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Lecture Notes: Volatility Trading Strategies

1 Volatility Trading Strategies

As previously explained, volatility is essentially the risk aspect of the market. It is the perception of risk that is “securitized” in the time value component of an option premium. The volatility can be implied in the options price (which includes traders’ expectations of future price movements) or be based upon the actual fluctuations in the price of the asset which underlies the option. Traders buy or sell volatility as their perception of risk in the future changes.

The ideal way to trade volatility is to maximize the exposure to both kinds of volatility (actual and implied) and minimize the exposure to the other factors which influence option prices, such as small movements in the underlying market and if possible time decay. This is done by using the “Greeks” to assess the exposure the trading strategy has to all the variables which drive option prices. To benefit from a change in actual volatility of the market, the trader will want to establish a gamma positive or negative position. To benefit from a change in implied volatility, the trader will focus on her kappa (vega) exposures. For the other derivatives such as delta, theta, and rho, she will try to minimize her exposure to these “Greeks” by driving their level to zero.

By doing so, the trader can focus her viewpoint on volatility alone. When one is completely neutral to the underlying market and is just trading volatility, it is termed pure volatility trading. In addition to pure volatility trading one can establish trading strategies that are initially neutral to the underlying market but can become an equivalent long or short position as the underlying market price moves to a particular level. These trades are usually called leaning volatility trades. Below we examine some of the pure volatility strategies.

1.1 “Pure” Buying Volatility Strategies

Suppose one purchased a call option which is an equivalent long position. If volatility increases one will profit. If the same person also bought a put option, which is an equivalent short position, in combination with the long

call what would we have? The put option has an opposite exposure to the underlying market, but will also benefit if volatility increases. These two trades can be combined in such a way that they will be neutral to the underlying market but they will still have a long volatility bias. That is how you go “long” volatility; by buying options. If one buys both a call and a put and adjusts carefully for the delta exposure of each, then the position can be neutralized to the underlying asset and will then be purely a volatility trade. Depending on which strike prices you choose, this combination trade is called either a straddle or a strangle.

1.1.1 Buying a Straddle

- A *long* (or *buying* or *bottom*) *straddle* is achieved when you buy a call option and a put option both at the same strike price and expiration date (generally both at-the-money).

The call option you purchase is a long position relative to the underlying market and the put option is a short position relative to the underlying. The total exposure of these two in combination will cancel out relative to the underlying position. This is because the positions bought are at-the-money options with delta exposures that approximately offset (recall that the deltas of at-the-money calls and puts are approximately 0.5 and -0.5 , respectively).

- While you have no exposure to the underlying market, this trade will be extremely sensitive to volatility.

Purchasing at-the-money options, which have the greatest time value, gives you the greatest absolute volatility sensitivity. Unfortunately, these options are also extremely sensitive to time decay. This is the reason very few traders can afford to maintain these strategies for long periods or until expiration. Most dealers rarely buy straddles for more than a few days. They use them as a short term trade expecting an immediate increase in volatility to occur. If this occurs, they close out the straddle, take their profits and run.¹ Straddles essentially double the exposure to volatility compared to the purchase of a single option. This means a doubling in the straddle value for the same increase in the rate of volatility.

The profit pattern (at expiration) of a long straddle is shown in Figure 1a. (The profit and loss profile of a long straddle over time is presented in Figure 1b.) The strike price of the call and put options is denoted by X . If

¹Often these are effective strategies to establish prior to the release of government trade figures or other news events that tend to cause volatility or market uncertainty to change.

the stock price is close to the strike price at expiration of the options, the straddle leads to a loss. However, if there is a sufficiently large movement in either direction, a significant profit will result. The payoff from a straddle is calculated below (to calculate the profit you need to subtract from the payoff the call and put premiums):

Payoff from a Long Straddle			
Stock Price Range	Payoff from Long Call Option	Payoff from Long Put Option	Total Payoff
$S_T \leq X$	0	$X - S_T$	$X - S_T$
$S_T \geq X$	$S_T - X$	0	$S_T - X$

1.1.2 Buying a Strangle

A variation on the above theme is the strangle which costs less than the straddle to establish.

- With the *long strangle* you are buying a call and a put on the same underlying asset for the same maturity, but at different strike prices. A long strangle is sometimes called a *bottom vertical combination*.

Like the straddle, the equivalent long position and the equivalent short position will offset each other relative to the underlying market. Generally, strangles are established with out-of-the-money options. If they are established with in-the-money options they are often referred to as *guts* positions.

The only way to quantify the differences between a straddle and a strangle is to examine the “Greek” derivatives for each strategy. Throughout the life of the options, the straddle will always have a higher gamma than the strangle and will therefore be more appropriate for those traders who are betting on an increase in the actual volatility of the market.

- Since with the strangle you are buying out-of-the-money options, you are paying a smaller premium compared to the straddle and you are not going to have the same amount of money exposed to time decay, because you have purchased less time value.² With the strangle, you are no longer maximizing your exposure to time value or to volatility. But you do have a position that does not cost as much to establish and therefore has a smaller loss potential.

²Although the rate of time decay for the strangle may actually be greater than for the straddle for various periods prior to expiration, the quantity of money that will be lost is less.

These trades can be established for perhaps a longer time period than the straddle, you still will want to take them off within 7 to 10 days if market volatility has failed to change.

- The other major benefit of the strangle is that it is constructed using out-of-the-money options which experience a greater percentage increase in their value from a change in volatility.

When an option is at-the-money, it will experience the greatest absolute increase in price from a change in implied volatility but the out-of-the-money options will have the greatest percentage impact. So the strangle is preferred by those traders who wish to bet on increases of the implied volatility while the straddle traders are betting on both an increase in the actual volatility (gamma effect) and the absolute impact of the implied volatility (kappa or vega effect).

The payoff function of a long strangle is given in the following table. The call strike price (X_2) is higher than the put strike price (X_1):

Payoff from a Long Strangle			
Stock Price Range	Payoff from Long Call	Payoff from Long Put	Total Payoff
$S_T \leq X_1$	0	$X_1 - S_T$	$X_1 - S_T$
$X_1 < S_T < X_2$	0	0	0
$S_T \geq X_2$	$S_T - X_2$	0	$S_T - X_2$

The profit pattern obtained from a long strangle is shown in Figure 2a. (Figure 2b plots the profit and loss profile of a long strangle over time.) The trader is betting that there will be a large price move but is uncertain whether it will be an increase or a decrease.

- Comparing Figures 1a and 2a, we see that that the stock price has to move farther in a strangle than in a straddle for the trader to make a profit. However, the downside risk is the stock price ends up at a central value is less with the strangle.
- The profit pattern obtained with a strangle depends on how close together the strike prices are. The farther apart they are, the less the downside risk and the farther the stock price has to move for a profit to be realized.

- While there are numerous other strategies one can establish to buy volatility, most traders will keep things simple and buy either the straddle or the strangle when trying to initiate a pure volatility strategy, because these strategies are the most sensitive to changes in volatility and are relatively simple to initiate and unwind.

1.1.3 Long Straddles and Strangles in the Strategy Matrix

With both straddles and strangles, the viewpoint is neutral to the market and long volatility. So we can fill in our strategy matrix, given in the previous lecture, as follows:

		Viewpoint on the underlying market (crude oil is the underlying market in this case)		
		Buyer	Seller	Neutral
Viewpoint on volatility	Buyer	<i>Buy call option</i>	<i>Buy put option</i>	► <i>Buy straddle</i> ► <i>Buy strangle</i>
	Seller	<i>Sell put option</i>	<i>Sell call option</i>	
	Neutral	<i>Long futures</i> <i>Bull spread</i>	<i>Short futures</i> <i>Bear spread</i>	

- These trades work when one is uncertain where the underlying market is going but one believes that volatility will increase over the short term and before time decay erodes the value of the position.

It is important that the trader remains disciplined: s/he must place the trades as a spread and take them off as a spread. If one starts looking at each component separately and trades them not as a spread but one at a time, things can get very dangerous. The disciplined trader remembers that s/he has “bought” volatility at a low level expecting to sell it at a higher level, ideally in a few days before the spread starts experiencing heavy time decay. What may occur is that the underlying market jolts one way or the other and s/he will be very tempted to take off only one side of the spread. For example, consider that we bought a straddle and the market collapsed, we might want to take off the call and let the put “ride”. What usually happens is that then the market will rally and you lose on both the call and the put. This kind of trading technique is called “legging”.

Whenever you trade, remember what your objectives are. More good trades go wrong when traders try to change position in midstream because they forget why they established the position in the first place. The spread trader would be well advised whenever s/he considers legging a trade to remember the old Wall Street adage: “Bulls make money, bears make money, but pigs get slaughtered”. Greed can cost the trader dearly.

- Long straddles and strangles are referred to as pure volatility trades because when you initially establish them, the positions are delta neutral and the trader profits equally if the market goes up or down. With both strategies, the unlimited profit opportunity is equal on both sides. What the straddle and strangle buyer is concerned about is that something happens quickly; either the market moves or volatility increases.

1.2 “Pure” Selling Volatility Strategies

Strategies which benefit from quiet times and static markets are probably the most common use for options in volatility trading. Many option trading professionals make money from selling options. Since options are securitized risk, some people think of them in a similar light to a casino. Strictly speaking this is not correct. Risk in an underlying market existed prior to the introduction of options. On the other hand, casinos create risk that did not previously exist in order to provide a vehicle for gambling. Nevertheless, gambling does provide an insight when considering the selling of options. In casinos the consistent winners over time are the gambling houses which sell the bets. Option sellers will win over time if they have the “edge”.

The “edge” is the difference between theoretical option values and actual option prices. The option seller attempts to sell options at prices higher than their theoretical value and option buyers do the reverse. In volatility selling strategies, trades are established to maximize the edge from overvalued market prices for options. The key element in the determination of the theoretical value of the option is an accurate estimation of future volatility. Suppose that a trader determines that the future volatility for options should be 20% while the current implied volatility in the market is 25%. To gain the edge, he will select those strategies which would profit from the implied volatility falling from 25% to 20%. In essence he will select those strategies which have a negative vega (κ).

1.2.1 Selling the Straddle

The purest of the selling volatility trades is the straddle where one simply does the exact opposite of those trades which make up the long straddle.

- With the *short straddle* (or *top straddle* or *straddle write*) you sell a call option and you sell a put option both on the same underlying position and maturity and with the same strike price, generally both at-the-money.

The reason that we sell at-the-money options is that these options have the greatest time value. The time value is the insurance component of the option premium and that is the amount the option writer expects to earn. At-the-money options are entirely composed of this insurance component.³

The profit pattern (at expiration) of a short straddle is shown in Figure 3a. (The profit and loss profile of a short straddle over time is presented in Figure 3b.) The strike price of the call and put options is denoted by X . The most you can make is the premiums received, if the stock price equals the strike price; if the price either increases or decreases, you realize a loss (potentially unlimited). The payoff from a short straddle is calculated below (to calculate the profit you need to add to the payoff the call and put premiums):

Payoff from a Short Straddle			
Stock Price Range	Payoff from Short Call Option	Payoff from Short Put Option	Total Payoff
$S_T \leq X$	0	$-(X - S_T)$	$-(X - S_T)$
$S_T \geq X$	$-(S_T - X)$	0	$-(S_T - X)$

1.2.2 Selling the Strangle

Another way to sell volatility is to sell a strangle. Straddles are problematic because they are only delta neutral at one point. If you are trying to maintain a delta neutral position with the straddle, when the market starts moving around, you have to constantly readjust your position to remain hedged.

- Many dealers prefer a position which may not make as much money but it is easier to manage. That is, positions which remain delta neutral over a wider range and do not require the same degree of revision. The strangle provides these kinds of benefits. Your maximum profit is spread over a much wider range.
- To create a *short strangle* (this is sometimes referred to as a *top vertical combination*) you sell an out-of-the-money call which is a short position and you sell an out-of-the-money put which is a long position. You establish this trade with options on the same underlying market, with the same maturity, and with different strike prices.

³Recall that option sellers make money in the same way as insurance companies. However, option sellers have an advantage when compared to insurance underwriters who can only sell insurance policy on one side of the market (insurance companies sell insurance, for example, to pay if your car is stolen; they cannot sell insurance against your car not being stolen).

The payoff function of a long strangle is given in the following table. The call strike price (X_2) is higher than the put strike price (X_1) :

Payoff from a Short Strangle			
Stock Price Range	Payoff from Short Call	Payoff from Short Put	Total Payoff
$S_T \leq X_1$	0	$-(X_1 - S_T)$	$-(X_1 - S_T)$
$X_1 < S_T < X_2$	0	0	0
$S_T \geq X_2$	$-(S_T - X_2)$	0	$-(S_T - X_2)$

The profit pattern obtained from a short strangle is shown in Figure 4a. (Figure 4b plots the profit and loss profile of a short strangle over time.) This is an appropriate strategy for a trader who feels that large price movements are unlikely.

- The good thing about selling straddles and strangles is that you make money from volatility decreasing and from time decay. If both occur you will have a double benefit. Time decay can become so important especially as you approach expiration that it can “save” your position even if volatility increases.
- The major problem with both of these trades is the unlimited loss potential.

A large group of individual option traders made quite a good living for many years by selling option volatility via straddles and strangles. Like the gambling house they won almost all the time. but the probabilities are against them winning all the time. If one assumes an unlimited risk potential for a long enough period, eventually one will realize that loss.

1.2.3 Buying a Butterfly Spread

- Many conservative and low capitalized traders may still wish to sell volatility but can only do so if they can limit their loss potentials. One way to achieve this is by buying a butterfly spread.

With a butterfly you sell at-the-money options that have the highest time value, and you buy out-of- or in-the-money options as disaster insurance. Thus, you are selling the options with the greatest amount of time value and you are buying options with very low time value to eliminate the unlimited loss potentials on both the upside and the downside. The spread is known as a *long* or *bought butterfly spread* because a net premium must be paid to establish the strategy.

One of the several ways to create a butterfly spread is to

- (i) buy a call option with a relatively low strike price (X_1),
- (ii) buy a call option with a relatively high strike price (X_3), and
- (iii) sell two call options with a strike price X_2 , halfway in between X_1 and X_3 . Generally X_2 is close to the current strike price.

The pattern of profits/losses from the above strategy is shown in Figure 5a. (Figure 5b gives the profit and loss profile of a butterfly spread over time.) A butterfly spread leads to a profit if the stock price stays close to X_2 but gives rise to a small loss if there is a significant price movement in the underlying market in either direction. The payoffs from a butterfly spread are shown in the following table:⁴

Payoff from a (Long) Butterfly				
Stock Price Range	Payoff from 1st Long Call	Payoff from 2nd Long Call	Payoff from Short Calls	Total Payoff
$S_T < X_1$	0	0	0	0
$X_1 < S_T < X_2$	$S_T - X_1$	0	0	$S_T - X_1$
$X_2 < S_T < X_3$	$S_T - X_1$	0	$-2(S_T - X_2)$	$X_3 - S_T$
$S_T > X_3$	$S_T - X_1$	$S_T - X_3$	$-2(S_T - X_2)$	0

⁴Note that these payoffs are calculated using

$$X_2 = 0.5(X_1 + X_3).$$

The approach to the construction of the butterfly presented above is only one of many equivalent combinations that will produce the characteristic profit and loss profile. For example, the butterfly can be constructed by using a bull call spread and a bear call spread, or by using a bull put spread and a bear put spread, or a bull put spread and a bear call spread. It is important to note that if any divergences in the values of these equivalent structures exist, there is an easy arbitrage strategy called the box which we will discuss in the following lecture.

- A butterfly is a short volatility strategy that makes money from volatility decreasing but mostly from time decay. In this case the most you can lose is determined at the initiation of the strategy thus giving it a limited loss potential. Butterflies are superb trades for under-capitalized traders who wish to sell volatility but cannot accept the unlimited loss potential associated with straddles and strangles. The profit potential has been reduced because the disaster insurance options had to be purchased, but if the market moves dramatically, these small traders will suffer a limited loss instead of being wiped out.

The traders who did not come back after the great stock market crash of October 1987 were the people who sold straddles. Straddles and strangles should be undertaken by market professionals who can withstand the possible loss potentials.

Butterfly spreads are also brilliant from a time decay standpoint, especially in the last 30 days. They decay at an extraordinary rapid pace in the last 30 days. So these trades are ideal to reap the rewards of heavy time decay without having to assume an unreasonable amount of risk (see Figure 5b).

1.2.4 Short Straddles, Strangles, and Butterflies in the Strategy Matrix

These positions are all initiated as delta neutral positions. That is, you do not know whether the market will go up or down. You would prefer that over the period it goes nowhere, if possible. For all these trades, time decay works in your favor and so does a decrease in volatility.

Which of these strategies should be used depends on whether you can accept limited or unlimited loss potential. these trades are pure volatility trades because they are neutral to the underlying market when they are established and they will get hurt equally if the market goes up or down. They are not leaning in any way, shape or form. One is simply trying to benefit from a decrease in volatility and an increase in time decay with these trades

We can fill in our strategy matrix as follows:

		Viewpoint on the underlying market (crude oil is the underlying market in this case)		
		Buyer	Seller	Neutral
Viewpoint on volatility	Buyer	<i>Buy call option</i>	<i>Buy put option</i>	<i>Buy straddle</i> <i>Buy strangle</i>
	Seller	<i>Sell put option</i>	<i>Sell call option</i>	▶ <i>Sell straddle</i> ▶ <i>Sell strangle</i> ▶ <i>Buy butterfly</i>
	Neutral	<i>Long futures</i> <i>Bull spread</i>	<i>Short futures</i> <i>Bear spread</i>	

Figure 1a

Figure 1b

Figure 2a

Figure 2b

Figure 3a

Figure 3b

Figure 4a

Figure 4b

Figure 5a

Figure 5b