:

- understand application of options in combination strategies;
- appreciate risks and rewards of using options in speculation;
- understand how option combinations could be used for hedging; and
- understand application of option combinations for generating arbitrage profits.

Structure

11.1 Introduction

11.2 Option Strategies for Speculation

11.3 Option Strategies for Hedging

11.4 Option Strategies for Arbitrage

11.5 Summary

11.6 Self Assessment Questions

11.7 Further Readings

11.1 INTRODUCTION

You have understood basic option definitions, potential gains and possible losses in individual option positions. Individual option positions could be one of four – long call, short call, long put, short put. The basic features of these individual positions are summarized for refreshing your understanding:

Position	*Premium*	*Gains*	*Losses*	*View*	*Risk Level*
Long Call	Pay	Unlimited	Limited	Bullish	Low
Short Call	Receive	Limited	Unlimited	Bearish	High
Long Put	Pay	Unlimited	Limited	Bearish	Low
Short Put	Receive	Limited	Unlimited	Bullish	High

Each individual option has a certain set of features, risks and rewards. Many times, the payoffs that you seek and the risks that you are prepared to accept may not exactly match with the individual product features. Therefore, you may be required to combine some of these options to generate the level of comfort that is acceptable to you in terms of risk and that is reasonably satisfying in terms of potential rewards.

Combinations may help you to:

- Increase potential rewards
- Reduce possible risks
- Decrease risk to reward ratio
- Reduce cost of options
- Increase probability of success

Background Data

It is easier to understand option combinations if we use practical data and build strategies based on market practices. We have chosen data on the Nifty for this purpose. The data relates to October 9, 2009 and covers the Nifty index, Nifty futures and several strikes of Nifty options. We will refer to this data table in this Unit at several places.

Nifty Index on October 9, 2009 - closing 4,941.75

Expiry Date	Option Type	Strike Price	High Price	Low Price	Prev Close	Last Price
	Futures					
29-Oct-09	Oct	-	5,027.50	4,923.05	5,001.70	4,931.00
29-Oct-09	CE	5000	141.95	95.00	133.15	95.00
29-Oct-09	PE	4900	123.60	80.10	93.80	118.00
29-Oct-09	CE	5100	93.70	56.05	84.90	57.00
29-Oct-09	PE	5000	172.00	112.35	132.55	165.90
29-Oct-09	CE	5200	59.00	30.80	50.25	31.00
29-Oct-09	PE	4800	85.80	53.15	65.75	83.00
29-Oct-09	PE	4700	59.60	39.50	45.85	57.15
29-Oct-09	CE	5300	28.95	15.50	26.10	15.75
29-Oct-09	PE	4600	39.50	26.00	30.75	37.00
29-Oct-09	CE	4900	200.05	144.00	189.85	146.90
29-Oct-09	PE	5100	232.65	165.15	181.65	225.50
29-Oct-09	CE	5400	13.65	7.45	13.05	7.50
29-Oct-09	PE	4500	26.00	17.00	21.05	24.00
29-Oct-09	CE	5500	6.50	3.95	6.50	4.20
26-Nov-09	-	-	5,035.00	4,935.50	5,011.05	4,941.00
29-Oct-09	PE	4300	11.60	8.50	10.05	10.00
29-Oct-09	PE	4400	16.90	11.20	14.10	15.00
29-Oct-09	CE	4800	272.00	208.00	267.35	210.00
29-Oct-09	PE	5200	308.80	228.30	246.10	300.00
29-Oct-09	PE	4200	7.90	5.60	6.95	6.60
29-Oct-09	CE	5600	2.90	1.95	2.85	1.95
31-Dec-09	PE	4300	85.00	80.00	65.00	84.00
26-Nov-09	CE	5300	83.90	62.50	84.30	63.00
26-Nov-09	CE	5500	39.30	27.00	38.65	27.00
26-Nov-09	CE	5600	27.00	18.00	25.45	18.00
26-Nov-09	PE	4500	75.95	55.00	59.05	73.00
26-Nov-09	CE	5000	216.00	176.05	216.05	178.00
26-Nov-09	PE	4700	122.65	94.50	100.00	122.00

11.2 OPTION STRATEGIES FOR SPECULATION

Speculation requires the trader to have a view. In the simple equity market, possible views are: (a) bullishness, (b) bearishness. In derivative markets, you could have more complex views. In particular, the following views could easily be conceptualized: (a) bullish, (b) bearish, (c) volatile (which means market will move significantly but you are not sure of the direction – up or down), (d) neutral or range bound (which means market is not likely to move significantly and is more likely to remain around the present levels).

Further, in derivative markets, you will be able to enhance your gains if you can express your views in specific terms. For example, to believe that market will move upwards (bullishness) is rather simplistic. It may be more specific to say that the current market which is at 4,941.75 (in your opinion) is likely to move upwards but not beyond 5,200 in the next 10 days time.

If you are able to express your view clearly, you will be able to design derivative trading strategies more effectively. Conversely, if your view is rather vague, the strategies and the resulting gains are also likely to be grey.

Understanding and Defining Risk

The second parameter (apart from a clearly expressed specific view) is to define the level of risk which you can afford. For example, you may be required to specify that you can afford to lose Rs. 5 lakhs in the next 10 days (and not more). In option trading, the trade off is between the cost of premium and the level of risk assumed. For example, if you are willing to pay a huge premium, the risk would be zero. If you are not willing to pay any premium (rather you would prefer to receive premium), then you will be required to assume risk. Between these two extremes (of paying the entire premium or receiving the entire premium), there lie a whole spectrum of intermediate positions where you trade-off between paying a premium and assuming risk.

Specific Strategies

In this section, we take you through various strategies. For each strategy, we will go through the following steps:

a) View in general and specific terms

b) Possible diagram for the view

c) Creating the diagram using individual option instruments

d) Creating a payoff table supporting the diagram which will clearly show the potential gains and losses at various price points on expiry.

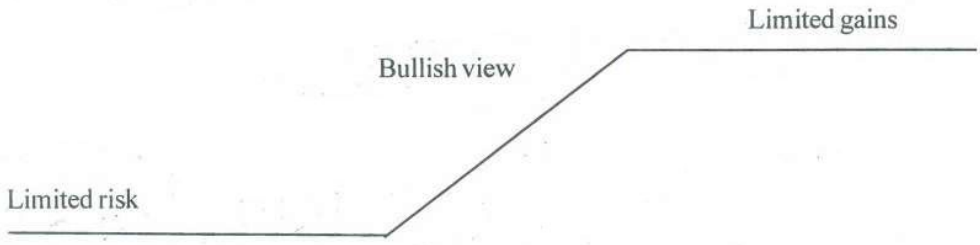
1) Bull Spread using Calls
2) Bull Spread using Puts
3) Bear Spread using Puts
4) Bear Spread using Calls
5) Ratio Spreads for bullish views using Calls - low risk
6) Ratio Spreads for bullish views using Calls - high risk
7) Ratio Spreads for bearish views using Puts - high risk
8) Ratio Spreads for bearish views using Puts - low risk
9) Long Straddle
10) Short Straddle
11) Long Strangle
12) Short Strangle
13) Long Butterfly
14) Short Butterfly
15) Long Condor
16) Short Condor

1) Bull Spread using Calls

View: Moderately bullish, Nifty will move upwards from the current level of 4941.75 but not above 5200

Risk level preferred: Low (limited)

Diagram preferred:



Options required to create the above payoff:

- Long 5000 Call : Premium Rs. 95
- Short 5200 Call : Premium Rs. 31
- Net Premium (cost) : Rs. 64

Premiums rounded off to nearest rupee

Payoff Table

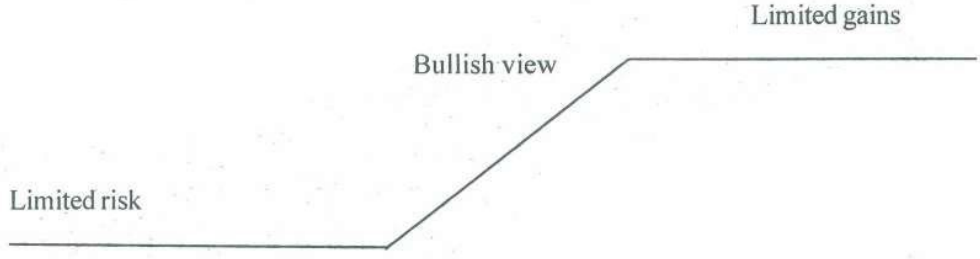
Expiry Price	*Payoff on Long 5000 Call*	*Payoff on Short 5200 Call*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5500	500	-300	-64	136
5400	400	-200	-64	136
5300	300	-100	-64	136
5200	200	0	-64	136
5150	150	0	-64	86
5100	100	0	-64	36
5050	50	0	-64	-14
5000	0	0	-64	-64
4900	0	0	-64	-64

2) **Bull Spread using Puts**

View: Moderately bullish, Nifty will move upwards from the current level of 4941.75 but not above 5100

Risk level preferred: Low (limited)

Diagram preferred:



Options required to create the above payoff:

- Long 4900 Put : Premium Rs 118
- Short 5100 Put : Premium Rs 225
- Net Premium (income) : Rs 107

Premiums rounded off to nearest rupee

Payoff Table:

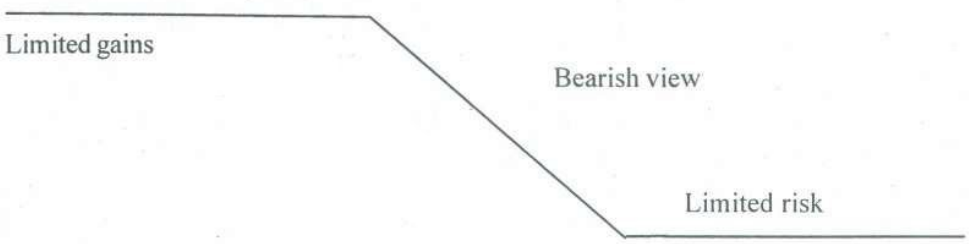
Expiry Price	*Payoff on Long 4900 Put*	*Payoff on Short 4700 Put*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5500	0	0	107	107
5400	0	0	107	107
5300	0	0	107	107
5200	0	0	107	107
5150	0	0	107	107
5100	0	0	107	107
5050	0	-50	107	57
5000	0	-100	107	7
4900	0	-200	107	-93
4800	100	-300	107	-93

3) **Bear Spread using Puts**

View: Moderately bearish, Nifty will move downwards from the current level of 4941.75 but not below 4700

Risk level preferred: Low (limited)

Diagram preferred:



Options required to create the above payoff:

- Long 4900 Put : Premium Rs 118
- Short 4700 Put : Premium Rs 57
- Net Premium (cost) : Rs 61

Premiums rounded off to nearest rupee

Payoff Table:

Expiry Price	*Payoff on Long 4900 Put*	*Payoff on Short 4700 Put*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5000	0	0	-61	-61
4900	0	0	-61	-61
4850	50	0	-61	-11
4800	100	0	-61	39
4750	150	0	-61	89
4700	200	0	-61	139
4600	300	-100	-61	139
4500	400	-200	-61	139

4) **Bear Spread using Calls**

In the same manner as we created Bull Spread using either Calls or Puts, you can create a Bear spread using either Puts or Calls. Intuitively, you will realize that a Bull Spread is easier using Calls (as Calls are primary bullish instruments) and a Bear Spread is easier using Puts (as Puts are primarily bearish instruments). In the market place too, you will find it easier to execute bull and bear spreads using Calls and Puts respectively. This is because volumes are higher in Out of the Money options than in In the Money options. So you will find execution is difficult if you attempt bull spreads using puts or bear spreads using calls.

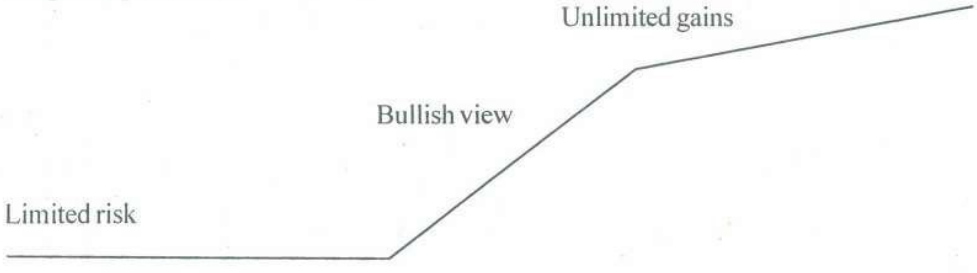
5) **Ratio Spreads for bullish views using Calls – low risk**

In the above spreads, we bought 1 call / put and sold 1 call / put. In ratio spreads, we change this ratio. You will realize that when you buy any option you are paying a premium (cost) but limiting your risk and leaving the rewards more open (as compared to a situation where you sell options and limit your rewards). When you sell any option, you are receiving a premium (potential income) but taking risk and limiting rewards. If you are more keen to earn rewards (which will typically happen if you are strong on your bullish or bearish view), it will make more sense to buy more options and sell relatively less options - for example, you could buy 2 calls and sell 1 call. On the other hand, if you are comfortable with risk, you may seek to generate current income (by selling more options) and face a potentially difficult situation if your view goes wrong. In this case, you will sell more options than buy – for example, you could buy 1 call and sell 2 calls.

View: Moderately bullish, Nifty will move upwards from the current level of 4941.75 but not above 5200, however there is a reasonable probability that it could move above 5200 also and you don't want to sacrifice such potential gains (above 5200) entirely.

Risk level preferred: Low (limited)

Diagram preferred:



Options required to create the above payoff:

- Long 5000 Call : Premium Rs. 95 – 2 units
- Short 5200 Call : Premium Rs. 31 – 1 unit
- Net Premium (cost) : Rs. 159 for the set of 2 long and 1 short call

Premiums rounded off to nearest rupee for convenience

Payoff Table:

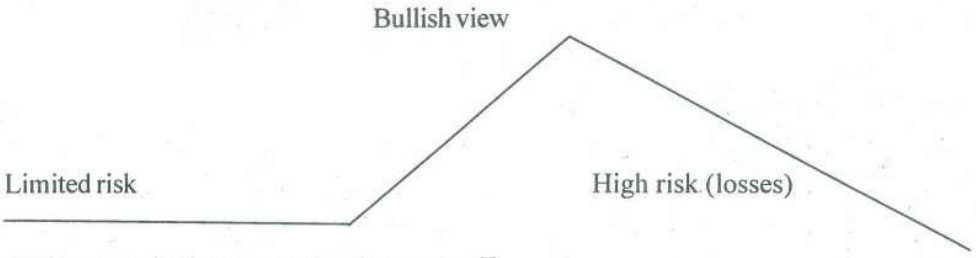
Expiry Price	*Payoff on Long 5000 Calls (two)*	*Payoff on Short 5200 Calls (one)*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5500	1,000	-300	-159	541
5400	800	-200	-159	441
5300	600	-100	-159	341
5200	400	0	-159	241
5150	300	0	-159	141
5100	200	0	-159	41
5050	100	0	-159	-59
5000	0	0	-159	-159
4900	0	0	-159	-159

6) Ratio Spreads for bullish views using Calls – high risk

View: Moderately bullish, Nifty will move upwards from the current level of 4941.75 but not above 5200, and you are comfortable with risk if Nifty indeed moves beyond 5200 as you strongly believe that Nifty will not cross this level of 5200.

Risk level preferred: High to medium

Diagram preferred:



Options required to create the above payoff:

- Long 5000 Call : Premium Rs. 95 – 1 units
- Short 5200 Call : Premium Rs. 31 – 2 unit
- Net Premium (cost) : Rs. 33 for the set of 1 long and 2 short call

Premiums rounded off to nearest rupee for convenience

Payoff Table:

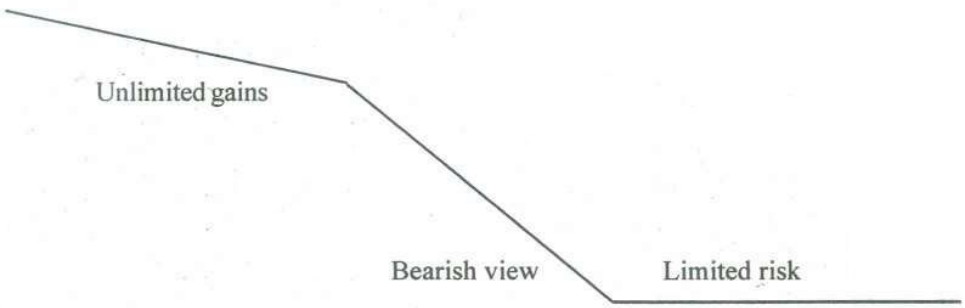
Expiry Price	*Payoff on Long 5000 Calls (two)*	*Payoff on Short 5200 Calls (one)*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5500	500	-600	-33	-133
5400	400	-400	-33	-33
5300	300	-200	-33	67
5200	200	0	-33	167
5150	150	0	-33	117
5100	100	0	-33	67
5050	50	0	-33	17
5000	0	0	-33	-33
4900	0	0	-33	-33

7) Ratio Spreads for bearish views using Puts – low risk

View: Moderately bearish, Nifty will move downwards from the current level of 4941.75 but not below 4700, however there is a reasonable probability that it could move below 4700 also and you don't want to sacrifice such potential gains (below 4700) entirely.

Risk level preferred: Low (limited)

Diagram preferred:



Options required to create the above payoff:

- Long 4900 Put : Premium Rs, 118 – 2 units
- Short 4700 Put : Premium Rs, 47 – 1 unit
- Net Premium (cost) : Rs, 189 for the set of 2 long and 1 short put

Premiums rounded off to nearest rupee for convenience.

Payoff Table:

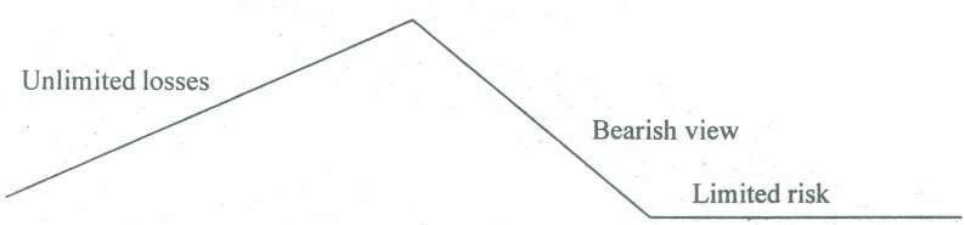
Expiry Price	*Payoff on Long 4900 Puts (two)*	*Payoff on Short 4700 Put (one)*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5000	0	0	-189	-189
4900	0	0	-189	-189
4850	100	0	-189	-89
4800	200	0	-189	11
4750	300	0	-189	111
4700	400	0	-189	211
4650	500	-50	-189	261
4600	600	-100	-189	311
4500	800	-200	-189	411

8) Ratio Spreads for bearish views using Puts – high risk

View: Moderately bearish, Nifty will move downwards from the current level of 4941.75 but not below 4700, and you are comfortable with losses if indeed Nifty moves below 4700.

Risk level preferred: High to medium

Diagram preferred:



Options required to create the above payoff:

- Long 4900 Put : Premium Rs.118 – 1 unit
- Short 4700 Put : Premium Rs. 47 – 2 units
- Net Premium (cost) : Rs. 24 for the set of 1 long and 2 short puts

Premiums rounded off to nearest rupee for convenience.

Payoff Table:

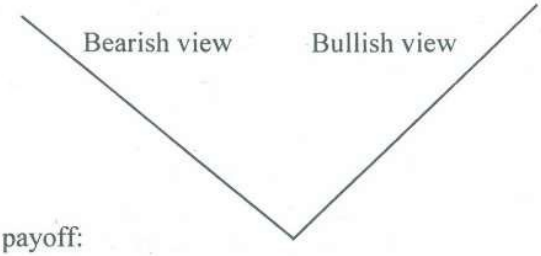
Expiry Price	*Payoff on Long 4900 Puts (one)*	*Payoff on Short 4900 Put (two)*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5000	0	0	-24	-24
4900	0	0	-24	-24
4850	50	0	-24	26
4800	100	0	-24	76
4750	150	0	-24	126
4700	200	0	-24	176
4650	250	-100	-24	126
4600	300	-200	-24	76
4500	400	-400	-24	-24

9) **Long Straddle**

View: Volatile – market will move significantly either upwards or downwards, but you are not sure of the direction

Risk level preferred: Low risk, limited losses

Diagram preferred:



Options required to create the above payoff:

- Long 4900 Call : Premium Rs. 147
- Long 4900 Put: Premium Rs. 118
- Net Premium (cost) : Rs. 265

Premiums rounded off to nearest rupee for convenience

Payoff Table:

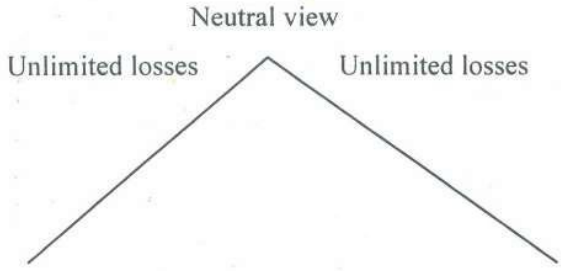
Expiry Price	*Payoff on Long 4900 Call*	*Payoff on Short 4900 Put*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5500	600	0	-265	335
5300	400	0	-265	135
5100	200	0	-265	-65
5000	100	0	-265	-165
4900	0	0	-265	-265
4800	0	100	-265	-165
4700	0	200	-265	-65
4600	0	300	-265	35
4500	0	400	-265	135

10) **Short Straddle**

View: Neutral – market will remain range bound

Risk level preferred: High – objective is to earn premium from the view

Diagram preferred:



Options required to create the above payoff:

- Short 4900 Call : Premium Rs. 147
- Short 4900 Put: Premium Rs. 118
- Net Premium (income) : Rs. 265

Premiums rounded off to nearest rupee for convenience

Payoff Table:

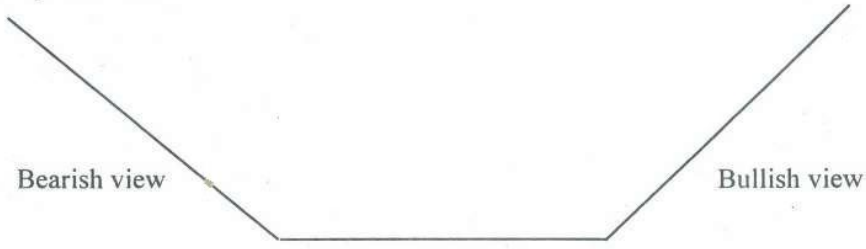
Expiry Price	*Payoff on Long 4900 Call*	*Payoff on Short 4900 Put*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5500	-600	0	265	-335
5300	-400	0	265	-135
5100	-200	0	265	65
5000	-100	0	265	165
4900	0	0	265	265
4800	0	-100	265	165
4700	0	-200	265	65
4600	0	-300	265	-35
4500	0	-400	265	-135

11) **Long Strangle**

View: Volatile – market will move significantly either upwards or downwards, but you are not sure of the direction.

Risk level preferred: Low risk, limited losses. The long strangle differs from the straddle in the manner in which strikes are selected. By selecting strikes which are out of the money, the options bought become relatively cheaper. However, the positive payoff results only when the underlying (in our case Nifty) moves substantially on either side. Thus, while the cost is lower than the straddle, the probability of success is also relatively lower.

Diagram preferred:



Options required to create the above payoff:

- Long 5000 Call : Premium Rs. 95
- Long 4900 Put: Premium Rs. 118
- Net Premium (cost) : Rs. 213

Premiums rounded off to nearest rupee for convenience

Payoff Table:

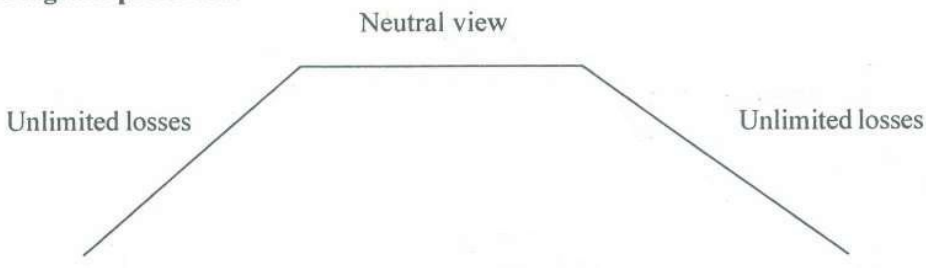
Expiry Price	*Payoff on Long 5000 Call*	*Payoff on Short 4900 Put*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5500	500	0	-213	287
5300	300	0	-213	87
5100	100	0	-213	-113
5000	0	0	-213	-213
4900	0	0	-213	-213
4800	0	100	-213	-113
4700	0	200	-213	-13
4600	0	300	-213	87
4500	0	400	-213	187

12) **Short Strangle**

View: Neutral – market will remain range bound

Risk level preferred: High - objective is to earn premium from the view.

Diagram preferred:



Options required to create the above payoff:

- Short 5000 Call : Premium Rs. 95
- Short 4900 Put: Premium Rs. 118
- Net Premium (income) : Rs. 213

Premiums rounded off to nearest rupee for convenience

Payoff Table:

Expiry Price	*Payoff on Long 5000 Call*	*Payoff on Short 4900 Put*	*Call Premium (Net) on day of inception*	*Net Gain/(Loss)*
5500	-500	0	213	-287
5300	-300	0	213	-87
5100	-100	0	213	113
5000	0	0	213	213
4900	0	0	213	213
4800	0	-100	213	113
4700	0	-200	213	13
4600	0	-300	213	-87
4500	0	-400	213	-187

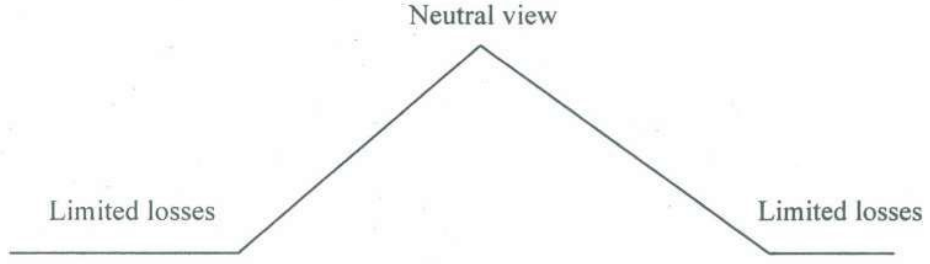
13) **Long Butterfly**

The long butterfly strategy is an improvisation to the short straddle. The short straddle is a very high risk strategy as you are exposed to both upside and downside risk and if you go wrong in your view (that market will remain neutral), you may find yourself staring at huge losses. In the long butterfly, you seek to reduce or arrest your losses on both sides. You will buy a call on the upside and a put on the downside, which will help you arrest these unlimited losses. As you pay these premiums, the maximum potential gains in a long butterfly will be lower than that from the short straddle.

View: Neutral – market will remain range bound

Risk level preferred: Low risk – losses to be limited

Diagram preferred:



Options required to create the above payoff:

- Short 4900 Call : Premium Rs.147
- Short 4900 Put: Premium Rs.118
- Long 5200 Call : Premium Rs. 31
- Long 4600 Put : Premium Rs. 37
- Net Premium (income) : Rs.197

Premiums rounded off to nearest rupee for convenience

14) **Short Butterfly**

The short butterfly strategy is an improvisation to the long straddle. The short straddle is a very expensive strategy as you pay for both options, the call and the put. If the market does not move significantly as you expect, then you will be disappointed. Further, you may believe that while market will move in either direction, the magnitude of the direction may not be very significant. In such a view, you are better off selling out of the money

Payoff Table:

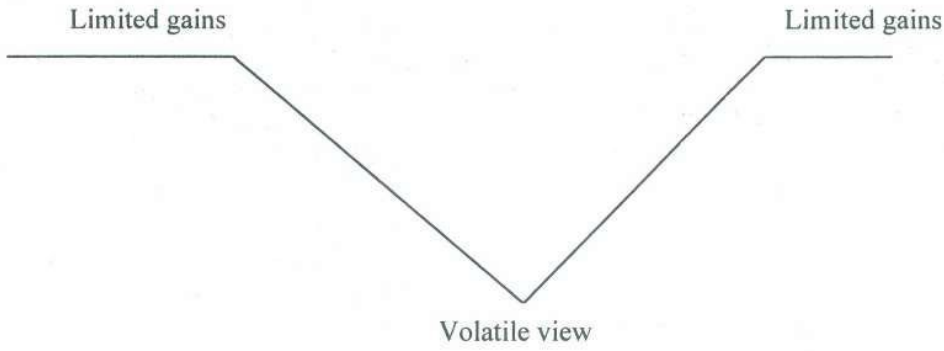
Expiry Price	*Payoff on Long 4900 Call*	*Payoff on Long 5200 Call*	*Payoff on Long 4900 Put*	*Payoff on Long 4600 Put*	*Call Premium (Net) on day of inception*	*Net Gain/ (Loss)*
5500	-600	300	0	0	197	-103
5300	-400	100	0	0	197	-103
5100	-200	0	0	0	197	-3
5000	-100	0	0	0	197	97
4900	0	0	0	0	197	197
4800	0	0	-100	0	197	97
4700	0	0	-200	0	197	-3
4600	0	0	-300	0	197	-103
4500	0	0	-400	100	197	-103

calls and puts and reducing the cost of your straddle. You will end up sacrificing unlimited gains on both sides.

View: Volatile – market will move up in either direction (you are not sure which), but you do not believe that the movement will be very significant.

Risk level preferred: Low risk – losses to be limited

Diagram preferred:



Limited losses

Options required to create the above payoff:

- Long 4900 Call : Premium Rs. 147
- Long 4900 Put: Premium Rs. 118
- Short 5200 Call : Premium Rs. 31
- Short 4600 Put : Premium Rs. 37
- Net Premium (cost) : Rs. 197

Premiums rounded off to nearest rupee for convenience

Payoff Table:

Expiry Price	*Payoff on Long 4900 Call*	*Payoff on Long 5200 Call*	*Payoff on Long 4900 Put*	*Payoff on Long 4600 Put*	*Call Premium (Net) on day of inception*	*Net Gain/ (Loss)*
5500	600	-300	0	0	-197	103
5300	400	-100	0	0	-197	103
5100	200	0	0	0	-197	3
5000	100	0	0	0	-197	-97
4900	0	0	0	0	-197	-197
4800	0	0	100	0	-197	-97
4700	0	0	200	0	-197	3
4600	0	0	300	0	-197	103
4500	0	0	400	-100	-197	103

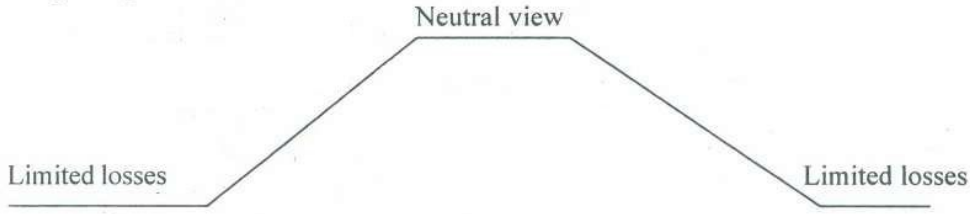
15) **Long Condor**

The long condor strategy is an improvisation to the long butterfly. In the long butterfly, you use one strike. In the long condor, you use two different strikes. The objective is to provide for a longer range of profit than the butterfly will allow. The profit range widens to the extent of the strikes chosen by you.

View: Neutral – market will remain range bound

Risk level preferred: Low risk – losses to be limited

Diagram preferred:



Options required to create the above payoff:

- Short 5000 Call : Premium Rs. 95
- Short 4900 Put: Premium Rs. 118
- Long 5200 Call : Premium Rs. 31
- Long 4600 Put : Premium Rs. 37
- Net Premium (income) : Rs. 145

Premiums rounded off to nearest rupee for convenience

Payoff Table:

Expiry Price	*Payoff on Long 5000 Call*	*Payoff on Long 5200 Call*	*Payoff on Long 4900 Put*	*Payoff on Long 4600 Put*	*Call Premium (Net) on day of inception*	*Net Gain/ (Loss)*
5500	-500	300	0	0	145	-55
5300	-300	100	0	0	145	-55
5100	-100	0	0	0	145	45
5000	0	0	0	0	145	145
4900	0	0	0	0	145	145
4800	0	0	-100	0	145	45
4700	0	0	-200	0	145	-55
4600	0	0	-300	0	145	-155
4500	0	0	-400	100	145	-155

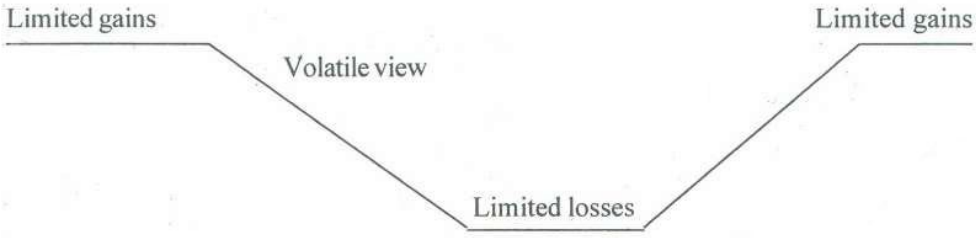
16) **Short Condor**

The short condor is an extension of the short butterfly. You wish to further reduce your costs by using two strikes instead of one (as in the short butterfly).

View: Volatile – market will move up in either direction (you are not sure which), but you do not believe that the movement will be very significant.

Risk level preferred: Low risk – losses to be limited

Diagram preferred:



Options required to create the above payoff:

- Long 5000 Call : Premium Rs. 95
- Long 4900 Put: Premium Rs. 118
- Short 5200 Call : Premium Rs. 31
- Short 4600 Put : Premium Rs. 37
- Net Premium (cost) : Rs. 145

Premiums rounded off to nearest rupee for convenience

Payoff Table:

Expiry Price	*Payoff on Long 5000 Call*	*Payoff on Long 5200 Call*	*Payoff on Long 4900 Put*	*Payoff on Long 4600 Put*	*Call Premium (Net) on day of inception*	*Net Gain/ (Loss)*
5500	500	-300	0	0	-145	55
5300	300	-100	0	0	-145	55
5100	100	0	0	0	-145	-45
5000	0	0	0	0	-145	-145
4900	0	0	0	0	-145	-145
4800	0	0	100	0	-145	-45
4700	0	0	200	0	-145	55
4600	0	0	300	0	-145	155
4500	0	0	400	-100	-145	155

11.3 OPTION STRATEGIES FOR HEDGING

Hedging assumes that you have already an underlying (or expect to hold an underlying) which either carries current risk or could carry risks in future. Hedging attempts to reduce or minimize such risks. These strategies could apply to cases where you already own equity and seek to reduce risk of potential fall in the price of your equity. The following strategies applied using options alone will be most relevant in this context:

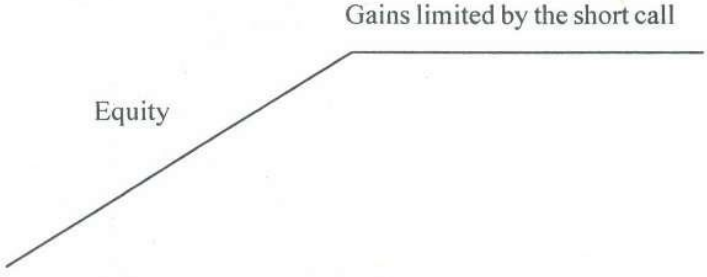
- Covered Call Strategy
- Put Insurance Strategy
- Collar Strategy

Covered Call Strategy

If you own a stock which you intend to hold for the long run but you believe that in the short run (say this one month) it is not going up too much, you could consider selling a call against this stock. The call will generate a premium which will accrue to you as income if the stock does not move up (as you believe). If the stock indeed moves up beyond the strike price of your call, then you will have to pay the difference. However, in this case, you will be paying only against the appreciation that you have earned on the underlying stock and thus are not out of pocket in a real sense.

Suppose you hold Hindustan Unilever shares whose price is currently Rs. 275. You believe that Hindustan Unilever is a strong stock which you would like to own for the long term. However, you believe that in the current month, it is not likely to move up beyond Rs. 290. You could consider selling a call of 290 strike. If the premium is say Rs. 2, you would receive this premium when you sell the call.

Your combination strategy will appear as under in the diagram format:



The payoff from the strategy will be computed as under:

Payoff Table:

Expiry Price	*Gain on Equity*	*Payoff on Short 290 Call*	*Call Premium (Net) on day of inception*	*Net Gain/ (L*	*Comments o s s)*
300	25	-10	2	17	Max gain is 17
295	20	-5	2	17	Max gain is 17
292	17	-2	2	17	Max gain is 17
290	15	0	2	17	Max gain is 17
285	10	0	2	12	
280	5	0	2	7	
275	0	0	2	2	
270	-5	0	2	-3	Loss is not due to call
265	-10	0	2	-8	Loss is not due to call

The covered call strategy can also be used in situations where you intend to sell the stock only if it moves beyond a certain price. For example, in the above case, if you intend to sell Hindustan Unilever if it moves above Rs. 290 but as the current price is only Rs. 275, you are unable to sell – you could sell a 290 call for Rs. 2. If the stock moves beyond Rs. 290, you would sell the share and buy back the call. If the stock remains below Rs. 290, you would in any case have earned a premium of Rs. 2 (and would therefore be better off than merely holding simple equity by Rs. 2).

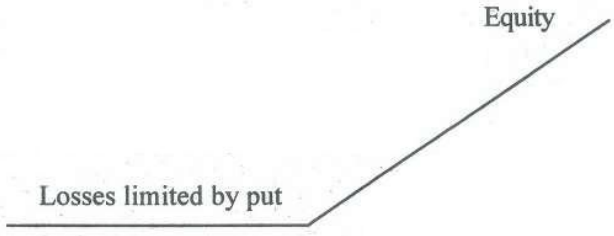
Put Insurance Strategy

If you are holding equity but are nervous in the short run about possible fall in the market, you could buy puts against your stock. If you are nervous about the stock or the market in the long run, it is advisable to sell the stock itself.

Continuing the above example, if you are nervous about Hindustan Unilever (Rs. 275 current market price) in the short run, you could buy a 260 Put for say Rs. 2.

If the stock indeed falls below Rs. 260, you will be compensated by the Put. If the stock remains above Rs. 260, then you should think of this Rs. 2 as the cost of insuring your stock. When you buy medical insurance and do not fall ill, the premium that you pay is an expense simpliciter. Something similar happens in case of puts which have been bought for insuring stocks but expire worthless.

Diagram:



The payoff from the strategy will be computed as unde..

Payoff Table:

Expiry Price	*Gain on Equity*	*Payoff on Long 260 Put*	*Put Premium (Net) on day of inception*	*Net Gain/(Loss)*
300	25	0	-2	23
290	15	0	-2	13
280	5	0	-2	3
270	-5	0	-2	-7
260	-15	0	-2	-17
250	-25	10	-2	-17
240	-35	20	-2	-17
230	-45	30	-2	-17
220	-55	40	-2	-17

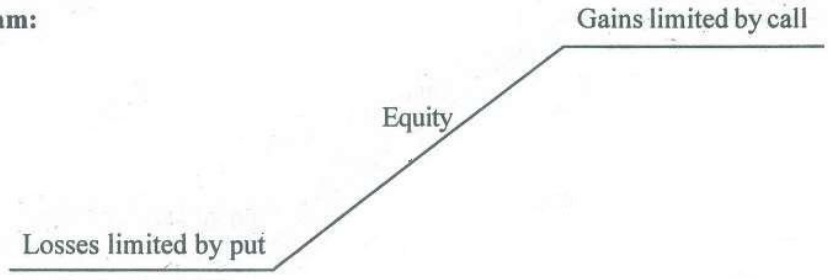
Your max loss in this strategy is Rs. 17.

Collar Strategy

In many situations, you may seek protection from downside risk but may shy away due to the cost of the put premium. In such cases, you could consider a collar strategy where the objective is to sell a call on the upside (thereby sacrificing potential upside gains) and use the call premium to buy put insurance. Thus, the insurance comes free or almost free.

Continuing, the above example, you would sell the HUL 290 Call for Rs. 2, and use this premium to buy the 260 Put. Thus, the combination of options becomes zero cost for you. You are now protected for falls in the price of HUL below Rs. 260, but in return have given up gains which could possible arise if HUL were to cross Rs. 290.

Diagram:



Payoff Table:

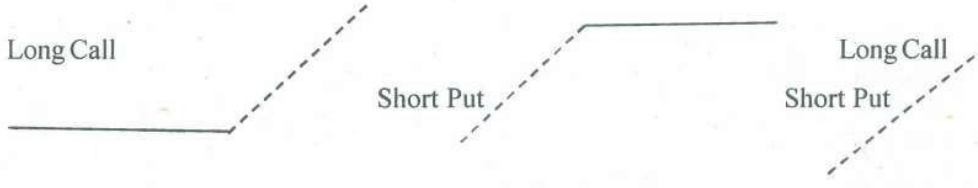
Expiry Price	*Gain on Equity*	*Payoff on Short 290 Call*	*Payoff on Long 260 Put*	*Premium (Net) on day of inception*	*Net Gain / (Loss)*
300	25	-10	0	0	15
290	15	0	0	0	15
280	5	0	0	0	5
270	-5	0	0	0	-5
260	-15	0	0	0	-15
250	-25	0	10	0	-15
240	-35	0	20	0	-15
230	-45	0	30	0	-15
220	-55	0	40	0	-15

11.4 OPTION STRATEGIES FOR ARBITRAGE

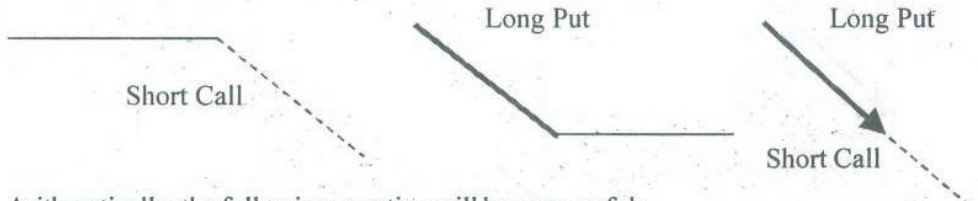
Arbitrage refers to the exploration of mispricing in the market and seeks to generate relatively low risk gains by buying cheap and selling dear simultaneously either in different markets or in different instruments. Arbitrage strategies in derivative markets range from the simple cash and carry arbitrage which was discussed in the Units on Futures to complex strategies involving equity, futures and options.

Any product in the equity, futures, options universe can be bought or sold naturally (i.e., directly in the form that they exist in the market place) or can be crafted synthetically (i.e., by combining other derivative instruments). While equity cannot be synthetically created, the payoffs from equity are similar to that of futures, which can be synthetically generated.

This possibility of synthetic instruments creates a multitude of arbitrage opportunities for traders. First let us discuss how synthetics can be created. The long futures position can be created by combining a long call with a short put. A review of the relevant diagrams will help in understanding this better.



In the same manner, the short futures position can be understood as a combination of the short call and the long put.



Arithmetically, the following equation will be very useful:

Synthetic Futures Price = Strike Price + Call Premium - Put Premium

If Natural Futures Price is more than Synthetic Futures Price, then you will buy the Synthetic (which means Long Call and Short Put) and you will sell the Natural Futures.

Conversely, if Natural Futures Price is less than Synthetic Futures Price, then you will sell the Synthetic (which means Short Call and Long Put) and you will buy the Natural Futures.

Now, let us consider whether the 5000 Call and Put of the Nifty in comparison to Nifty Futures provide an arbitrage opportunity. Relevant prices are:

Futures : 4931
5000 Call : Rs. 95
5000 Put : Rs. 166

If you buy the 5000 Call and sell the 5000 Put, the effective cost comes to 5000 + 95 - 166 = 4929 while Nifty Futures are trading at 4931.

Thus, you could go long the 5000 Call, short the 5000 Put and sell Nifty Futures and you will generate a risk free gain of Rs. 2. This will be clear from the following payoff table.

Net Premium on day of inception (income) : Rs. 71.

Payoff Table:

Expiry Price	*Gain on Equity*	*Payoff on Long 5000 Call*	*Payoff on Short 5000 Put*	*Premium (Net) on day of inception*	*Net Gain / (Loss)*
5500	-569	500	0	71	2
5300	-369	300	0	71	2
5100	-169	100	0	71	2
5000	-69	0	0	71	2
4950	-19	0	-50	71	2
4900	31	0	-100	71	2
4800	131	0	-200	71	2
4700	231	0	-300	71	2
4600	331	0	-400	71	2

At the same point of time, the Nifty Index itself is trading at 4942 (rounded off to the nearest rupee). Thus, if you were to buy the 4900 Call and sell the 4900 Put and arrive at an effective cost of 4929 (as above) and at the same time, sell the Nifty Index (equity basket), you could reap a gain of Rs 13. However, in Indian markets, when you sell equity, you need to provide delivery. Delivery will be possible only if you already own all the stocks in the basket. Alternatively, you could consider selling an Exchange Traded Fund (ETF), provided you have delivery of the ETF. You will also need to ensure that the prices of the ETF match well with that of the underlying index, which is not easy in Indian conditions given the background of not sufficient liquidity in ETFs.

You may find in some situations that the combination of the Call and Put trades above, the futures price of the underlying. If the Call + Put price in the above case were (hypothetically) 4937, you could then Buy Nifty Futures at 4931 and sell the combo (that is, sell the Call and the Put). You would then be able to generate a risk free gain of Rs. 6 under all situations.

Arbitrage between Options

Each combination of Calls and Puts at each strike provides a synthetic. Thus, a 5000 Call and 5000 Put combination has its own price, while the 4900 Call and 4900 Put will have its own price and so own. If you work out the individual combination prices and find that they differ, you could arbitrage between these Calls and Puts.

Let us consider another underlying for an easier example. Lets assume Reliance Industries Futures are quoting at 2150. The Reliance 2100 Call is quoting at Rs. 91 and the 2100 Put is quoting at Rs. 38. The combination price will be 2100 + 91 - 38 = Rs. 2153. Thus, if you buy Reliance Futures and sell the combination (that is Sell the Call and Buy the Put), you will generate a risk free gain of Rs. 3.

Now assume the 2200 Call is quoting at Rs 25 and the 2200 Put is quoting at Rs. 77. The combination price will be 2200 + 25 - 77 = 2148. You could buy this combination (that is Buy the 2200 Call and Sell the 2200 Put) and simultaneously sell Reliance Futures at 2150 and generate a risk free gain of Rs. 2.

Further, you could arbitrage between the 2100 series of options and the 2200 series of options. You could buy the 2200 series (cost 2148) and sell the 2100 series (cost 2153) and generate a risk free gain of Rs. 5. Let us examine in detail how this can be managed.

Trades will be effected as follows:

- Reliance 2200 Long Call : Rs. 25
- Reliance 2200 Short Put : Rs. 77
- Reliance 2100 Short Call : Rs. 91
- Reliance 2200 Long Put : Rs. 38
- Net Premium on day of inception (income) : Rs. 105

Payoff Table:

Expiry Price	*Payoff on Long 2200 Call*	*Payoff on Short 2200 Put*	*Payoff on Short 2100 Call*	*Payoff on Long 2100 Put*	*Net-Premium on day of inception*	*Net Gain / (Loss)*
2300	100	0	-200	0	105	5
2250	50	0	-150	0	105	5
2200	0	0	-100	0	105	5
2150	0	-50	-50	0	105	5
2100	0	-100	0	0	105	5
2050	0	-150	0	50	105	5
2000	0	-200	0	100	105	5
1900	0	-300	0	200	105	5
1800	0	-400	0	300	105	5

You will observe that there is a multitude of arbitrage opportunities available when you combine options, futures and equity. Spotting these opportunities requires skills in understanding the trading screen, speed of spotting the opportunities, interfacing with Excel, good fast software that can help in configuring and throwing up mispricing details and finally speed of execution. As per SEBI regulations, recently trading using computer software programs has been allowed in India. This will facilitate automatic mode of identification of above opportunities and allow you as a trader to spot and execute flawlessly.

11.5 SUMMARY

Each individual option has a certain set of features, risks and rewards. Many times, the payoffs that you seek and the risks that you are prepared to accept may not exactly match with the individual product features. Therefore, you may be required to combine some of these options to generate the level of comfort that is acceptable to you in terms

of risk and that is reasonably satisfying in terms of potential rewards. In this chapter we have tried to explain different Option trading strategies for speculating, hedging, arbitraging and combination strategy.

The unit has explained all possible strategies applicable in different market situations with different investment motives. It will surely help us to hit the market opportunities more strategically using option contracts.

11.6 SELF ASSESSMENT QUESTIONS

1) Using the Nifty data in this Unit above, create a Bull Spread using two calls other than those used in the example.
2) Using the Nifty data in this Unit above, create a Bear Spread using two puts other than those used in the example.
3) Using the Nifty data in this Unit above, create a Bull Ratio Spread using two calls other than those used in the example.
4) Using the Nifty data in this Unit above, create a Bear Ratio Spread using two puts other than those used in the example.
5) Using the Nifty data in this Unit above, create a Long Straddle using a strike other than those used in the example.
6) Using the Nifty data in this Unit above, create a Short Strangle using strikes other than those used in the example.

11.7 FURTHER READINGS

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Solutions to Self Assessment Questions

Option Greek Solutions

Stock price	2142.7	2142.7	2142.7
Strike price	2250	2400	2010
Delta	0.403	0.2411	0.7101
Values of Calls will change by:			
2150	2.94	1.76	5.18
2140	(1.09)	(0.65)	(1.92)
2160	6.97	4.17	12.28
2300	63.39	37.93	111.70

Delta estimates - Calls

Equity price	2142.7		
Less than	More than	Delta known	
1980	1.000	0.710	
2010	Known	Known	0.710
2040	0.710	0.403	
2100	0.710	0.403	
2160	0.710	0.403	
2250	Known	Known	0.403
2280	0.403	0.241	
2370	0.403	0.241	
2400	Known	Known	0.241
2430	0.241	-	

Option Greek Solutions

Stock price	2142.7	2142.7	2142.7
Strike price	2250	2400	2010
Delta	-0.597	-0.7589	-0.2901
Values of Puts will change by:			
2150	(4.36)	(5.54)	(2.12)
2140	1.61	2.05	0.78
2160	(10.33)	(13.13)	(5.02)
2300	(93.91)	(119.37)	(45.63)

Delta estimates - Puts

Equity price	2250		
Less than	More than	Delta known	
1980		(0.290)	
2010	Known	Known	(0.290)
2040	(0.290)	(0.597)	
2100	(0.290)	(0.597)	
2160	(0.290)	(0.597)	
2250	Known	Known	(0.597)
2280	(0.597)	(0.759)	
2370	(0.597)	(0.759)	
2400	Known	Known	(0.759)
2430	(0.759)	(1.000)	

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