Volatility
&
Arbitrage Trading

Options involve risk and are not suitable for everyone. Prior to buying or selling an option, a person must receive a copy of *Characteristics and Risks of Standardized Options*. Copies may be obtained from your broker, one of the exchanges, or The Options Clearing Corporation.

Examples that are covered in this manual or discussed through out the course do not take into consideration commissions and other transaction fees, tax considerations, or margin requirements, which are factors that may affect the economic outcome of any investment strategy.

Any strategies or examples covered in this manual or discussed during the presentation, including actual securities and price data, are strictly for illustrative and educational purposes and are not to be construed as an endorsement, recommendation or solicitation to buy or sell securities of any type.

An investor should review transaction costs, margin requirements, and tax considerations with his broker and tax advisor before entering into any options strategy.

ARBITRAGE - Pricing

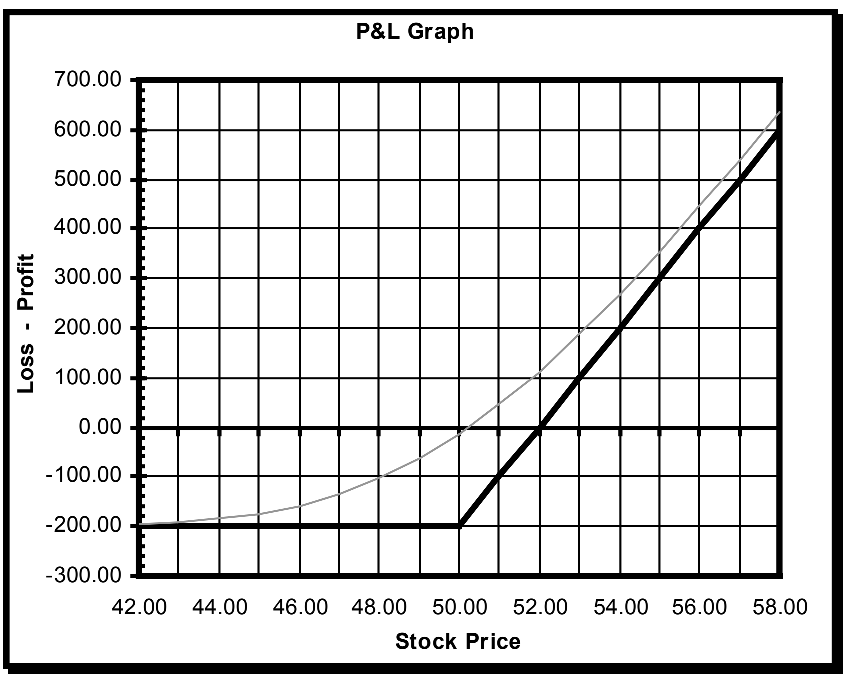
The Building Blocks

By now the reader should be familiar with the risk / reward characteristics of six fundamental positions:

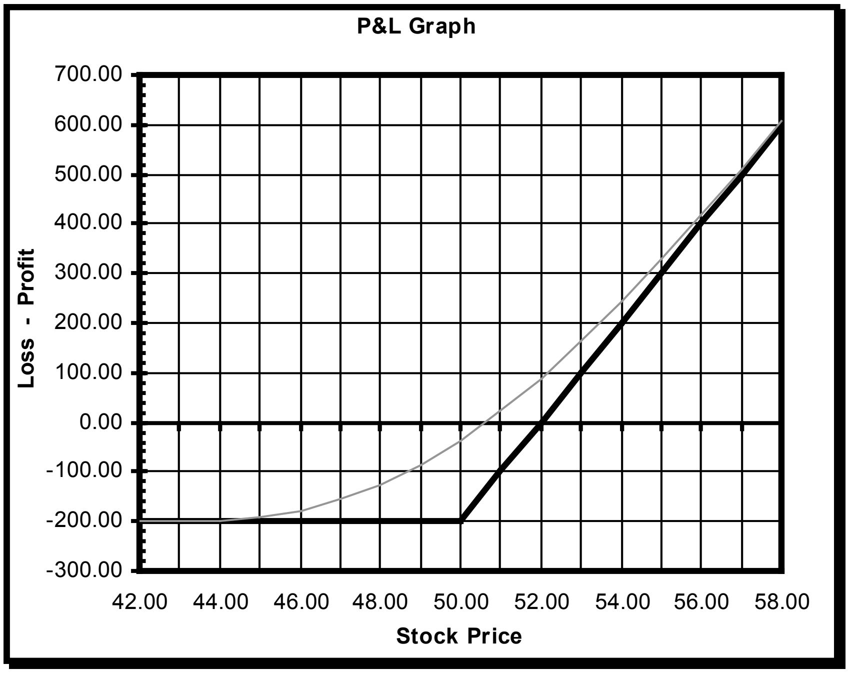
- Long Stock
- Short Stock
- Long Call
- Short Call
- Long Put
- Short Put

Rather than looking at each of the above positions as independent strategies, the reader should now look at them as ***building blocks.*** Used in combination, these building blocks can create a variety of strategies to addresses any market sentiment. The process of combining these building blocks is called the creation of **Synthetics.** For example, assume XYZ is trading at $50 and the July 50 XYZ calls and puts are each trading at $2. Compare the following P/L graphs:

Purchasing 1 July 50 call



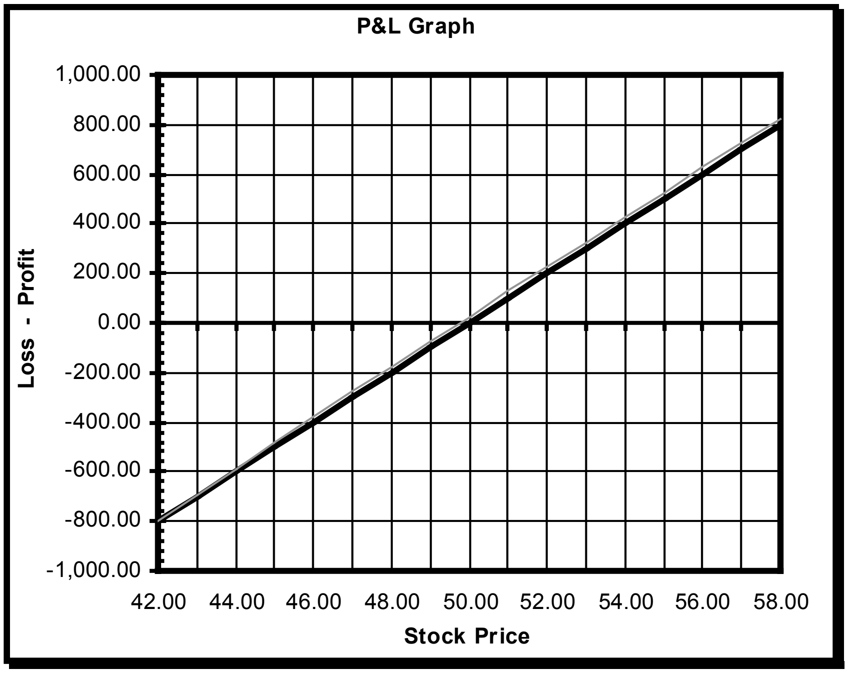
Purchasing 100 shares of stock and 1 July 50 put.



Notice how the graphs are identical; is this a coincidence?

We know that the outright purchase of the call will cost us $200 (2 X100). We also know that purchasing the $50 level put will offset any downside that we have in the stock, therefore if purchase stock for $50/share our p/l graph will be identical to that of a 50 level call. However, the married put transaction is a much bigger capital commitment. The trader might be better off purchasing the call as it will provide him with leverage; he can put the position on many more times for the same amount of capital committed.

Now consider the consequences of purchasing 1 July 50 call and selling 1 July 50 put. Because the prices of the call and put offset each other, there is no net cost to putting on this position. At expiration, if the stock is trading above $50 you will exercise the option and then purchase 100 shares of XYZ at a net cost of $50/share. I the stock closes below $50, the holder of the put will exercise and you will be assigned, thus purchasing 100 shares of stock for $50/share. In either event, you will end up owning 100 shares of XYZ for $50/share.



Importance of Understanding Synthetics

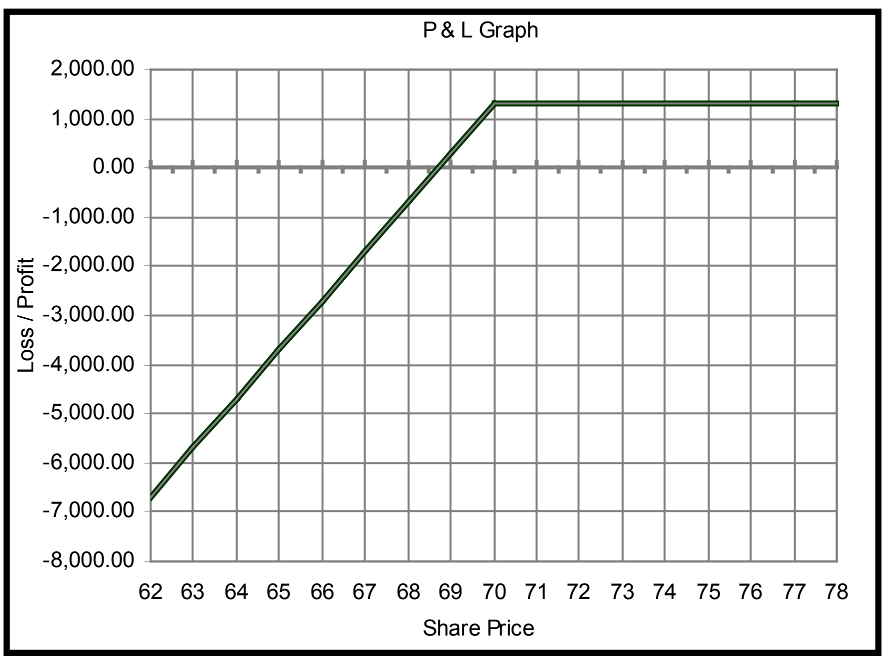
Being able to identify synthetics and understanding the synthetic relationships between all options on a trading screen creates many advantages for the trader. Most notably, this understanding of synthetics provides:

- Techniques for arbitraging building blocks; scalping of options or stock by taking advantage of discrepancies in pricing
- Alternatives for building, or legging, into positions
- Strategies for either buying or selling options that might otherwise be difficult to execute due to market liquidity or slippage
- Techniques for identifying pricing discrepancies, or skews, that exist in the marketplace
- Ways to appraise the true market value of any single building block
- Methods for calculating options pricing
- An understanding of the risk inherent in any market position
- Alternatives for closing out or neutralizing risk in market positions

Practical Applications

Although synthetics are used extensively by professional traders and institutions as vehicles for arbitrage (the first item on the list), it is impractical for most off-floor or Reg.-T traders to attempt to utilize them in this way. Execution and carrying costs, compounded by slippage, makes straightforward arbitrage (I.e. reversals and conversions) extremely difficult. The reader of this text would be better served by focusing on each strategy and synthetic concept introduced as a means for understanding options pricing, factors that may be affecting that pricing, and alternatives for alleviating market risk.

For example, a trader has purchased 1000 shares of MSFT for 68.70 and then that he has eliminated directional risk in a long stock position by selling a call will see the following graph:



The trader would be surprised to see that selling the call has only provided him with a downside *buffer*; it did not alleviate or eliminate his risk. Furthermore, if the trader had an understanding of synthetics he would see that selling calls against a long stock position has created a synthetic short; a position best avoided in a bear market.

Should I Use the Synthetic or the Actual?

Recall the married put example from the previous page; the trader might be better off purchasing the call rather than the married put. This tends to be true in most cases. Exception to this principle may be situations already discussed: skew, volatility, slippage. In these cases it might actually be better to use the synthetic equivalent. Another disadvantage of using the actual option is that it eventually expires. A trader that has a longer-term bullish sentiment on a stock might not want to try purchasing a call every month. Net transaction costs aside, purchasing the stock and put as needed might better meet his objective.

The Six Synthetics

The following examples illustrate the relationship between calls, puts and stock. There are six stock/options combinations, which result in "synthetic positions." Note that in each formula, each call and put has the same strike price and expiration.

Synthetic	Combination
Long Stock	Long Call w/ Short Put
Short Stock	Short Call w/ Long Put
Long Call	Long Put w/ Long Stock
Short Call	Short Put w/ Short Stock
Long Put	Long Call w/ Short Stock
Short Put	Short Call w/ Long Stock

Pricing Synthetics

We now have two different ways to acquire a building block: we can purchase or sell the building block directly, or we can purchase or sell it synthetically. In order to determine the price at which we would be creating the synthetic position, we must have the following pieces of information:

- Current stock price
- Option strike price
- Days to option expiration
- Dividend payment dates and amounts (If applicable)
- Applicable interest rates (Risk Free Rate) to calculate Cost of Carry

Once all of the above variables are determined, including the Cost of Carry, calculating the price of the synthetics then simply becomes a process of using these formulas:

Synthetic Pricing Formulas

- Synthetic Call Price
  (Put Price + Stock Price + Cost to Carry) – Strike Price

- Synthetic Put Price
  (Call Price + Strike Price – Cost to Carry) – Stock Price

- Synthetic Stock Price
  (Call Price – Put Price) + Strike Price

Cost of Carry

Most traders, including professional traders, will borrow (or collect in the case of shorting) money to establish their market positions. The cost of borrowing or receiving money associated with carrying a position is called the Cost of Carry. Specifically, it is the interest paid (received) on a position which debits (credits) a trading account. When stock and/or options are purchased the trader will pay interest to the clearing firm for using their funds; similar to borrowing on margin for retail or Reg. T. traders. When stocks and/or options are sold, the account is credited and the trader will receive interest on the credit balance to his account. Even in instances where the trader may be trading in a cash account, cost of carry must be calculated to reconcile for opportunity cost.

***Formula :* Cost of Carry**

Interest Rate x Strike Price x Days to Expiration / 360

? *Which interest rate should be used to calculate cost of carry?*

Determining Your Cost for the Synthetic – Your % Rate

- Retail and Reg. T traders receive different rates than professional traders; this rate is usually higher than professional broker/dealer rates and varies from brokerage to brokerage. When calculating the price at which you'd be creating a synthetic, use *your specific long or short rate.* When you are executing a trade on margin (borrowing funds), you will use a long rate. Shorting transactions, where you're taking a credit into your account, should be calculated using the short rate. Like a loan vs. a savings account, the brokerage creates a "spread," between borrowing and lending. Consult your brokerages for more information regarding individual interest rates.

Comparing Options Values; Pricing Alignment – Broker Call Rate

- Mispricings, or skews, are more easily spotted by looking at implied volatility information. However, in instances where an off-floor trader is trying to determine the reasons why on-floor traders are making a particular market, the price actual options must be compared to their synthetic equivalents.

- Bids and offers reflected in an options chain are made in the trading pits by traders whose function it is to provide liquidity; hence the name Market Maker. These Market Makers make markets based on *their* transactions cost, including *their* cost of carry. Market making requires a significant amount of capital deployment and risk. To assist in their function of providing liquidity in the market place, market makers are extended special margin privileges, and at a reduced interest rate. Although, these rates vary from one Market Maker to another, they tend to be close to the Broker Call Rate. When calculating synthetics that involve a long cost of carry, add about ½ point to the Broker Call; when calculating a short interest, subtract about ½ point.

✓ ***Example: Cost of Carry***
MSFT is trading @ $52
A trader is trying to calculate the cost of carry for the Jan 50 c/p.

Days to Expiration: 42days.
Broker Call Rate – Long: 6%

- Rate .06 x Strike 50 x 42 /360 = .35\
  The Cost of carrying the options until expiration would be .35.

✓ ***Example: Synthetic vs. Actual***

Compare the prices of the long call and synthetic long call to determine which would be the better purchase.

Stock Price: 52
Interest rate: 6%
Days to expiration: 60
Volatility: 35

CALL	STRIKE	PUT
4.5 – 4.75	MAR 50	1.5 – 1.75

① Cost to Carry is .50 or ½
Calculated as follows: .06 x 50 x 60/360 = .50

② Synthetic Long Call = Long Put w/ Long Stock

③ *Pricing Formula:*
Synthetic Long Call Price =
(Put Price + Stock Price + Cost to Carry) – Strike Price

④ (1.75 + 52 + .50) – 50 = 4.25

The synthetic call is cheaper than the actual call.

Conversion / Reversal

We now know that a synthetic position, when compared to the actual position, has the exact same risk/reward characteristics. This not only allows us to create any position we'd like, it gives us an alternative for locking in gains or neutralizing risk associated with holding any position; we can close out a position by doing the opposite transaction with its synthetic.

- Long the synthetic ⇨ sell the actual position
- Short the synthetic ⇨ buy the actual position

Doing any of the above neutralizes a position; it is no longer subject to directional risk. Changes in the value of the underlying stock will have no effect on a neutralized position. Trading a synthetic with its actual equivalent is called a conversion or a reversal.

- In a conversion, stock is purchased
- In a reversal, stock is sold

Conversion

-Call + Put + Stock + Cost to Carry - Dividend

(*subtract dividend when calculating prices based on disseminated quotes).

Reversal

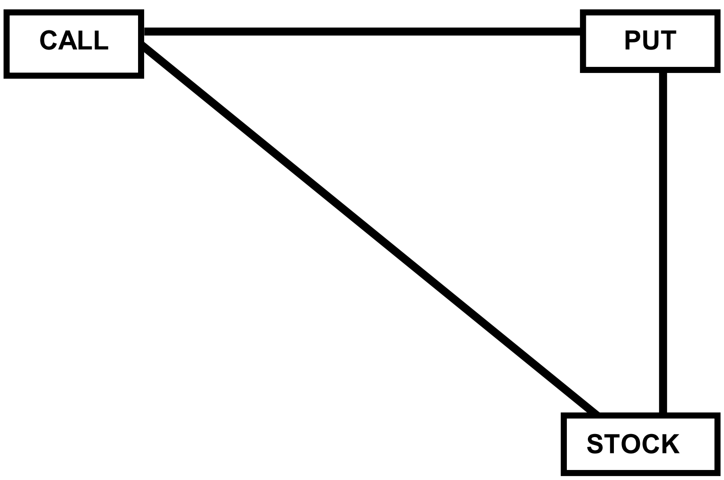
+Call – Put – Stock – Cost to Carry + Dividend

(*add dividend when calculating prices based on disseminated quotes).

The Synthetic Triangle

Putting on a building block synthetically always involves a combination of the other building blocks. In the case of calls, this means using puts and stock. In the case of puts, it means using calls and stock; and, in the case of stock, it means using puts and calls. The rule is that when puts and stock are combined, they are always both bought (or both sold). When calls are combined with either puts or stock, if the call is purchased then the other leg is sold and vice versa.

The Synthetic Triangle is a useful mnemonic aid:



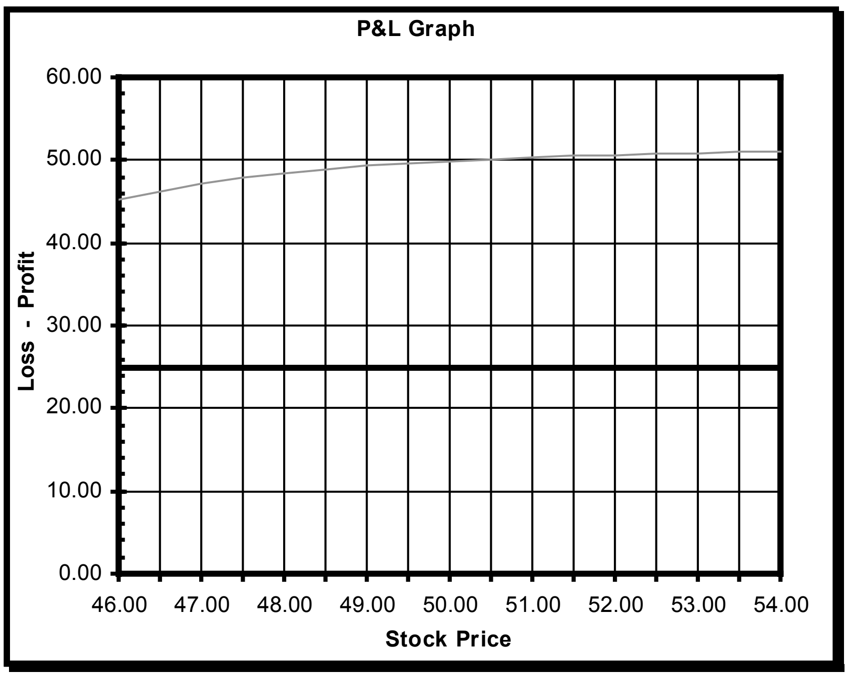
- One corner is a building block.
- Completion of any two corners of the triangle is a Synthetic.
- Completion of all three sides is a Reversal or Conversion.

Synthetic Triangle Matrix

Synthetic (Formula)	Closing Synthetic	Reversal / Conversion
+ Cn = + P + S	- C	Conversion
+ Pn = + C - S	- P	Reversal
- Cn = - P - S	+ C	Reversal
- Pn = - C + S	+ P	Conversion
+ Sn = + C - P	- S	Reversal
- Sn = - C + P	+ S	Conversion

✓ *Example: Reversal*

MSFT $50.25 (6%) (31 exp.)
(Call 1.50 + Strike 50) = 51.50 Purchase Price
(Put 1.50 + Stock 50.25) = 51.75 Sale Price
.25 Credit
.25 Short Interest
.50 Total



✓ *Example: Actual vs. Synthetic*

A trader has created a married put position; originally purchasing MSFT for $68, and the Feb 65 put for 1.60. The stock is now trading at $69.70; the put at 1.05. In weighing his alternatives for liquidating the position he is has two choices:

Alternative A: Sell the put and the stock at market prices

Alternative B: Close the position by treating the married put as a call; selling the actual call against it.

Let's weigh all factors relevant to this particular situation:

- Original stock purchase: 1000 shares of MSFT for 68
- Original put purchase: Long 10 February 65 puts for 1.60
- Current stock price: 69.70
- Current put bid price: 1.05
- Current Feb 65 call bid price: 6.10
- Days to Exp: 30
- The trader's Long Rate: 2.5%

Choosing Alternative A yields the following results:

1.70 (stock profit) - .55 (put loss) = 1.15 x 1000 = $ 1150 profit

Note that the 1.25 profit does not including two transaction costs (stock and options).

Choosing Alternative B yields the following results:

The position is equivalent to a long call purchased for 4.73; calculated as follows:

1. ***Cost of carry:***

Interest Rate x Strike Price x Days to Expiration / 360

2.5% x 65 x 30 / 365 = .13

2. ***The synthetic call price***

(Put Price + Stock Price + Cost to Carry) – Strike Price

(1.60 + 68 + .13) – 65 = 4.73

3. Selling the actual to close out the synthetic
6.10 (actual call) – 4.73 (synthetic call) = 1.37 x 1000 = $1370 profit

Note that closing out the position in this manner only requires one transaction cost – the short call commission.

4. Conclusion:
At a minimum (commissions not included), Alternative B is more profitable by $220.

✓ ***Example: Synthetic Long Stock into a Reversal***

A trader has created a synthetic long stock position; buying calls and selling puts at the same strike price. The stock has risen in price and the trader wishes to close out his position. What are his alternatives? As in the previous case study, the trader has two choices: liquidating each component of his position at market prices, or closing the position out synthetically.

With XYZ Trading @$50
Original call position: long 10 Jul 50 calls for 3.80
Original put position: short 10 Jul 50 puts @ 3.20

With XYZ Trading @ 52.50
Current call bid price: 4.80
Current put ask price: 2.30

Days to expiration: 92
Current Broker Call Rate: 5.75%

Alternative A: Liquidate at market prices:

1.00 (call profit) + .90 (put profit) = 1.90 x 1000 = $1900 profit

Alternative B: Synthetically sell stock:

1. The Synthetic Stock Price
(Call Price – Put Price) + Strike Price
(3.80 – 3.20) + 50 = 50.60

2. Selling actual stock against the position yields a profit of:

52.50 (actual stock price) - 50.60 (synthetic stock price)=
1.90 x 1000 = $1900 profit

3. But don't forget: the trader has just shorted stock;

He will be receiving short interest over the life of the position! If his short rate is Broker Call (in this case 5.75%) minus ½ point, he will receive short stock interest of:

Interest Rate x Strike Price x Days to Expiration / 360 = Cost of Carry

5.25% x 50 x 92 / 360 = .67

.67 x 1000 (number of shares short) = $670

- Shorting the stock adds an additional $670 to the profit (.67 x 1000); not to mention that only one transaction charge is incurred. Closing the position by legging into a reversal yields a net profit of $2570!

Reversal Conversion Risks

Interest Rate Changes

Changes in holding costs (cost of carry) can radically change the profit potential of any options position, especially in the case of arbitrage strategy. As we discussed in the Market Compass Risk Management course, a rise in interest rates causes call prices to rise and put prices to fall (the same in true in reverse, with a fall in interest rates). This will undoubtedly affect any reversal or conversion. However, because interest rates rarely change in 1-point increments over a short period of time, it is considered to be a small risk factor. Interest rate risk will, however, affect reversals and conversions in LEAPS.

✓ ***Example: Interest Rate Risk***

XYZ is trading $48.90
Days to Expiration: 363
Short Rate: 5.75%

Long 10 LEAP Jan 45 call for 7.60
Sell 1000 Shares XYZ @ 48.90
Sell 10 LEAP Jan 45 put @ 2.00

1. Cost of carry:

   Interest Rate x Strike Price x Days to Expiration / 360

   5.75% x 45 x 363 / 360 = 2.60

2. This can be priced out in several ways; let's use the synthetic put formula:

   (Call Price + Strike Price – Cost to Carry) – Stock Price

   7.60 + 45 – 2.60 – 48.90 = 1.10

3. Collecting 2.60 from holding short stock over one year has allowed us to create a synthetic long put for 1.10; we sold the actual put @ 2.00; collecting a net profit of $900 (.90 x 1000) if we hold the position to expiration.

4. If interest rates drop to 3.25% in on year, we actually collect less for our short stock, thus creating a higher price for the synthetic long put:

   3.25% x 45 x 363/360 = 1.47

5. Based on the adjusted rate, our synthetic put was purchased for 2.23, making the reversal a losing transaction by .03!

PIN Risk

One side of the reversal or conversion is a short contract. This creates uncertainty when the stock closes at the short strike (PINS) at Expiration. This problem can be easily remedied by purchasing in the short contract for .05 or .25 on the final day of trading. Although these options are worthless, you are removing any uncertainty of being long or short stock on the Monday following Expiration; the assumption is that the short contract was sold at a much higher price upon legging into the reversal or conversion.

Dividend Risk

ABC is trading 114.25
Days to Expiration: 30

Short Rate 5%

Long 10 Feb 110 call for 6.30
Short 10 Feb 110 put 2.20
Sell 1000 Shares of ABC @ 114.60

1. Cost of carry:
   Interest Rate x Strike Price x Days to Expiration / 360

   5.00% x 110 x 30 / 360 = .45

2. This can be priced out in several ways; let's use the synthetic stock formula:

   (Call Price – Put Price) + Strike Price

   6.80 –2.20 + 110 = 114.60

We synthetically purchased stock for 114.60; but if we complete the reversal we actually make an additional .45 from the short stock interest, for a total profit of 450 (.45 x 1000).

3. What if ABC announced a special one-time dividend of .50?

   The shorter of stock (the reversal) will have to pay the dividend amount; this amount is added to the transaction cost. In this case the position becomes a –$50 loser (-.05 x 1000).

The BOX

Boxes can be used in several ways:

- **On a less practical basis**
  As a way to offset risk in a reversal or conversion

- **More Practical**
  An alternative for legging out of synthetic long stocks or closing out a spread &

  As tool for pricing the fair value of a given spread.

  Let's look at each of the above in turn:

Concerned With Stock Component

You've initiated a conversion or reversal and are concerned with risk associated with the stock portion of the equation; a possibility of a special dividend. Your position is as follows:

Long 10 Feb 50 calls
Short 10 Feb 50 puts
Short 1000 shares of stock

This can be eliminated by executing by executing a taking out the stock part of the equation. You can accomplish this by

Doing a Three Way:
Substitute short stock for short 10 deep ITM calls or long 10 deep ITM puts; now the position might look like:

Long 10 Feb 50 calls
Long 10 Feb 50 puts
Short 10 Deep ITM calls (or Long 10 Deep ITM puts)

The problem with this scenario is if the stock moves strongly in the direction of the option that you've substituted for stock, it acts less like stock.

Get Rid of Stock By Reversal or Conversion

An alternative is to execute the opposite transaction at a different strike. For example, the original position (a reversal) can be offset by doing a conversion at a different strike. Stock is shorted in one transaction, and repurchased in the other, leaving synthetic long stock at one strike, and synthetic short at another. Your position might now look like this:

Long 10 Feb 50 calls
Short 10 Feb 50 puts

Short 10 Feb 55 calls
Long 10 Feb 55 puts

The question is then, how much is the box worth?

Computing the value of the Box:

The full value of the Box at Expiration is the difference between the strike prices.

The fair value of the Box at any point in time is determined by taking the value of the box at Expiration minus the carrying costs until Expiration. For example a 5-point box that expires in 9 months with carrying costs of 6% is worth:

5 – (5 x 9/12 x 6%) = 5 - .225 = 4.78

Trading firms may use as a way to borrow money at a given interest rates by selling the box at its current fair value. For instance, in the above example, the trader selling the 5-point box @ 4.78 is essentially borrowing 4.78 for 9 months at an interest rate of 6%.

Cash rich firms may lend money at a given interest rate by buying the box below at its current fair market value. Again, assuming that the fair value of the 5 box is 4.78, the buyer of the box is purchasing (giving or lending money to the seller) an instrument that will eventually pay out a .22 credit at Expiration, when the box goes to its full value of 5. This strategy only makes sense if the firm buying the box can do the trade for a reasonable amount of edge; being able to purchase the box below its fair market value. Being able to do so is similar to lending money at a higher interest rate than could otherwise be gained in the marketplace by putting cash into bonds or money-market instruments.

Long the box: Syn Long stock at the low strike, syn. short stock at the high strike

Short the box: syn. short stock at the low strike, syn long stock at the high strike

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As an alternative to closing a spread

You've executed a call bull spread and are having difficulty liquidating. You can use the box to close the position out synthetically.

Look at the box in our example, it's essentially these two spreads:

Feb 50/55 bull call spread
Feb 50/55 bear put spread

Assuming that they were traded for good prices, the two positions locks in a gain. This is explained by looking at them synthetically. Suppose we purchase the bull call spread for $3.00. The P/L graph this position will look exactly like selling the put spread for $2.00.

- *The value of the call and put spreads between any two strikes should not exceed the difference between the strike prices*.

If the above rule is broken, arbitrageurs would enter the market place and synthetically "scalp" the spreads since:

- *Buying a call spread is the same as selling a put spread at the same strikes and*

- *Selling a call spread is the same as buying the put spread at the same strikes*

Therefore if we buy the Feb 50/55 call spread, we can hedge it by *selling* the Feb 50/55 put spread.

An Alternative for closing a Synthetic Long Stock

The Box (see complex positions) is a long stock combo and a short stock combo, which cancel each other out. This is an alternative to the reversal. Once the stock has gained in value the ATM combo is sold (short synthetic stock). The profit is calculated by subtracting the short combo synthetic's price from the long combo synthetic price. If the combos where both traded for even then the initial combo price is the equivalent of purchasing stock for $50 and the second short combo is the equivalent of selling stock for $55. Creating a net profit of $5.

Position	Call Contracts	Strike	Put Contracts	Position
Initial Long Combo	+1	ITM (50)	-1	Initial Long Combo
Second Short Combo	-1	ATM (55)	+1	Second Short Combo
Stock Position	N/A			

To determine fair value of any spread

When pricing Boxes as spreads, the prices of the spreads must add up to the current value (includes carrying cost) of the box. In our example, if the Feb 50/55 call bull spread is trading for $3, the Feb 50/55 put spread should be trading for 1.78.

If a trader can buy the put spread for 1.50 and also buy the call spread at 3, he would be paying a total of 4.50 for something that is worth 4.78.

If the trader can sell the call spread for 3, and then sell the put spread at 2.10. he would receiving 5.10 for something that is worth 4.78.

Volatility

Review:
Theta & Vega

Theta (Time Decay)

Unlike stocks, an option that is listed for trading today will disappear at some point in the future. The experienced options trader understands that despite the many advantages, options have limitations; they are a wasting asset. As time move forward, all options decay, although not at the same rate. The following illustrates the affect of time on the value of an option over a period of one day;

✓ ***Example***
XYZ is trading @ $45.
XYZ Jul 45c is trading @ 1.25
Trading sheets indicate that the option has a .01 Θ.

1. Because options contracts usually represent 100 shares, multiplying .01 (the Theta) by 100 will give the theoretical dollar decay per option contract over one day.

2. In this example the option contract would decay $1.00/day.

3. On Thursday, an investor purchases one XYZ Jul 45c and $125 is debited from her account. The investment is deemed to be worth that amount on that day.

4. On Friday, the stock has not moved. The investor's $125 investment will now theoretically be worth $124, although this may not yet be reflected in the option's price (see example B, below).

5. On Monday, the stock is still @ $45 and volatilities are unchanged. The investor's $125 investment will now theoretically be worth only $121.

✓ ***Example***
CQE is trading @ $51.50
CQE May 50c is trading @ 3.25
Pricing models indicate that the option has a .02 Θ.

1. On Thursday, an investor purchases 1 CQE May 50 c @ 3.25 and $325 is debited from her account.

2. On Friday, CQE is still @ $51.50 & volatilities are unchanged.

3. The daily decay is may be unnoticeable on a day-to-day basis.

4. The investor's $325 investment is now theoretically worth only $323.

5. Although the option theoretically decays at a rate of .02/day, this may not yet be reflected in the disseminated market prices.

☛ *Listed options currently trade in .05 increments.*

6. Although the option has in fact decayed .02 and is only theoretically worth 3.23, Market Makers will only make a market to the nearest .05. Therefore, the quoted price of the option might still be 3.25.

7. On Monday, volatilities are unchanged and CQE is still trading @ $51.50.

8. Although all other variables are unchanged, the Θ is now noticeable. Four days have elapsed since the calls were purchased. Therefore, .08 cents of value will have come out of the options.
   4 X .02 Θ = .08 Θ

9. Market Makers will give the CQE May 50c a value to the nearest increment of .05.

10. The disseminated market for the CQE May 50c might be: 3.05 – 3.15

Rate of Decay

In-the-money (ITM) options are made up of mostly intrinsic value and, therefore, usually have very little decay. The amount of premium attached to an *ITM* options will determine its actual rate of decay.

At-the-money (ATM) options may or may not have any intrinsic value. None-the-less, they have the greatest amount of premium will, therefore, have the greatest amount of decay.

Out-of-the-money (OTM) options have no intrinsic value. Although their entire price is made up of premium, this premium amount is usually smaller on a dollar basis when compared to *ATM* options. *OTM* options decay at a rate similar to *ITM* options.

The following table lists the price, intrinsic value and premium amount for each call option with the XYZ trading @ $46. Note the premium attached to each option. The amount of premium that has been attached to an option, the decay will vary accordingly.

XYZ @ $46					
Month/Strike	Call / Put	Price	Intrinsic	Premium	Θ
MAR 40	Call	7.125	6.00	1.125	.011
MAR 45	Call	3.25	1.00	2.25	.032
MAR 50	Call	1.50	0.00	1.50	.015

In the above example, we can calculate that the MAR 45c will be worth $3 in roughly 8 days.

(Call price 3.25 – target price 3 = .25)
(.25 / theta .032 = 7.8 days)

Net Premiums

Market Makers are master volatility traders and spreaders. Positions and spreads are established by comparing premiums of various options. In assessing the value of any spread or position, they go beyond calculating its daily Θ. Market Makers want to know the amount of *premium* that is in the *entire* position. This calculation is called the Net Premium. The Net Premium is NOT the net amount of *capital* that has been invested in a position; it is the amount of extrinsic value that is in a position.

The Net Premium is weighed relative to the amount of decay that takes place on a daily basis. A Net Premium calculation shows the two things. First, it tells the Market Maker how much capital has been put into a position and how much of it is intrinsic value at a given stock price, with a given number of days until expiration. Second, the Net Premium calculation will show how much of that position's capital wasting asset. This is used to gauge the position's assumed profitability compared to the amount of capital expended. The Net Premium calculation is sometimes called the "premium over parody." The following table illustrates net premiums;

XYX @ 45.25 w/ 41 days until Expiration						
Strike	Call/Put	Last Sale	Intrinsic	Premium	#Contracts	Net Premium
Jul 45	C	5.90	.25	5.65	10	5650
Jul 45	P	5.60	.00	5.60	10	5600
Jul 50	C	2.90	.00	2.90	-10	2900
Total						8350

An examination of the above position reveals the following:

- **Total Capital:** $8,600 (the amount spent on the position).
- **Total Premium:** $8350 (the amount over intrinsic value).
- $8350 the amount considered to be at risk at this time.
- 97% of the position is premium (a wasting asset)

The holder of this position must now weigh the risk ($8350) with the likelihood that the stock will move enough (in this case up or down, away from 45) to justify the amount of premium paid for the position.

Vega

Recall that Vega is the measurement of the change of an option's value over a one point change in the volatility assumption. The buyer of a $5 option at a 67 volatility would benefit form a rise in volatility; if volatility goes up, the option increases in price. Keep in mind, however, that at Expiration all options go to intrinsic value or zero. If the $5 that was paid for the option is all extrinsic value, the option will go to zero. Hence the relationship between theta and vega: vega is juice (extrinsic value), and theta is the wasting away of that juice. Often times rises in volatility only make-up for losses due to theta. Novice traders that do not have an understanding of this very important concept will often find themselves losing money; they are "winning" from volatility, losing on a dollar-to-dollar basis.
When choosing the amount of extrinsic value to buy or sell, carefully consider which strike to purchase; different options at different strike prices will be affected differently by vega. This is a result of the varying amount of premiums in different options. Depending on time to expiration and the option's strike price, changes in volatility may or may not change an option's value.

ITM
(Low Vega sensitivity)
ITM options generally have a vega that is lower than the ATM options. This is because of the low premiums and high probability that they will finish ITM at expiration.

ATM
(High K sensitivity)
ATM options generally have the highest vega as these options have the greatest amount of premium. ATM options are also the most unpredictable; they can go from ITM to OTM from one stock tick to the next

OTM
(Low Vega sensitivity – near term)
(High Vega sensitivity – far term)
OTM options are very unusual. They are hardest options to price and their **Δ** are not always theoretically accurate, they do not react to time decay as other options do.

When an option is near expiration (front month options) the vega is similar to ITM vega.

Far-term options (6 months – LEAPS) tend to have a vega skew, especially the calls, as investors generally believe stocks have a greater chance of increasing in value then they do of decreasing in value. Part of the equation has to do with the increased probability that these options will finish ITM.

The OTM far-term LEAP calls tend to be skewed higher because of the interest equation. Interest is calculated into the option prices since you are diverting payments on long equity the stock should by (regardless of movement) trading at an increased priced calculated by the stock price + interest for that specific time period. Since stocks are skewed to the upside, so is the far-term call vega.

Vega & Time

Options that have a greater amount of time until expiration will have a higher vega. More until expiration increases the likelihood that the stock will move, thus increasing an option's sensitivity to changes in volatility.

The higher the volatility the great the risk to the seller of the options, as these options have a greater chance of finishing ITM at expiration.

Leaps have the highest vega and therefore the largest vega risk. A one-point move in volatility will affect the Leaps prices more so then the near-term months.

Types of Volatility

Types of Volatility

The ideal volatility input into a pricing model would be the one most closely reflecting the actual, future movement of the underlying. Let us refer to this as the future volatility. Absent a crystal ball, however, future volatility is unknowable. Therefore, most traders turn, for good measure, to the performance of the stock in the past, the historical volatility. Next, the trader will factor in to the historical volatility, any special circumstances anticipated prior to expiration. This allows the trader to generate a forecast volatility, which is essentially the trader's best guess at future volatility. Armed with his or her forecast volatility, the trader is then able to draw a comparison with the volatility indicated by the market price of the option, the volatility determined by this market is referred to as the implied volatility. Let us examine these measures more closely.

Volatility Pricing Models

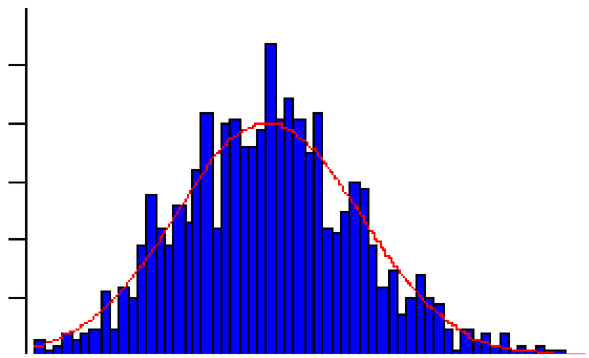
Volatility is a significant factor in determining an option's price. Theoretical pricing using pricing models is sensitive to small changes in volatility inputs.
Increased volatility translates into higher option prices, with the reverse being true for decreased volatility

That said, a rigorous examination of the detailed mathematics of the various pricing models is beyond the scope of this book and, in the judgment of the authors, this knowledge is unnecessary for gaining useful mastery of the concepts involved. Some familiarity with these models is useful. We will now turn our attention then to the following issues:

- How pricing models account for price movement in the underlying
- How volatility is expressed and what that expression represents
- How the models use that information to establish an option's theoretical price

Pricing Models and Price Movement

Pricing models generally make the assumption that consecutive price changes are random; the next price the underlying trades will either be unchanged, up or down, without any bias as to direction. If we were to graph where prices might be as of a future date (along the x or horizontal axis), versus the likelihood of the stock trading at each of those possible prices (along the y or vertical axis), we would come up with a bell-shaped curve, or normal distribution curve illustrated below.



Normal distribution is a probability distribution that describes the behavior of many events and is used by pricing models to describe the probable occurrences of stock price fluctuations. *[Note: The pricing models actually tend to use a slightly skewed variation of normal distribution called lognormal distribution. Use of the normal distribution herein will simplify the discussion while still conveying the essential concepts and relationships involved between pricing models and volatility.]* The normal distribution or bell shaped curve is symmetrical about its mean price, and has the property that the values, which are most likely to occur, are closer to the mean value that those less likely to occur.

A normal distribution is described by two characteristics:

- Its **mean;** and
- Its **standard deviation**

Mean

The arithmetic mean, generally referred to as the average, is the sum of all of the occurrences divided by the number of occurrences. For example, given the following XYZ closing prices over a two-week period:

Date:	12/3	12/4	12/5	12/6	12/7	12/10	12/11	12/12	12/13	12/14	12/17	12/18
Closing Price:	48	50.75	51	51.25	50.75	51.50	52	52.75	51.25	50.75	51.25	54

= 615.25 / 12 = **51.27 (the mean).**

The mean would be 51.27. Note that most of the closing prices (data) are close to the mean price (51.27), while there are only a few at one extreme or the other (48 or 54). This bunching of most likely outcomes near the mean is an important characteristic of a normal distribution, and is measured by each distribution's standard deviation.

Standard deviation

Standard deviation, which can also be described as "the mean of the mean", is a statistic that describes mathematically how potential outcomes are distributed from the mean of a normal distribution. By definition:

- approximately 68.3% of all outcomes will be within ± 1 standard deviation from the mean;
- approximately 95.4% of all outcomes will fall within ± 2 standard deviations from the mean; and
- approximately 99.7% of all outcomes will fall within ± 3 standard deviations from the mean.

For example, if the price distribution of Stock XYZ were described by a normal distribution with a mean of 20 and a standard deviation of 3, this would be characterized by:

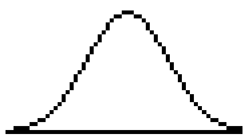
- A bell-shaped curve centered at 20;
- 68.3% of all outcomes would fall within the range of 17 - 23 ((20 – 3) to (20 + 3));
- 95.4% of all outcomes would fall within the range of 14 – 26 ((20 – 6) to (20 + 6)); and
- 99.7% of all outcomes would fall within the range of 11 – 29 ((20 – 9) to (20 + 9).

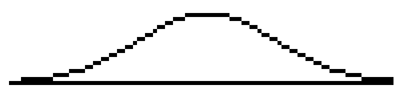
While if the price distribution of Stock ABC is described by a normal distribution with a mean of 20 and a standard deviation of 5, this would be characterized by:

a. a bell-shaped curve centered at 20;
b. 68.3% of all outcomes would fall within the range of 15 - 25;
c. 95.4% of all outcomes would fall within the range of 10 – 30; and
d. 99.7% of all outcomes would fall within the range of 5 – 35.

The normal distribution graphs of XYZ and ABC would look something like the following:

The height of the normal distribution at any stock price





measures the relative probability, or frequency, that the stock will be trading at that value at the time in question. Therefore, the

relative "flatness" of ABC's normal distribution compared to that of XYZ means that it is much more likely that XYZ will be trading at one of the possible prices near the man than ABC. Conversely, ABC is much more likely to reach prices away from the mean than is XYZ. Thus, ABC has a tendency to move much farther in price much faster than XYZ, making it a more volatile stock. A higher standard deviation translates into a more volatile stock.

Historical (stock) Volatility

As its name implies, is a measure of actual price changes in an underlying issue over a specific period in the past. Through the statistical analysis of historical data, a trader attempts to predict the future volatility of the underlying. It must be noted, however, that there is not just one measure of historic volatility; historic volatility can be calculated over any period you choose. The trader will have to decide what period(s) should be analyzed; a week, a month, or a year. In addition, he or she must also ask which price comparisons volatility assessments should be based upon: closing price to closing price; opening price to opening price; or the daily high/low range. Different price comparisons will calculate different volatilities. Generally, the trader calculates historical volatilities over both a short-term (1-2 months) and a longer term and then the decides how to weight each calculation in forecasting future volatility.

Calculating Historical Volatility

Let's assume that Stock XYZ is currently trading at $100, interest rates are at 6%, and we are told that XYZ's volatility is 36. What do these numbers tell us? The number 36 is the standard deviation of the normal price distribution expected one year from today. It is expressed as a percentage of the mean price also as measured a year from today. That mean price represents the stock price that will be necessary if the investor is to break-even when the net cost of financing the purchase of the stock for a year is factored in.

For example, under our current assumptions, it would cost $6 in interest charges to finance the full cost of the $100 purchase price at 6% for one year. If this stock did not pay dividends, the stock would need to be trading at $106 one year from now in order to compensate for the $6 of interest charges incurred. [Note: *If the stock paid a dividend, the $6 interest charge would need to be reduced by the amount of dividends to be received over the next year. For example, if the stock paid dividends totaling $2.50 during the course of the year, the break-even and thus the mean price of the distribution would be $103.50 ($100 plus $6 interest to be paid minus $2.50 dividend to be received)].* The volatility of 36 would mean that the prices one year from now should fall in a normal distribution with a mean of $106 and a standard deviation of 38.16(36% of 106). This would mean that approximately 66% of the time, the price of the stock one year from now would fall within the range of 68-144

(106 ± 38), and approximately 95% of the time within the range of 30-182 (106 ± 76).

Although this helps us understand volatility in relation to stock, it is important to keep in mind that when dealing with options, it is not always practical to use a 12-month period when making volatility assumptions. If an option has 3 months until expiration, it is not particularly helpful to know the expected price ranges 12 months from now. Is it possible then, to determine what a 40 annual volatility translates to in predicted stock price movement over a *shorter* period?

Yes. We can use the following formula to compute volatility for a shorter period of time (daily, weekly, monthly, etc): divide the annual volatility by the square root of the number of trading periods in a year. For example, if XYZ is trading at 100 with an annual volatility of 10% and we want to determine its daily volatility, we need to divide the annual volatility (10%) by the square root of the number of trading periods in a year (256). The square root of the number of trading days in one year is 16 (16 x 16 = 256. There is no trading on weekends or holidays therefore they do not apply as prices cannot change on these days). Now we divide 10% by 16 = 5/8%, at which point we can conclude that the daily standard deviation for a one day period is 5/8% X 100 (XYZ's price) = .625. XYZ is expected to move within a range of .625 +/- two trading days out of three, 1.25 +/- 19 trading days out of 20, and more than 1.25 +/- only one day out of twenty trading days.

A comparison is made between a stock's Volatility Number and the implied volatilities in the market place (see the "Implied Volatility" and "Theoretical Volatility" section of this workbook).

To calculate volatility over time the following formulas are used:

✓ ***To Calculate for Daily Volatility***

$$\text{Daily Volatility} = \frac{\text{Annual Stock Volatility}}{\text{Square root of } 256^{*}\ (16)}$$

(* Excludes holidays and weekends)

✓ ***To Calculate for Weekly Volatility***

$$\text{Weekly Volatility} = \frac{\text{Annual Stock Volatility}}{\text{Square root of } 52\ (7.211)}$$

✓ ***To Calculate for Monthly Volatility***

$$\text{Monthly Volatility} = \frac{\text{Annual Stock Volatility}}{\text{Square root of } 12\ (3.464)}$$

✓ *To Calculate Standard Deviation of any time frame:*

Take the stock price and multiply it by the volatility number (expressed as a percentage) that has been determined for that period.

Example:
XYZ is trading @ $35.
Its Annual Stock Volatility is 40
Daily Volatility: .025 (40annul vol. / 16 = 2.5% or .025)
Daily Standard Deviation: $.87 (35 stock price X .025 daily vol.)
XYZ should move .87 from the previous day's close 68% of the time.

- *This does not mean the stock <u>will</u> move! Remember it's only 68% chance!*

Practical Application of Historical Volatility

As mentioned above, Market Makers use stock volatility to assess the risk or reward potential of a position. Market Makers will sometimes review a stock's volatility by calculating the daily, monthly or weekly volatility. This will allow them to predict likely stock movement over any time frame that they choose.

Because Historical Volatility is the measurement of a stock's volatility over a certain period of time, Market Makers choose their time frame carefully. This is because measurements of different time frames will yield different Stock Volatility Numbers! Most traders approach Stock Volatility calculations in the following manner:

The historical time frame that is relevant to the life of an option is used. For example, the purchaser of an XYZ 3-month option will look at Stock Volatility on a 3-month basis. Looking at data for one year or more may yield a volatility number that is either too high or too low.

- *Remember: as more numbers are fed into a calculation, the greater the range of results.*

In calculating volatility, Market Makers usually data from several time frames: 1 month, 3 month, 6 month, and 12 month volatilities are used.

Implied volatility

Implied volatility is the marketplace's assessment of the future volatility of the underlying. This implied volatility measures the level of volatility that is implicitly assumed within the current market price of the option. Implied volatility could also be considered a measure of the market consensus of expected volatility of the underlying stock. Implied volatility can be derived from running a pricing model backwards. In other words, the trader may enter the current market price of an option into a pricing model along with the underlying price, strike price, time to expiration, interest rate and any applicable dividends. When s/he then runs the model, it will solve for the unknown - the volatility that the marketplace is using to price the option. This number represents the **implied volatility**.

Implied volatility may or may not be equal to the future volatility assumption of an underlying. When the volatility assumption that we are using to determine the theoretical value of an option differs for the volatility that marketplace is using to determine the value of an option we are able to enter all the data into the pricing, as we have done below, with the exclusion of the volatility assumption and entering the theoretical value that you have previously solved for, to determine what volatility the marketplace is giving the option.

✓ ***Example:***
XYZ is trading @ $42
Mar 40 calls are trading 5.85 in the marketplace

Inputs to determine *theoretical value*	
Underlying Price	42
Volatility Assumption	40
Interest Rate	6%
Dividend	0
Strike Price	40
Option Price	Unknown
Days to Expiration	91
Out Put (Market Vol.)	55

Inputs to determine *implied volatility*	
Underlying Price	42
Volatility	Unknown
Interest Rate	6%
Dividend	0
Strike Price	40
Option Price	
Days to Expiration	91
Out Put (Theo. Value)	4.75

In the above example, we see that the marketplace has placed a higher value on the March 40 call than the trader who generated an informed volatility prediction based on current movement in the underlying, historical volatility and an expectation of market sentiment. What explains this divergence? Generally, this disparity anticipation of news which might in a large move in the price of the underlying, whether that move is up or down.

Factors Influencing Implied Volatility

When assessing the market's implied volatility, it is important to realize how variations in supply and demand may also require market makers to change the volatility variable in order to ensure liquid markets. In these circumstances, the customer brings their anticipation of a change in price to the market, she or he buys or sells accordingly, and the market maker recognizes the importance of responding to or capitalizing of these changes. The market maker is not changing volatility on an option contract based on his expectation of a news event, but he is changing volatility based on the public's expectation of an event affecting they anticipate will effect the value of an option.

Depending upon how a particular option exchange is structured, market makers and/or a specialist are charged with providing liquidity to the markets. For each option on each stock they make the market for, these floor traders establish two prices: the bid, which is the price at which they will purchase that option; and the offer (sometimes referred to as the **ask**, or **asking price**), which is the price at which they will sell that option. The difference between the bid and offer prices, known as the **spread**, is limited in size by regulation. When supply and demand for options are in balance, that is there are approximately as many buyers as sellers, market makers act as middlemen, collecting the spread as they buy at the bid price from the sellers and sell at the offer price to the buyers. At these times, they collect their profit without assuming much risk. However, these conditions are infrequent due to a typically one-sided order flow in option markets. Usually most customers all want to either purchase options or sell options. If all the customers are purchasing options, the option market makers are selling, this is referred to as one-sided order flow. In a two-sided order, flow situation customers are buying *and* selling. Two sided order flow is generally more common in larger issues that have greater volume. Again, for most option market makers, however, two-sided order flow is rare.

Given a typically one-sided market, market makers are obligated, albeit reluctantly, to create the balance. In other words, when there are more sellers, the market makers become buyers. Not only then are market makers like a merchant with an inventory of products that aren't selling, but also because of their role, they must continue to buy. When this happens, they invariably lower their prices for the option. They will continue to lower their prices as long as the imbalance continues.

When there are more buyers, the floor traders accumulate not only inventory, but risk. Under these circumstances, floor traders will increase their prices in an effort to reduce further buying, or to provide a larger cushion against their increased risk. At these times of imbalance between option demand and supply, an option's implied volatility can vary dramatically from any notion of a reasonable forecast volatility. The market is not really adjusting volatility; it is adjusting prices to reflect changed market conditions. Volatility, however, is the pricing variable that absorbs this change.

In terms of the increase in demand for options, consider the increased demand during earnings months when investors enter the options marketplace in order to speculate on the earnings of a particular underlying. As large buy orders continue to enter the trading pit, the floor traders continually increase the price (as explained above). This price increase produces an increase in the implied volatility. Continued buying by the public under these circumstances means that the public is willing to pay more for the perceived opportunity of making money on a large earnings move in the underlying. Other events that might increase the demand for options include take-over rumors, earnings releases and other news announcements.

Conversely, if there is a large supply of a particular class or type of option, prices will decrease resulting from a corresponding decrease in the volatility variable. After the earnings have been announced, for example, option implied volatility would generally revert to more 'normal' levels as orders come in to sell options. The unknown is now known and the speculators are now selling the options they purchased. Clearly, the old adage "buy the rumor, sell the news" is true when evaluating volatility. The excess demand now becomes the source of an excess supply. Again, the increased selling will cause the floor traders to lower their prices by way of a decrease in volatility.

✓ ***Example:***

XYZ is trading @ $42

Before earnings with expectation of upcoming announcement

Before Earnings with expectation of upcoming announcement, XYZ is trading $42		
MAR 40 calls are valued 4 ¾		
Inputs:	Underlying	42
	Volatility	**40**
	Interest Rate	6%
	Dividend	0
	Strike price	40
	Days to Expiration	91
	Option Theoretical Value:	4 ¾

After Earnings:

XYZ is trading 42		
MAR 40 calls are valued 3 ¼		
Inputs:	Underlying	42
	Volatility	**20**
	Interest Rate	6%
	Dividend	0
	Strike price	40
	Days to Expiration	90
	Option Theoretical Value:	3 ¼
With a drop in volatility and all else remaining equal, the new option value will be considerably less than it was directly prior to earnings announcements.		

Using Implied Volatility

Implied volatility is your benchmark not only in determining which options are overpriced and which are under priced, but also in determining how *much* they are out of line. These differences can be substantial. Consider the following table where implied volatility comes in at ten points above and below your theoretical assessment.

Theoretical Volatility: 32	**Implied Volatility: 22**	**Implied Volatility: 42**
Stock Price: 50	Stock Price: 50	Stock Price: 50
Strike Price: 45	Strike Price: 45	Strike Price: 45
Days to Expiration: 365 (1yr)	Days to Expiration: 365 (1yr)	Days to Expiration: 365 (1yr)
Interest Rate: 6%	Interest Rate: 6%	Interest Rate: 6%
Volatility: 32	**Volatility: 22**	**Volatility: 42**
Dividend: none	Dividend: none	Dividend: none
Call Option Value: 10.44	**Call Option Price: 8.94**	**Call Option Price: 12.12**
Put Option Value: 3.00	**Put Option Price: 1.44**	**Put Option Price: 4.69**

Based on your assumption of 32 volatility in the stock over the next year, you calculate the value of the 45 levels calls and puts to be $10.44 and $3.00, respectively. The second column considers a situation where the market prices of these options are $8.94 for the calls and $1.44 for the puts, resulting in an implied volatility of 22. Thus by your assessment, the calls are undervalued by $1.50 and the puts by $1.56. By contrast, the third column represents market prices for the calls $1.68 more than you think that they are worth and puts $1.69 overpriced, reflecting an implied volatility of 42.

Understanding the differences between implied and forecast volatility is or critical importance for the serious options investor or trader. It is the basis for selecting the most appropriate option position to implement. For any market expectation you might have, such as bullish, bearish, or neutral, there will be several strategies available to exploit that expectation with limited risk. In evaluating these alternatives, a strategy that involves purchasing options would be more appealing if those options appeared to be under priced, just as a strategy for selling options would be more appealing if the options appeared to be under priced. Similarly, you would not want to use these strategies under conditions when either under priced options were being sold or overpriced options needed to be purchased. Investing and trading strategies using options will be covered in detail later in this book.

Using Implied vs. Historical

Many brokerages use the disclaimer "past performance is not an indication of future profits." Likewise, the experienced trader understands that the past may provide a wealth of data, but that that data will not always accurately predict the future. This is especially true when dealing with volatility assessment. With so much data to consider, it can at best be considered a subjective art form. Market Makers accept this dilemma, and therefore, do not burden themselves with "analysis paralysis." Like master stock picker, Market Makers accept that they will never truly buy the bottom or sell the absolute top. In assessing volatility, they use logic, consider relevant market news, look at history (see above), consider probabilities and draw then on experience. If they can then assemble a position that is profitable 40% of the time, they will be successful in the long run. The option evaluation process may go as follows:

1. Before entering into a position, the Market Maker will determine how options premiums are being affected by market conditions.
2. The Market Maker creates a pricing sheet using the Stock (historical) Volatility.
3. The Market Maker creates a pricing sheet using the implied volatility of the expiration month in question.
4. The implied values are compared to the historical values.

Implied Higher Than Historical
If the implied monthly volatility is trading at a high premium when compared to the historical stock volatility, this indicates increased speculation. The market believes that although volatilities are high, they may go even higher. Uncertainty is prevalent. Perhaps earnings are approaching, an FOMC meeting is ahead, or maybe there is fear of a market downturn.

Implied Lower Than Historical
If the implied monthly volatility is trading at a discount when compared to the historical stock volatility, this indicates a decrease in speculation. Perhaps volatilities are already low, but the market thinks that it is going lower. Maybe an anticipated news has been released, only to be a non-event. Slow summers or steady bull markets are low volatility situations; there is a lot of "certainty" in the market.

✓ *Example:* Volatility Buyer or Seller

Scenario A
VQE will be announcing earnings one week before July expiration. Dennis and Catherine both believe that earnings will be better than expected.

With VQE trading at $62 per share on July 1st, Dennis pays $3.25 for 20 July 65 calls, for a total investment of $6500.00 (100 X 3.25 X 20 = $6500).

Two weeks later VQE announces earnings, which as anticipated, were better than expected; VQE jumps to $67 per share. Speculators enter the marketplace, stock and options volume increase as traders trade out of their positions; the July 65 calls trade for $3.00.

Dennis is shocked to find that his options decreased in value only by $0.025 per option despite a $5 increase in the price of the underlying stock. Dennis has lost $500 on the position ($25 X 20 = $500).

Dennis has purchased OTM options at a high volatility. These options were eventually "crushed" with a large up move in VQE (for more on this concept, see the Options Skew section of this workbook).

Scenario B
Catherine also believes that VQE will rise on better than expected earnings. Looking at the options chain, she notices that, due to an increase demand for calls (speculation), the implied volatility of the July 65 call is 130, well above the historical implied average of 70. Although she is bullish, Catherine does not want to buy any options at the current implieds; she believes that the option's premium will decrease as the stock rises and as the volatility declines. Addressing this concern, Catherine decides to purchase 100 shares of VQE for $62 per share and then sell 1 July 65 call at $3.25 (100 X $3.25 = $325) for a total investment of $5875 (100 X $62 - $325 = $5875). When Catherine unwinds her position after the earnings announcement, she sells her stock out at $67 per share (67-602 X 100 = $500) and repurchases the Jul 65 calls for $3.00 (3.25-3.00 X $100 = $25). Catherine made $500 on her stock purchase and $25 on the calls that she sold, for a total profit of $525.

Expected/Forecast Volatility

This is what a trader attempts to predict based upon his informed/educated speculation. More specifically, forecast volatility is an estimate of the volatility of the underlying for a specific period into the future. For most traders, the starting point of volatility forecasting is a review of one or more historical volatilities. Knowing that news events move markets, the trader adds in to the equation his or her assessment of how anticipated news events will affect volatility. For example, volatility usually rises in the period just prior to a quarterly earnings announcement. If the company is the subject of a government investigation or is involved in major litigation, the possibility of news involving a major development should not be ignored. For these reasons, volatility assessment is a highly subjective process, which can offer no guarantee of accuracy.

Pricing Models and Option Theoretical Value

Given all required inputs, particularly volatility, the various pricing models are then able to assess the probability, the likelihood, if you will that a stock will reach a certain price by an option's expiration. This allows the pricing model to calculate the average amount the investment would be worth at expiration of the option. This average return is commonly referred to as the expected return. Expected return is an important concept. Let us look at it more closely.

Consider a game where you roll two dice and you get back a dollar amount equal to the sum of the dice. For example, if you roll a 5:1, you get $6 (5 + 1). Let us calculate the expected return from playing this game. There are 36 different outcomes from rolling two die. Each of them is equally likely. The expected results from rolling the dice 36 times are summarized as follows:

Sum of dice	2	3	4	5	6	7	8	9	10	11	12
Number of occurrences*	1	2	3	4	5	6	5	4	3	2	1
Total payoff for that sum	$2	$6	$12	$20	$30	$42	$40	$36	$30	$22	$12

**Let x:y represent the result of a roll of the dice, with the value x representing the number rolled on the first die and y representing the number rolled on the second die. There are then 36 different outcomes, ranging from 1:1 to 1:2 …to 6:6. Six of these outcomes add up to a roll of seven. These are 1:6,2:5,3:4,4:3,5:2, and 6:1. Five of these outcomes add up to a roll of 6. These are 1:5,2:4,3:3,4:2, and 5:1. There is only one way to roll a 2, 1:1, and so on for each potential sum.*

For all 36 outcomes, the total payoff would be $252 (2+6+12+20+30+42+40+36+30+22+12). By dividing this total by 36, the number of outcomes, we get the average or *expected* return of $7 for each time the game is played. If it cost you $6 to play this game, you would be getting a bargain. If it cost you $8, on the other hand, you would be overpaying. Finally, if the game cost you $7, this would be considered **fair value**.

This example is simplified model for how the pricing calculators establish the fair value of an option:

- First, by using the volatility input to calculate the probabilities of various investment outcomes as of an option's expiration;
- Then by computing the resulting expected return; and finally,
- After adjusting, the expected return for various costs associated with purchasing and holding the option contract until expiration, considering that adjusted expected return to be the fair value of the option. Let's look at some simplified examples involving options.

Example #1

Assumptions: It is mid-April. Stock ABC is trading at $50. Based on *expected volatility*, we calculate that the probability that ABC will close at 55 or below May option expiration is 80% and that of the remaining 20% of the time, the average value that ABC will close at May option expiration is $58.

What is the expected return on purchasing the May 55 call? If this exact situation occurred 100 times, our probability calculations indicate that the May 55 call would finish worthless 80 times (that is what an 80% chance of finishing at or below $55 at May expiration means), and the total return from the remaining 20 times would be $60 (20 finishes above $55 with an average option value of $3 per each occurrence). By dividing the aggregate return of $60 by 100 (the number of times the investment was made), we get $.60, the average or *expected return* you would anticipate getting back from a single investment in the option. If you only expect to get back $.60 each time you purchase the option, you probably wouldn't pay more than $.60 for it. Ignoring any other costs (commission, etc.), the fair value for the May 55 call would be $.60.

Example #2

Assumptions: It is mid-April. Stock XYZ is trading at $50. Based on *expected volatility*, we calculate that the probability that XYZ will close at 55 or below May option expiration is 60%, and that of the remaining 40% of the time, the average value that XYZ will close at May option expiration is $62.

What is the expected return on purchasing the May 55 call? If this exact situation occurred 100 times, our probability calculations indicate that the May 55 call would finish worthless 60 times, and the total return from the remaining 40 times would be $280 (40 finishes above $55 with an average option value of $7 at expiration per each occurrence). This would result in an average return of $2.80 each time you made the investment. Again ignoring any other costs (commission, etc.), the fair value for the May 55 call would then also be $2.80

Stock XYZ (Example #2) is more likely to increase enough in price for its May 55 call to finish in-the-money than is Stock ABC (Example #1). Without attempting to quantify that difference for now, we say that XYZ is more volatile than ABC. As a result of that increased volatility, not only is the XYZ May 55 call more likely to finish in-the-money than the ABC May 55 call (40% of the time for XYZ versus only 20% of the time for ABC), when it does finish in-the-money, it will do so, more-so than the ABC May 55 call. Thus, the increased volatility has a double-barreled impact on the value of the option: it increases both the probability that it will finish in-the-money *and* how much that option may be worth. Both increases impact the expected return on an investment in the option and therefore its fair market price.

Practical Applications of Theoretical Volatility

Market Makers generate theoretical volatilities to meet their volatility forecast; comparing the output to historic or implied volatilities. This analysis can be used in several ways:

For Pricing Alignments

The pricing model's volatility input is set to the implied volatility of the particular expiration month for the option that is being traded. Current option prices are compared against the theoretical prices that are then generated. All options of a given expiration month are then compared to one another. Traders do this to look for pricing discrepencies between options or to evaluate possible spreads. Ignore far *OTM* and *ITM* option volatilities when using this method.

For Accumulation

The pricing model's volatility input is set to the historical low, or at a volatility where options premiums would be accumulated (or bought). This is done when a trader predicts that volatilities will move back towards the mean or higher. When theoretical prices match the actual prices in the market place, this indicates a signal to buy options premium.

For Liquidation

The pricing model's volatility input is set to the historical high or at a volatility where the trader wishes to sell or liquidate options premium. When the theoretical prices match actual market prices, this indicates a sell signal. The Market Maker is predicting that premiums will eventually decrease towards the mean or lower.

✓ *Example:* Volatility for Liquidation

XYZ Stock Volatility: 40 Implied Avg.: 43
Historical Implied Volatility: high 44 / low 29

1. Deduction: Implied is running in the range of historical highs and is higher than the current stock volatility.
2. Strategy: Sell volatility.
3. Formulate a strategy that would offer the best risk/reward ratio.
4. Set theoretical volatility in pricing model for liquidation. Set it slightly higher than current implied (44-48).
5. Compare theoretical prices to actual prices.
6. Find *highest* volatility options to sell and *lowest* volatility options to buy.

Skew & the Compass Point©

As discussed earlier, each option trades at an implied volatility that is calculated by comparing the option's price relative to the underlying stock price (or the market's estimation of future volatility). Options skew shows that "down-side" strikes tend to be skewed higher and that "up-side" strikes tend to be skewed lower; a natural consequence of collaring by most traders and institutions.

- *Think of options skews as "the footprints of the institutions."*

Because institutions trade in large volumes, their executing of risk collars creates skew.

A closer examination of options skew, however, reveals something else: there is a point along the OTM call strikes where implied volatilities rise again and OTM put volatilities rise even higher. We will call this the Compass Point©.

- *The Compass Point is usually the option strike that is 1 Standard Deviation OTM.*

As a rule of thumb, traders say that stocks make a 3 SD move at least once a year. As such, they protect themselves by purchasing the strike at the 1 SD point. Although these options are trading at a "high implied," they may really only be trading for .50 or less. Traders often purchase these options with the realization that they may go out worthless, but the small amount paid for them are well worth the insurance against an unexpected move.

Volatility Spreading

Horizontal Calendar Spread

A horizontal calendar spread, frequently also referred to as a horizontal time spread, is a strategy in which an option is sold and an option of the same type and exercise price but with a further out expiration date is purchased. When the outlook for the stock is neutral, the *at-the-money* call or put options are used. With a mildly bullish outlook, use the nearest strike *out-of-the-money* call options. A mildly bearish outlook would call for the nearest strike *out-of-the-money* puts. Consider the following example:

In late February, XYZ stock is trading for $90 and its options are trading with a 35 volatility. A sampling of options prices is:

Calls	Options	Puts	Calls	Options	Puts	Calls	Options	Puts
6.82	MAR85	1.48	8.32	APR85	2.64	9.58	MAY85	3.57
3.80	MAR90	3.45	5.47	APR90	4.78	6.80	MAY90	5.77
1.87	MAR95	6.53	3.40	APR95	7.73	4.69	MAY95	8.67

Notice that the horizontal calendar spread is put on for a debit; you pay more for the farther-out option than you receive for the near-term option. If the stock does not move significantly in price by expiration of the near-term option, time will erode the price of the near-term option at a faster rate than the farther-term option, especially if the ATM options are used. This will widen the spread in price between the two options, producing a profit. Assuming that at March expiration the options are still trading with 35 volatility, let us compare how several time spreads will do when the stock closes at March expiration at $85, $90, and $95:

Spread	**Initial Debit**	**March Expiration Value**		
		85	**90**	**95**
MAR85P – APR85P	1.16	3.26	1.48	.58
MAR85P – MAY85P	2.09	4.52	2.64	1.45
MAR90P – APR90P	1.33	1.36	3.45	1.65
MAR90P – MAY90P	2.32	2.47	4.78	2.89
MAR90C – APR90C	1.67	1.68	3.80	2.01
MAR90C – MAY90C	3.00	3.11	5.47	3.61
MAR95C – APR95C	1.53	0.67	1.87	4.01
MAR95C – MAY95C	2.82	1.76	3.40	5.78

Note that if the stock remains at $90, the spreads involving the ATM March 90 strike do best. This results because the decay of the ATM calls is much faster than the decay of either the ITM March 85 or OTM March 95 options. However, if the stock drifts towards another strike, the spreads that do the best are those that are at that strike.

At expiration of the near-term option, the position could be closed out, or the long option could be retained. Holding the long position could produce a substantial profit if the stock made a dramatic move in the appropriate direction (up for a call, down for a put). Holding the long position also risks loss either from time decay or having the stock move in the wrong direction.

The following matrix illustrates resulting positions after the first leg of the horizontal has expired at Expiration:

Horizontal - LONG				**Horizontal - SHORT**			
Near-term Calls		Near-term Puts		Near-term Calls		Near-term Puts	
ITM	OTM	ITM	OTM	ITM	OTM	ITM	OTM
Syn. Put	Long Call	Syn. Call	Long Put	Covered Call	Short Call	Syn. Short Call	Short Put

The maximum risk of this position is the full amount of the debit paid to initiate the position. A loss of this magnitude will result only if the stock moves so significantly prior to the near-term expiration, that both options lose their entire premium.

It is important to note that these spreads are volatility sensitive. If you recall from our discussion of the Greeks, the more time to expiration, the more the impact of a change in volatility. Thus, these spreads are long vega; if volatility increases, the longer term options will increase more in price than the near term options, increasing the spread, thus increasing the profit. The reverse is true if volatility declines. Compare the impact on the spreads if volatility increased to 50 or decreased to 20 just after the spreads were established:

Spread	**Initial Debit**	**Spread Value**	
		Vol = 20	**Vol = 50**
MAR85P – APR85P	1.16	.48	1.85
MAR85P – MAY85P	2.09	.91	3.27
MAR90P – APR90P	1.33	.70	1.95
MAR90P – MAY90P	2.32	1.21	3.40
MAR90C – APR90C	1.67	1.03	2.27
MAR90C – MAY90C	3.00	1.86	4.05
MAR95C – APR95C	1.53	.76	2.30
MAR95C – MAY95C	2.82	1.49	4.11

The March 85-April 85 put spread, which you just paid $1.16 for, would be worth $1.85 at a 50 volatility and only $.48 at a 20 volatility. All spreads have increased in value at a 50 volatility and have lost value when volatility goes to 20. This indicates that these spreads would merit serious consideration when volatility is low, when the chances of a volatility increase are greater than the chances of a further decline in volatility.

Why would the Volatility Trader establish this spread?

The trader is looking for an increase in volatility, and thus an increase in the position's value.

When is this spread used?

- **Pre-earnings**
  Volatility Traders are purchasing what they estimate to be low volatility in the far-term months. They are speculating that volatilities will then increase with increased speculation during and earnings period.

- **Volatility Skew**
  Near-term options volatilities are skewed higher when compared to the further out options.

Premium Factor

- This spread is put on for a debit; the difference between the near-term and farther-out option prices.
- The trader is a net purchaser of time premium, and therefore is long volatility.

Capital Risk Factor

- The maximum risk of this position is the full amount of the debit paid to initiate the position.
- The maximum loss will result if the stock moves significantly prior to the near-term option's expiration. This will cause the spread between the prices of the two options to shrink dramatically.

Volatility Factor

- The trader is "getting long Vega."
- The value of both the long and short options will increase with a rise in volatility. However, the further out option will increase at a greater rate than the short term option. This is due to a long term's higher Vega component,
- Any rises in the near-term option's volatility may be negated by ever increasing Θ.

Theta Factor

- The trader is net short Θ because the near term options decay at a faster rate, and therefore have more Θ, than the further out options.
- If the stock does not move significantly in price, time will erode the price of the near-term option at a faster rate than the farther-term option. The Θ is working in the trader's favor.

✓ *Example: Diagonal Spread*

Stock XYZ $34					
Position	**Month**	**Strike**	**Type**	**Price**	**Vega**
-10	FEB	35	Calls	1.05	-.046
+10	JUN	35	Calls	(2.70)	+.091
Totals				(1.65)	+.045

Scenario

Volatility Trader Joe is long the above Horizontal Time Spread. He thinks that volatility is currently low and that they will increase within the next 3 months. He is purchasing the JUN option and selling the FEB option to subsidize it. Using options modeling software (like the one provided with this workbook) Joe will assess the risk and reward of his position.

The position is initially a front-spread graph because any stock movement away from the strike of the FEB option will result in gradual losses. If the stock rises or falls at any time during the life of the position, the two options offset each other. However, the price fluctuations in the FEB options will always be greater due to higher Deltas and Gammas.The best scenario would be for the stock to sit at the front-month strike.

The position was put on for a debit of $1650.00. This is the maximum risk for this position, illustrated by the black line in the P/L graph. The maximum loss will occur in two ways. First, if the stock moves away from the FEB strike before it expires (see above). Second, if Joe does nothing with the position, waits, and lets both options expire worthless.

- The position is net long 45 Vega:
  [(Net Vega .045 x Position 10) x Unit of Trade 100)]

- For every one-point *increase* in volatility, the net position profit will theoretically *increase* $45 dollars.

- For every one-point *decrease* in volatility, the net position profit will theoretically *decrease* $45 dollars.

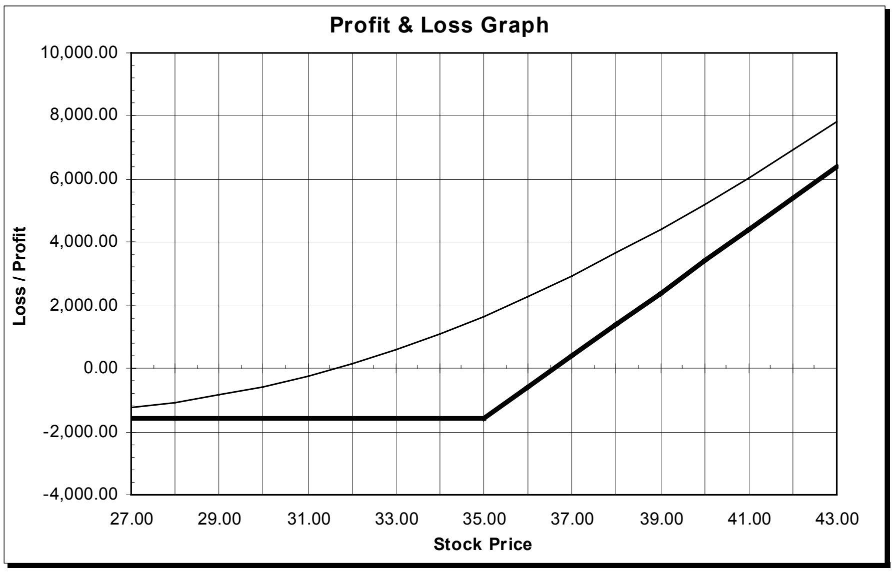
- As February expiration approaches the net position Vega will increase. After February expiration the position will be net long the Vega of the June 35c.

- February options that were sold reduce the net amount of Vega that is accumulated by purchasing the outer month option.

- For Trader Joe, this is a great strategy if he believes that volatility is at a low and that it will. Additionally, he commits less capital because his purchase of the JUN option is being subsidized by selling the FEB option.

At Expiration Joe's position is as follows:

The graph is a below illustrates the position after the FEB option has expired. At this point, Joe is essentially long 10 contracts of the JUN 35c option at 1.65 (shown in the second graph).



Short Horizontal Spread

Like the long Horizontal / Calendar Spread the position involves the use of two options of the same strike price and of different expiration months. Unlike the Long Horizontal Spread, the near-term option is purchased and the far-term option is sold. This is considered to be a short volatility position. In options parlance, the trader is has established a “Back-spread” position.

Why would the Volatility Trader establish this spread?
The trader is looking for a decrease in volatility, thus increasing the value of the overall position.

When is this spread used*?*

- Earnings speculation.

At the apex of high volatility during earnings speculation.
Options volatilities tend to increase during times of increased speculation times, such as earnings. Traders raise then sell high volatilities and to capitalize on stock movement in the near term.

- Volatility Skew
  When far-term or LEAP options are trading at a historically high volatility when compared to near-term options.

Premium Factor

- This spread is put on for a credit; the difference between the near-term and farther-out option prices.
- The trader is a net purchaser of options premium.

Capital Risk Factor

- When the position is initially executed, a credit is received.
- Maximum risk occurs if volatility goes up in the outer-month This will cause the spread between the two option prices to increase dramatically. Risk also occurs if the front month expires, nothing is done, and the trader is left with a short a naked (unhedged) outer-month option.

Volatility Factor

- The Trader is "getting short Vega."
- The value of both the long and short options will decrease with a decrease in volatility. However, the far-term options will decrease in value at a greater rate than the short-term options. This is due to the long-term's higher Vega sensitivity.
- Any rises in the near-term option's volatility must exceed the daily Θ amount to be profitable.

Theta Factor

- The trader is long Θ because the near term options decay at a faster rate, and therefore, have more Θ, than the further out options.
- If the stock does not move significantly in price, time will erode the price of the near-term option at a faster rate than the farther-term option. The Θ is working against the trader.

The chart below shows resulting positions at expiration given the type of spread that has been established.

Horizontal - LONG				**Horizontal - SHORT**			
Near-term Calls		Near-term Puts		Near-term Calls		Near-term Puts	
ITM	OTM	ITM	OTM	ITM	OTM	ITM	OTM
Syn. Put	Long Call	Syn. Call	Long Put	Covered Call	Short Call	Syn. Short Call	Short Put

✓ *Example: Short Horizontal*

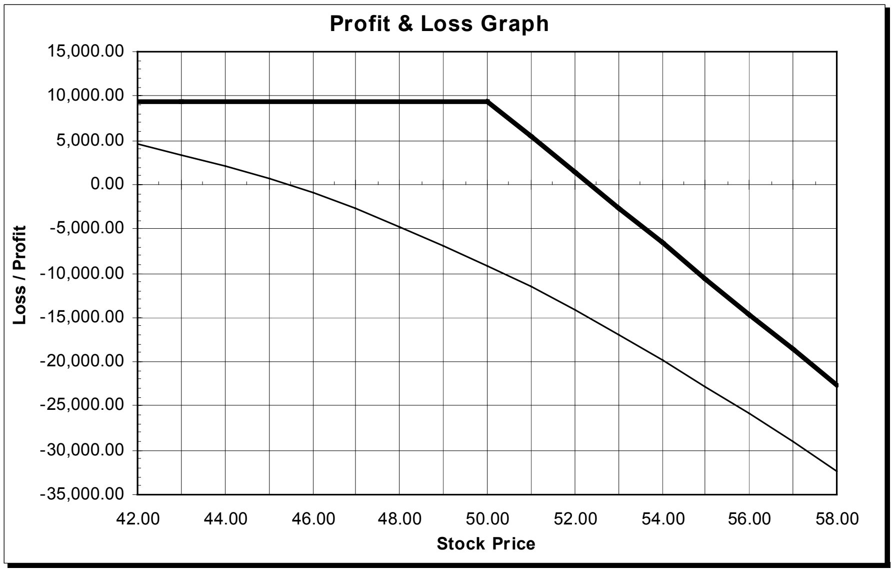
Stock XYZ $49					
Position	**Month**	**Strike**	**Type**	**Price**	**Vega**
+40	MAR	50	Calls	(1.70)	+.066
-40	JUL	50	Calls	4.05	-.129
Totals				2.35	-.063

Scenario
Volatility Trader Dana is short the above Horizontal Time Spread. She thinks that volatility is currently too high and that they will decrease within the next month. She is has purchased the JUL option and sold the MAR option to subsidize it. Using options modeling software (like the one provided with this workbook) Dana will assess the risk and reward of her position.

The position was put on for an initial credit of $9400.00. The maximum credit will occur in to ways. Firstly, if the stock moves far away form the MAR strike before expiration. Secondly, if volatilities in the JUL options decrease significantly or if the stock closes at the JUL strike at JUL expiration.

- The position is net short -252 Vega
- [(Net Vega -.063 x Position 40) x Unit of Trade 100)].
- For every one-point *increase* in volatility, the net position profit will theoretically *decrease* $252 dollars.
- For every one-point d*ecrease* in volatility, the net position profit will theoretically *increase* $252 dollars.
- As March expiration approaches, the net position Vega will decrease. After February expiration the position will be net short the Vega of the July 50c.
- For Dana, this is a great strategy because she believes that volatility is at a high point and that it will decrease. Additionally, she is protected from directional exposure because she is long the MAR options.

At expiration Dana's position will look like this:



The greatest loss at this point occurs if the stock closes at the 50 strike. Dana is long these options and they will go out worthless at 50. At this point, Dana is essentially short 10 contracts of the Jul 50c @ 9.40. Although this sounds lucrative, Dana must be mindful that she is now short an un-hedged (naked) call.

Diagonal Calendar Spread

In this variation on a horizontal calendar spread, the option purchased is of the same type but not the same exercise price as the near-term option sold. In the case of a call calendar spread, the option with the next highest exercise price to the option sold is used, while in the case of a put calendar spread, the option with the next lowest exercise price is used.

The March 90-April 85 put spread, the March 90-May 85 put spread, the March 90-April 95 call spread, and the March 90-May 95 call spread would all be examples of a vertical calendar spread.

Several important differences from the horizontal time spread result from the fact that a lower priced option is purchased in a vertical calendar spread:

- Its initial cost is less, and may even result in a credit;
- It will perform better when the stock moves in the wrong direction (down in the case of a call spread, and up in the case of a put spread);

When the stock moves strongly in the direction of the type of contract (up in the case of a call spread, and down in the case of a put spread) it will perform worse because the long contract will not increase in price as quickly as the lower exercise price option used in the horizontal version. In fact, the maximum loss is the initial debit plus the difference in strike prices between the contracts sold and purchased. This will occur when both options become so *deep-in-the-money* that there is very little premium remaining in their prices. At that point their market values will differ only by the difference in strike prices.

If the stock doesn't move, this position will outperform the horizontal time spread both on an absolute basis and on rate of return. This happens because there will be less decay in the value of the long option used in the vertical time spread than in the horizontal time spread.

Using the pricing example from the previous discussion of horizontal calendar spreads, a comparison of the initial credit (debit) of the vertical spread to the value of the position at March expiration at a variety of stock prices is:

Spread	Initial Credit (Debit)	March Expiration Value		
		85	90	95
MAR90P – APR85P	.81	(1.55)	1.48	.54
MAR90P – MAY85P	(.12)	(.22)	2.64	1.42
MAR90C – APR95C	.40	.64	1.87	(1.20)
MAR90C – MAY95C	(.89)	1.72	3.40	.47

To determine the result, combine the initial credit (debit) with the value of the position at March expiration. For example, at March expiration with the stock closing at $85, the March 90-April 85 put spread would have resulted in a $.74 loss (the $.81 credit received initially reduced by the negative value of the position at expiration). This position does extremely well when the stock closes near the near-term strike at expiration. It produces a profit when the stock moves against the near-term position (above the near-term put strike or below the near-term call strike); and does not fare well when the stock moves favorably for the near-term position (below the near-term put strike or above the near-term call strike).

Why would the Volatility Trader establish this spread?
This is one of the Volatility Trader's most powerful tools. His ability to analyze and formulate Diagonal Spreads is a tremendous asset. It will allow him to create bullish or bearish positions with leverage, *and* at a credit or small debit. This allow him establish Delta neutral or Vega neutral positions to meet his directional or volatility speculation with a predefined risk.

When is this spread used?
To "accumulate contracts."

Diagonal Spreads can be used in a variety of ways. There is no one situation that is ideal because there are so many Diagonal Spreads available. However, as a rule of thumb, Market Makers like to use DS-A to acquire options contracts. They subsidize the cost of buying contracts by selling higher priced options that expire at an earlier date.

Premium

Depending on the strikes used in establishing the Diagonal Spread, the premium factor will vary. For example, if DS-A is used the trader is purchasing premium. If DS-B is used, the trader is receiving premium.

Capital Risk Factor

- When the stock moves strongly in the direction of the type of contract, (up in the case of a Diagonal call spread, and down in the case of a Diagonal put spread), it will not perform as well. This is because the long contract will not increase in price as quickly as the lower exercise price option used in the horizontal version. The maximum loss is the initial debit plus the difference in strike prices between the contracts sold and purchased. This will occur when both options become so *deep ITM* that there is very little premium remaining in their prices. At that point their market values will differ only by the difference in strike prices.
-
- With DS-A there may be a credit when the position is first established. However, once the front-month option expires, the trader is long a far-term option that can potentially go out worthless if the underlying stock does not move. This spread has limited risk after the front-month option expires.

- With DS-B, there may also be a credit when the position is first established. However, the holder of DS-B must be aware that there is considerable risk once the front-month option expires; there is an un-hedged, short option remaining.

- Whatever the variation, the trader of this spread must carefully monitor the capital outlay (or credit) vs. current market conditions.

Volatility Factor

- Diagonal spreads can create long, short or neutral Vega positions. With DS-A, the trader is considered to be a purchaser of volatility. With DS-B, the trader is short volatility. The volatility factor will be determined by the trader's and determined strikes.

Theta Factor

- DS-A: the trader is short Θ.
- DS-B: the trader long Θ
- In either case, the trader would like the underlying stock to move towards the direction of the short strike for his particular position. For example, someone who is long XYZ APR 35c and short FEB 30c is going to want XYZ to go to 30 at FEB Expiration.

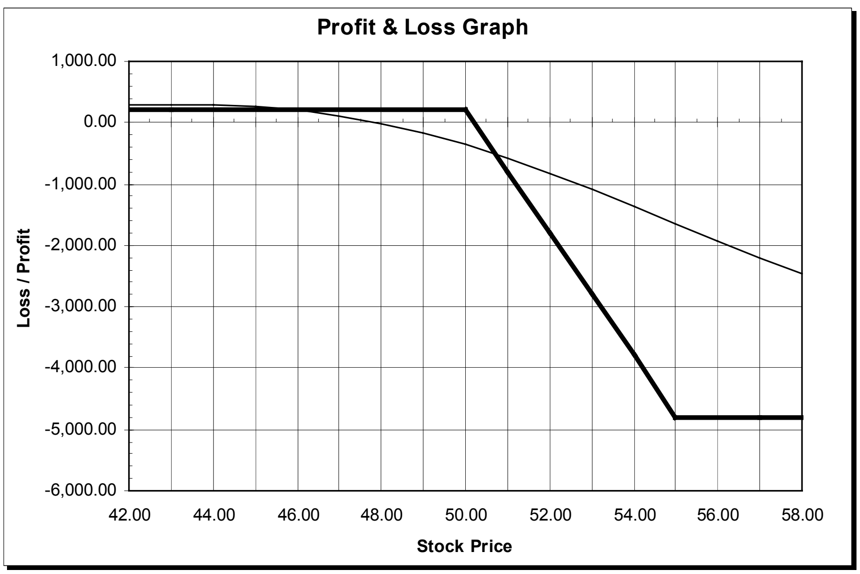
The chart below shows resulting position based on the stock closing at any given strike.

Selling Near Month / Buying Outer DS-A				**Buying Near Month/ Selling Outer DS-B**			
Near-term Calls		Near-term Puts		Near-term Calls		Near-term Puts	
ITM	OTM	ITM	OTM	ITM	OTM	ITM	OTM
Syn. Put	Long Call	Syn. Call	Long Put	Covered Call	Short Call	Syn. Short Call	Short Put

Example: Diagonal Spread

Stock XYZ $49					
Positio n	**Month**	**Strike**	**Type**	**Price**	**Vega**
-10	MAR	50	Calls	1.25	-.052
+10	MAY	55	Calls	(1.05)	+.073
Totals				.20	+.021

Scenario
Trader Vickie has implemented the above position (DS-A). She does not think that XYZ will not move much in the month of March. She would like to buy some contracts in May because that is when XYZ has its quarterly earnings. She likes the spread because she feels that May implied volatilities are lower than the historical implied volatilities.



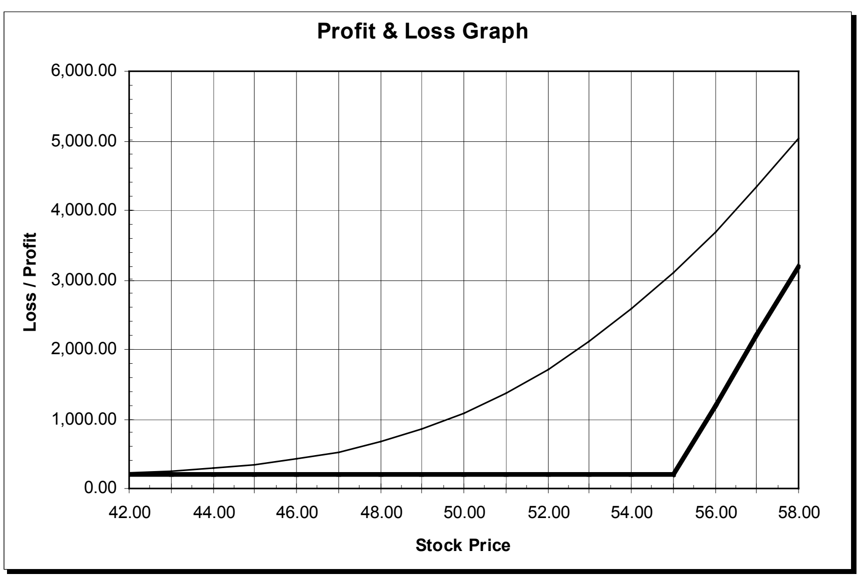
The above P/L graph shows that Vickie has a bear spread up to the expiration of the March options. Her position will change after March expiration. Vickie is currently short premium ("front-spread") because she sold *ATM* MAR calls and purchased *OTM* May calls. She has also received a credit in implementing this spread.

Vickie's position was put on for a $200 credit. This is the profit at March Expiration if the stock closes at the MAR strike.
The position has unlimited profit potential after MAR expiration. This is because Vickie is long MAY calls for a credit.
The max loss of the position is $4,800 [(Difference between strikes 5 – credit received .20] x number of contracts 10) x unit of trade 100 = 4,800

The maximum loss occurs if the stock rises and moves towards the long *OTM* strike before MAR expiration.

- Vickie's position is net long 21 Vega.
- [(Net Vega .021 x Position 10) x Unit of Trade 100]
- For every one-point *increase* in volatility, the net position profit will theoretically *increase* $21 dollars.
- For every one-point *decrease* in volatility, the net position profit will theoretically *decrease* $21 dollars.
- As XYZ rises towards 55, Vega will increase because the MAY 55c is now an *ATM* strike.
- Selling the MAR options has decreased the net Vega exposure until MAY expiration..

After MAR expiration, Vickie is left with a long Depending on where the stock is at that time, she will be long a given amount of Vega.



After MAR expiration, Vickie is long a MAY call option.

Long Ratio Time Spreads

As discussed in the Market Compass Position Trading class, ratio spreads allow a trader to be long or short contracts. They can be used to create leverage, capture Θ, or to create Vega neutral spreads. Ratio Spreads are usually traded between two options in the same expiration month. The trader can be either long or short the ratio spread, depending on her assessment of volatility or speculation of stock direction. Ratio spreads can be created in any fashion, 1:2, 2:3, 1:4, 3:5; although 2:1 is the most commonly used by Market Makers. When Ratio Spreads are traded between different expiration months, they are then referred to as Ratio Time Spreads. Market Makers rarely get put on Short Ratio Time Spread positions because they present significant risk for limited reward. As such, Market Compass will not devote any effort into teaching this strategy. The Long Ratio Time Spread is a much better position from many perspectives and will, therefore, be included in this curriculum. When assembling a Long Ratio Time Spreads position, be aware that they can be combined with other spreads, to address an array of market sentiment. Remember, the trader that uses her creative imagination in trading will always succeed over the “book-smart” trader.

Why would the Volatility Trader establish this spread?
The trader is looking for big stock moves or for a significant increase in stock volatility by expiration. Additionally, the trader may be able to establish a position at a minimal cost.

When is this spread used?
In anticipation of activity; when volatility is low and the trader anticipates that activity is brewing for a large stock move.

Premium Factor
The spread is usually put on for a small debit; the difference between the long term and short term option’s prices.
The trader is a net purchaser of options premium because the further out options are being purchased.

Capital Risk Factor
The maximum loss occurs if the stock closes at the strike of the outer-month option at its expiration. The maximum loss would be the difference between the two option strikes minus the net debit (or credit) of putting on the position.

The Volatility Factor
The trader is "getting long Vega."
If volatility increases, the trader will profit handsomely because she is long two long-term options with a larger Vega components.

Theta Factor
Depending on the strikes used, this spread can either be long or short Θ; Generally, the Θ is nominal.
In the near term the trader would like the stock to move towards the near-term strike. If this happens, the near-term option will increase in Θ. If the stock stays at here, the near-term option will eventually expire worthless while the outer term still has value.
In the long term the trader would like the stock to stay away from the long-term strike. Θ increases if the stock is trading near the strike. Additionally, if the stock closes at the strike at expiration, the option will go out worthless.

✓ *Example*

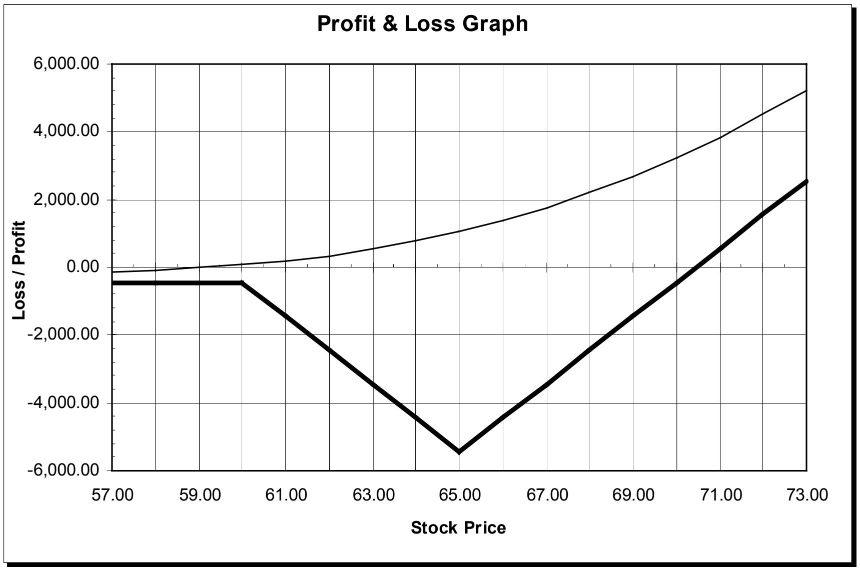
Stock XYZ $59					
Position	**Month**	**Strike**	**Type**	**Price**	**Vega**
-10	FEB	60	Calls	2.15	-.080
+20	MAR	65	Calls	2x (1.30)	2x +.088
Totals				(.45)	+.096

XYZ has dropped $10 two months ago because of rumors surrounding a court case. It has been sitting at $57-$59 since then. Trader Julia thinks that a judgement will come out in XYZ's favor when the case is decided in March. Julia thinks that volatility is low and that the stock is going to run.

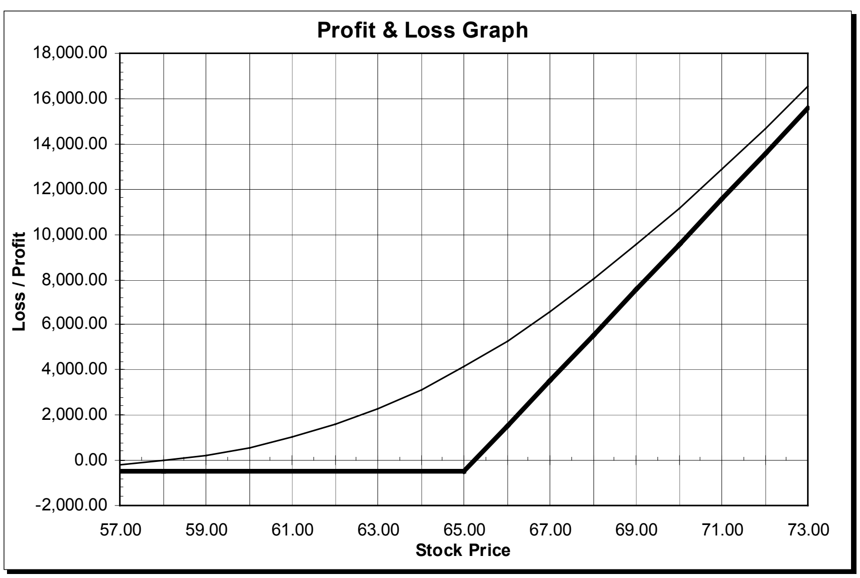
Julia's position was put on for a slight debit of $45. She is net long premium and Vega (see below).

The trader is selling the near-term *ATM* strikes and is purchasing two far-term *OTM* strikes. This results in a small debit. The spread has the most capital risky in the far-term.

If the stock closes at 65 on MAR expiration the max loss will be $5,450. This is the debit of the position and the difference between the strikes.
[(Position cost .45 + difference between strikes 5) x number of contracts 10) x unit of trade 100] = 5,450



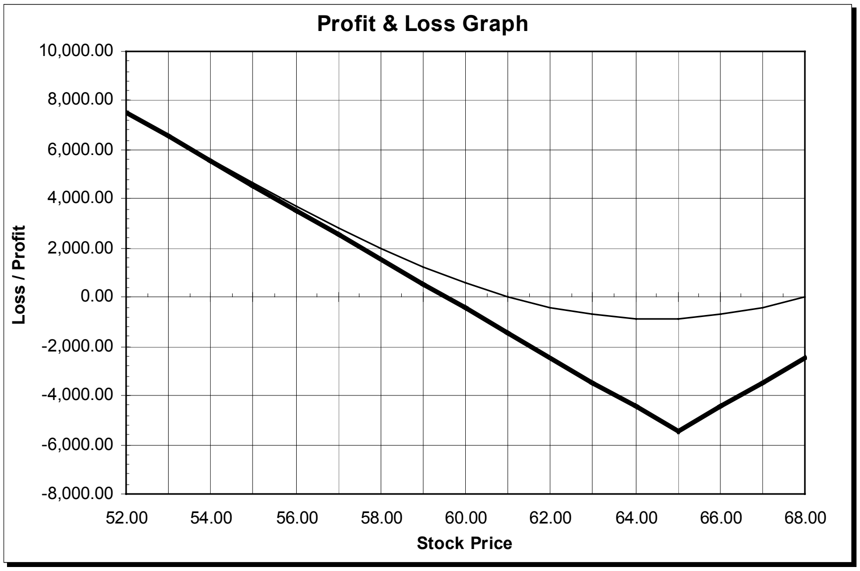
The position is net long volatility (Vega) and net long contracts. The Back-Spread curvature is a result of the position's net long contracts and Vega and components. This graph will change dramatically at FEB expiration (see below).



If the FEB 60c expires worthless, Julia will be long two MAR calls for a small debit ($456.00)

If the FEB 60c expires *ITM* and Julia does not buy it back, the resulting position would be a synthetic straddle: 10 MAR 65 Calls & 10 Synthetic MAR 65 Puts (10 MAR 65 calls & short –

1,000 shares of stock). The 1000 shares of short stock resulted from the stock being called away @ 60 (short calls). This is essentially a straddle that was purchased for $4500.00



Volatility Cycles

Volatility Cycles

As every experienced trader knows, stock and implied volatilities are ever changing. Certain times of the year or certain events are more volatile than others. The following are general rules of thumb concerning the cycle of volatility.

Earnings Cycle
Options volatility increase and decrease based on earnings speculations.

Yearly Cycle
Options volatility typically decreases in the summer and increases in the fall around late September early October.

The Variable Cycle
Any time there is a rumor, news, takeover, or any uncertain event, options volatility will increase from the mean.

Bull Market (low implied volatility)
In a bullish market the volatility usually decreases because we see very little protective put buying. The most common strategy used among investors in a bull market is the covered-call. Some investors with more capital sell cash secured puts (the same thing as the covered call). This tends to keep volatility low. The only option purchasing is speculated call purchasing. This may create an upside skew in the OTM calls.

Bear Market (high implied volatility)
In the bear market the volatility is usually increasing and sometimes dramatically. We see a lot of speculative and protective put buying, lots of call buying (trying to pick the bottom), and less and less covered-call and cash-secured put selling since the stock is dropping in value. There is usually an upside skew in the OTM puts.

VIX and VXN

Generally, market makers watch the VIX and VXN closely to get an idea of the overall market sentiment. These indices show them how the market volatility is affecting options premiums.

In a bull market, the VIX will go down within range of 20. This is considered the low end of the VIX, signaling low market volatility. Market makers use this as a cue to begin purchasing options, look for a correction or a sell-off.

When a crash, or bear market occurs, especially during a bull market, the VIX will spike. If the VIX starts moving above 30, market volatilities are considered high. However, history has shown that the VIX can move well over 50 or 60. This is considered extremely high, perhaps signaling a market bottom. Still, above 30, market makers will begin selling option premium in hopes of profiting from declining volatilities and time decay.

The same concepts apply to the VXN, the NASDAQ Composite Volatility Index: 45 is a bearish indicator, 65 is a bullish indicator.