CHAPTER 8

THE BUSINESS OF MARKET MAKING

For any option order that enters the pit, market makers must bid to buy or offer to sell. They are required to make a two-sided market on demand. In fulfilling these responsibilities, the market maker's goal is to accept only the amount of risk he is able to bear and to control his overall risk by trading away the particular risks he is unwilling or unable to retain for himself.

THE ROLE OF OPTIONS MARKET MAKERS

Beyond that, the market-making function is a critical component in the investment and capital formation process for four reasons. First, market makers add liquidity to the financial markets. Whether backed by large or small amounts of capital, each one has a willingness to assume risk and therefore contributes to the overall market's ability to facilitate the purchase and sale of securities with reduced price fluctuations.

Second, price efficiency is increased by the market-making function. As will be discussed later, many market makers conduct their trading through *hedging*—a process by which one security is bought and another with equal or similar risk characteristics is sold. By acting in this way, market makers keep the prices of similar securities in line with each other, no matter where the security is traded. This condition is called *price efficiency* and the presence of options market makers increases price efficiency.

Third, because hedging keeps prices efficient, options market makers also increase the ability of financial markets to transfer risk. Financial markets are composed of many participants who are willing to accept particular risks in the expectation of adequate compensation because they are better situated to accept those risks, or perhaps more expert in controlling them. The hedging process conducted by options market makers transfers risk between different market participants who would not, for a number of reasons, trade among themselves.

Fourth, by bidding, offering, and trading, options market makers provide valuable price information that is transmitted across all markets and is used in the decision-making process of other participants.

The Business of Market Making

Market making in the option pits is a business—one with its own special set of risks and rewards. Actually, the job is notorious for both big rewards and high risks; however, this reputation is only partly deserved. In some crucial respects, the "high rollers" label that often comes to mind when you think of floor traders can be misleading. In fact, the real job centers in controlling and minimizing risks. Despite the job's reputation, it's not the high-rolling gamblers who are successful over the long run.

The skill of market making is looking at trades, not in isolation, but in combinations to be bundled together as packages. A market maker attempts to trade those combinations that allow him to realize a profit and, at the same time, allow him to hedge away unwanted exposure by means of offsetting trades. The market maker's ideal trade is an *arbitrage*—a trade where there is a profit to be taken without retaining any accompanying risk.

Arbitrage trades are typically found in shades and colorations, not in pure, perfect form. A pure arbitrage—a truly rare find—is one where exactly the same fungible product can be bought and sold simultaneously at two different prices, bringing a genuinely riskless profit. Any variation from this incurs risk. Once, perhaps, there were such trades, when stock traders bought a stock in New York and jumped on their horses to ride hell-bent for Philadelphia to sell it at a price a point higher. But even then there was risk. Either the horse or the stock could take a tumble during the ride!

What options market makers typically look for, however, is not the perfect arbitrage, but a *synthetic arbitrage*. They try to synthesize one instrument out of a combination of others, and then to buy and sell the same package of risks for a profit. Their goal is to establish this low-risk combination of offsetting trades for a net profit on the whole package.

Measuring and evaluating risks can be a highly mathematical task, so that eliminating them is a highly quantitative enterprise. Ultimately, a synthetic arbitrage is a *mathematical arbitrage,* one where the mathematical characteristics of one set of instruments are combined to offset the mathematical characteristics of another. It should be clear that the market maker's job demands the fast thinking and discipline for which it is renowned, as well as complex analysis and careful judgment. A large part of being successful lies in the ability to spot synthetic arbitrage trades.

Large and Small Operations

A fair portion of market makers are "independents," trading for their own accounts. They trade as individuals relying on their experience and on the information they can gather standing in the pits. They can rely on PCs to help tally their trades and look over their positions after the close of the markets, and they may well have computer printouts or "sheets" of theoretical option prices over a range of underlying prices and volatilities. Most independent market makers usually trade without computer backup during the day. However some exchanges have set up pilot programs whereby market makers can compute option prices and keep track of their positions using hand-held computers.

As financial markets in stocks, currencies, and interest rate and other instruments have evolved and become increasingly sophisticated and interdependent, so have the options markets matured. Over the years, a range of firms have developed; they vary in their theoretical sophistication, in the complexity of their organizations, and in the power and complexity of their computer systems. Some are well capitalized, with perhaps $100 to $200 million or more behind them. They have developed sophisticated proprietary computer systems that employ their own quantitative approach to help evaluate and control their positions. They are not brokers; they do not serve customers. Instead, they are organizations trading for their own accounts.

These large firms can have dozens of traders both upstairs (off the trading floor) and down (actually in the pits on various trading floors). These firms maintain a presence on the floors of the exchanges that trade underlying instruments as well as on the floors of various options exchanges. They are organized to gather and make use of a wide range of information, both from the floors and from outside the pits. For example, their upstairs operations monitor news from many sources and relay it internally. They relay not only the news, but its anticipated impact, in the form of output from their computer models.

In between the independent market maker and the very large organization are firms with various structures, sizes, and styles. Some are simply organized teams of individual traders. Others try to differentiate roles so that some members concentrate on gathering information and providing analysis from outside the pits, while others function on the floors.

Styles of Options Trading

Besides differences in size and organization, there are differences in style among traders and trading organizations. The techniques market makers use to limit risk are multifaceted. While this section describes various styles, it is necessary to recognize that market makers can use any or all of these techniques during a day, depending on the ebb and flow of orders into the pits and the types of trades possible.

Day traders tend to hold small positions for very short times to reduce their risk and they often do not make any real attempt to hedge risks during the day. *Theoretical traders* buy what their quantitative models say, in theory, is cheap and sell what is overpriced. *Spread traders* make markets primarily in spread positions, which they then incorporate into their own overall positions. *Premium sellers* tend to sell more options than they buy because this strategy pays off as long as nothing out of the ordinary happens, but they must hurry to hedge their risks when an unusually large move does occur. And then there are those risk takers who "get a hunch, and bet a bunch."

These differences in style reflect not only how market makers take on risk and try to control it, but also how their attitudes differ. Some, such as the small independent day traders, or *scalpers,* are willing to accept the risks of briefly holding a long or short position. Others (often, but not exclusively, the larger organizations) make every attempt to hedge away as much of their risk as they can. This makes it possible for them to trade more theoretically and to hold their positions for longer periods—perhaps weeks—while they wait for prices to behave in a way that makes the theoretical edge pay off.

Together, these various styles for managing risk determine the role of the options market within the broader financial markets. The different styles of market making (arbitrageurs, day traders, theoretical traders, spreaders, and scalpers) determine how risk is distributed throughout the options markets and how much risk is transferred from the pits to outside markets.

HOW MARKET MAKERS PRICE OPTIONS

In a sense, the key to successful market making is very simple. The prescription for success is: Buy options that are cheap, sell those that are expensive, and yet eliminate the risks.

Market makers use a variety of approaches to the business, but few, if any, simply buy calls or sell puts when they are bullish and buy puts or sell calls when they're bearish. While most will *scalp* trades or *leg* into spreads on a short-term basis, they will generally not try to employ the long-term strategy of taking advantage of moves in underlying prices. The risk of simply taking direction bets, or taking on any one kind of exposure for that matter, is just too great. Those who do so don't survive over the long run.

All market makers attempt to control the risks of their positions, most of them by spreading options against other options or the underlying stocks or index futures. Easy as the prescription for synthetic arbitrage sounds, there is great skill in knowing how to follow it. First, the market maker must know what is mispriced. Second, he needs to know how to hedge away the unwanted risks. The two problems can be treated as different sides of the same coin. If the market maker can enter two or more offsetting trades that cancel out the risk, and if he can do this for a net profit, he has solved both problems.

Relative Pricing and Arbitrage Spreads

Market makers in the pit often don't need to worry about whether an option is actually overpriced or underpriced in some absolute sense. What matters is whether an option is mispriced *relative* to the underlying security or to other options at any given point in time so that the market maker can create a spread and reduce the risk of buying or selling the option.

There are a few such basic arbitrage spreads that will be examined in detail later. These spreads determine the price relationships that the underlying instrument and their various options should have to each other. When the basic price relationships don't hold, there is an opportunity for profit. The first thing that market makers learn to do when they enter the pit is to watch for the basic arbitrages. If the arbitrages are there to be done at current prices, traders spread options against options, or options against the underlying security, until their own buying and selling pressure forces the prices back into line and the possibility of further arbitrage disappears.

Synthetic Equivalents

To expand on this point, a market maker quickly learns to think in terms of synthetic equivalents. He compares prices of different combinations of puts, calls, and stock that have the very same risk exposure. Then, by buying the underpriced and selling the overpriced, he takes advantage of any mispricings and, at the same time, cancels out his net exposure by establishing an arbitrage spread. In fact, this basic technique is a fundamental part of the way that a market maker thinks when he considers what he can do at current prices.

Looking at option positions in terms of synthetic equivalents reveals alternatives. Pricing synthetic equivalents is part of the apparent "magic" in market making. It is key to understanding the professional's ability to begin making bids and offers within seconds after walking into a pit.

Let's first consider some forms of risk and examine some simple ways that the risk of one position can offset the risk in another. Owning a stock (being long the stock) is the most obvious way to take on exposure to the direction the stock price moves. Assume you are simply bullish. If the stock rises, you make money; if it falls, you lose. In either direction, the value of your position varies dollar for dollar with any change in stock price. So if you are long a stock, you clearly have direction risk.

There is an equivalent way of being long or bullish about direction—an equivalent way to acquire the same exposure with the same risk. By holding a combination of a long call and a short put (with the same strike and expiration), your exposure to movements in the stock price is identical to owning the stock itself. So a position combining a long call with a short put is called *synthetic long stock.* Why is this so? Suppose XYZ stock is trading at $100.

1. If you own the stock, you gain a dollar for every point it rises above $100 and lose a dollar for each point it falls. Now consider two at-the-money options.
2. If you own a $100 call, at expiration your position is worth a dollar for each point the stock has risen over $100. On the other hand, your call is worth nothing if the stock falls below $100.

3. If you are short a put, your position has lost a dollar for each point the stock has fallen below $100 by expiration. The short put has no value at expiration if the stock is above $100.

So the combination of (2) and (3), a long call and a short put, is synthetically equivalent to (1), holding long stock. If the stock price rises, the call is worth a dollar for each point the stock is above $100 and the short put is worthless. But should the stock fall, the long call has no value and the short put loses a dollar for each point below $100. Think for a minute about how you might take advantage of synthetically equivalent positions. At expiration, synthetic long stock and real long stock show the same net gain or loss with any change in stock price. The two equivalent positions have the same potential for gain and the same risk of loss when the stock price moves. Thus, by buying one and selling the other, you can eliminate the most significant form of position risk, namely, exposure to the direction of price movement. Buying stock and selling synthetic stock, or the reverse, results in no net direction exposure. The positions cancel one another because what you make on one, you lose on the other.

Not only is there a synthetic equivalent for long stock, there is a synthetic equivalent for any option or stock position. (See Table 8–1.) Market makers quickly learn to price options in terms of the basic stock and option positions, together with their synthetic equivalents. If prices of any options (or stocks for that matter) get out of line with other prices, market makers quickly spot the discrepancy and consider how to use the mispricing to position themselves in the option and its synthetic counterpart.

TABLE 8–1
Synthetic Equivalents for Stocks and Options

Position	*Synthetic Equivalent*
Long stock	Long call, short put
Long call	Long stock, long put
Long put	Short stock, long call
Short stock	Short call, long put
Short call	Short stock, short put
Short put	Long stock, short call

Conversions and Reversals

You've had a brief look at the basic idea of buying one instrument and selling its synthetic equivalent. Ready for more?

The two most basic forms of option arbitrage are the *conversion* and reverse conversion or *reversal.* If a market maker can buy long stock and sell synthetic long stock (or the reverse) for a net price difference that more than covers his costs, the combination of trades ought to net a profit with no direction risk. What matters is not the price of the call, put, or stock itself in isolation, but the relative price of the offsetting pieces.

For example, suppose a market maker finds 100 calls, expiring in 30 days, trading at $4 1/4 and the puts at $3 1/4 with the underlying stock trading at $100. He simply puts together the three pieces: selling the call, buying the put, and buying the stock. He takes in $1 and, at the same time, hedges away his exposure to any changes in the price of the stock prior to expiration.

Assume that carrying the stock until expiration (tying up his funds at $100 per share) costs him $100 × 10% interest rate × 1/12 of a year = 83 cents. His net profit, assuming no other costs and risks, is about 17 cents, which he can earn with no stock price exposure. All calculations should be multiplied by 100 because options cover 100 shares of stock. Furthermore, of course, appropriate interest rates need to be used in the calculation to reflect actual costs.

There is no reason to think of a conversion exclusively in terms of long stock and short synthetic stock. From Table 8–1, it is clear that a conversion can be viewed in terms of the other pieces. A conversion can be either a long call and a short synthetic call, or a short put and a long synthetic put, as well as long stock and short synthetic stock.

Of course, the opposite strategy, a *reverse conversion* or reversal, can be established if the call and put prices are out of line in the opposite direction. If, for example, the $100 call were offered at $4 and the put were $3 1/2 bid, a market maker could buy the underpriced call and sell the expensive put for a net debit to his account of 50 cents. He could then earn interest on the $100 he received from the short sale of the stock to generate a net positive return with no direction exposure.

Exclusive Deal on Interest

Readers may not be familiar with the concept of earning interest when stock is sold short because brokerage firms generally do not pay interest to individual customers. Market makers, however, who short large quantities of stock are allowed to keep the cash received when borrowed stock is sold. The cash is then invested in T-bills, and the interest income is a significant part of the profit from a reverse conversion position.

It should be apparent that the current level of interest rates determines whether a conversion or reversal is profitable. For that reason, these spreads are known as *interest rate plays*. Using his own appropriate current interest rate, a market maker calculates his "cost of carry" for the position, including the receipt of a dividend (long stock) or the payment of one (short stock). He then knows the size of the credit or debit that would make a conversion or reversal profitable, and he can examine current option prices with those values in mind.

Market makers who enter into conversions and reversals have largely eliminated their stock price risk, but they are still subject to the risk that interest rates will move against them prior to expiration. (For that reason, market makers may try to balance the number of conversions they put on against the number of reversals in order to hedge their interest rate exposure.)

There is no need to restrict this strategy to at-the-money options. As long as the put and call have the same strike price, a combination of a long call and a short put has the same direction exposure as holding the stock. However, parity, the intrinsic value of the in-the-money option, must be considered in computing the cost of carrying the spread until expiration.

For example, consider using a put and a call with a strike price of $90 and the stock trading at $100. The $90 call will be $10 in-the-money and will be trading at a price somewhere in excess of $10. Perhaps the call is trading at $12 3/4 and the put at $2. This means that the conversion, which requires buying the stock and selling the call, requires about $10 less to be invested for the holding period until expiration.

The strategy here is to put on the conversion whenever the difference between the option prices, after netting out parity, allows you to take in more than 75 cents, and to do the reversal if it costs less than 75 cents to put on the spread. This is because the cost of carry for the conversion is approximately ($100 for the stock − $10 parity received for the call) × 10% interest rate × 1/12 of a year = 75 cents.

An additional technicality to consider is that one cannot invest the full $100 price of the stock at the current rate of interest. A fee must be paid for borrowing the stock to sell short, and there are transaction costs to entering and exiting the spread. So the conversion might be profitable if the option prices differed by more than 85 cents, and the reversal might be profitable if the price difference were 55 cents or less.

To take some specific option prices, suppose a market maker finds the $90 call offered at $12 1/2 while there is $2 bid for the $90 put. He buys the call and sells the put for a total debit of $10 1/2. At the same time, he sells the stock for $100 and invests the money (minus approximately $10 he had to pay for the option spread) for a month to earn about 75 cents. After it's all over, he can buy back the stock and take off the spread. He will have taken in 75 cents in interest income and paid out 50 cents for the options, after netting out $10 parity.

Whether the options are at-the-money (or not) alters, but does not invalidate, the pricing relationship between puts and calls with the same strike. Because of these basic arbitrage spreads, at-the-money calls should be more expensive than the puts by the cost of carrying the stock until expiration. Out-of-the-money options should be priced so that the difference between the call and the put, after parity has been netted out, reflects carry costs (or interest) for the total amount invested.

If prices of any options get out of line with other prices, market makers quickly spot the mispricing, then buy whatever is cheap and sell whatever is relatively expensive—its synthetic equivalent—until their own buying and selling pressure forces prices back into line. In doing so, they are performing an important role in the stock and option markets. By forcing options and the underlying stocks to be priced appropriately relative to each other, market makers enforce pricing efficiency among the options and across the option and stock markets.

Dividends

Dividends also alter price relationships, but they do not abrogate basic pricing principles. In general, the value of a stock must be discounted by the amount of the dividend on the *ex-dividend date* (that date is the day before which an investor must have purchased the stock in order to receive the dividend). Absent of other relevant happenings, the price of a $100 stock paying a $1 dividend should be expected to fall by $1 on the ex-dividend date, and holders of record on that date should receive $1. Since the stock is worth less, an approaching ex-dividend date means that calls should be less valuable and puts more valuable. To be precise, the value of a long call and a short put together ought to be worth less by approximately the amount of the dividend than they would be without it.

The implications for conversions and reversals are fairly straightforward. If you put on the conversion—buy the stock, buy the put, and sell the call—then (since you own the stock), you can expect to receive the dividend. That means your cost of carrying the conversion is reduced by the amount of the dividend. The difference between the price you receive for selling the call and the price you must pay to buy the put—after you net out parity—needs only to exceed the new cost of carry to be profitable. That is, the call price, minus the put price after netting out parity, must be at least enough to compensate for the interest expense of holding the stock (minus the dividend that you receive). Algebraically this is expressed as:

Call price − Put price (− Call parity or + Put parity) >
Interest expense − Dividend received.

For the reversal to be profitable, the amount you must pay for the call, minus the price you receive for the put, must be less than you can expect to receive for investing the price of the stock until expiration, minus the value of the dividend that you have to pay out because you are short the stock. Algebraically this is:

Call price − Put price (− Call parity or + Put parity) <
Interest income − Dividend payout.

The basic arbitrage price relations remain intact, after some arithmetic adjustments, among all the options and their underlying stock, and market makers can establish conversions or reversals without extreme risk at all strike prices, whether or not dividends are anticipated.

Hidden Risks

From the calculations just covered, it should be apparent that arbitrage trades typically net a market maker only very small profits. The key to using these trades is to minimize any and all risks. One substantial loss can eat up all the profits from many such transactions.

This is a point well worth noting in trying to understand what a market maker does for a living. One who fails to spot a risk can lose all the profits he's made over a week, a month, or even a whole year. Two particular risks market makers must be aware of when they consider putting on reversals are especially instructive because they typify the kinds of hidden risks that many market makers learn to guard against only after harsh, expensive experience.

First, the possibility that the stock might close precisely at $100 on the day of January expiration, so that neither option is worth exercising, poses a danger to anyone carrying a synthetic long or short stock position as part of a spread. If the stock price is "pinned" precisely at the strike price at expiration so that no exercise occurs, the position can be left with direction exposure at expiration. This is sometimes referred to as *pin risk*.

Second, a reversal generates a profit because the funds received for selling the stock short can be invested until the spread is taken off—presumably until the options expire. Any reversal that involves in-the-money puts—especially if they are deep-in-the-money—involves the danger that the (short) puts will be assigned early. Early assignment would force the spread to be closed out prior to expiration. The market maker would be forced to buy back the stock when it is put to him or her. As a consequence, the interest income generated from the spread would be less, perhaps significantly less, than he or she anticipated based on the calculation for the full holding period.

Many a rookie market maker who bought out-of-the-money calls that looked cheap—intending to sell the puts and sell the stock short, then earn interest on the funds until expiration—has found himself getting "bagged" on the reversal. He thought he was hedged against any move in the price of the stock. But then he saw the price of the stock fall and found that his short puts had been exercised well in advance of expiration. Early exercise of the puts cut off the interest income he expected over the life of the options.

To see just how dangerous it can be to trade in these supposedly "riskless" arbitrage spreads, consider this extreme, but not unheard of, case. Suppose a $32 stock goes ex-dividend tomorrow and is paying a special $5 dividend. Assume further that the options expire after the ex-dividend date, but before this week is out. Entering a conversion or reversal in this stock could be a disaster for the unwary market maker. Let's see how this might work.

Ordinarily, you might expect the 30 puts, which are $2 out-of-the-money with a few days of life remaining, to be almost worthless; and you would expect the 30 calls to be worth only their inherent value of $2 because you would expect to exercise them today, prior to the ex-dividend date tomorrow. So you might consider buying the call and selling the put (and hedging with short stock) if you could pay anything less than $2.

In fact, if you pay $2 for the reversal, you will lose money. The put is worth $3, even though it is out-of-the-money! Tomorrow when the stock goes ex-dividend, the stock price can be expected to drop by $5. Thus, assuming nothing else extraordinary happens, the stock drops to $27 so that the put is $3 in-the-money. That means that later this week the put is exercised for its $3 inherent value before it expires, so the reversal should be a credit spread. That is, you should demand to be paid at least $1 to put on the reversal (because you will want to exercise your long call immediately for $2, and the short put will be worth $3 after the ex-date). Settling for anything less than a $1 credit in "buying" the synthetic stock would prove very expensive. It is the not-so-apparent risks that can prove costly to novice market makers who aren't careful in examining "riskless" trades.

Box Spreads

So far this chapter has explained why puts and calls with the same strike price must bear certain price relationships and how market makers can establish an arbitrage position if a put-call pair gets out of line. There are also other price relations that hold among options with different strike prices, and there are still other relations that hold among options with different expiration dates. Each of these relationships deserves a look.

Suppose a market maker finds two put-call pairs with different strikes that have their prices out of line in opposite respects—in one case the calls are cheap compared to the puts and in the other, the calls are expensive. For example, the $90 strike call is cheap relative to the $90 put, while the $100 strike call is expensive relative to the put.

The market maker's strategy here is to do a conversion using the $100 strike options and a reversal using the $90 strike options. Specifically, he should sell synthetic stock with the $100 strike options (sell the call and buy the put), and he should buy synthetic stock using the $90 strike. Against his short and long synthetic stock positions, he should buy and sell stock. Of course, the last step is superfluous. The two stock transactions simply net out. He can sell synthetic stock at one strike price and buy synthetic stock at another, and the option positions alone offset each other.

This strategy—long synthetic stock at one strike and short synthetic stock at another (long call, short put and short call, long put, all

TABLE 8–2
Ways of Thinking of a 90–100 Box Spread

1. Long 90 call, short 90 put, short 100 call, long 100 put
2. Long synthetic stock using 90 strike and short synthetic stock using 100 strike
3. Long 90–100 call, bull spread and long 90–100 put, bear spread
4. Short 90–100 call, bear spread and short 90–100 put, bull spread
5. Long 90–100 mambo-combo (in-the-money call and in-the-money put, also called *guts*) and short 90–100 strangle for surf and turf (out-of-the-money call and out-of-the-money put, also called *wings*)

with the same expiration)—is a basic arbitrage spread called a *box spread*. Box pricing relationships hold among options of all strike prices with the same expiration. For example, there is a 90–100 box, a 100–110 box, a 90–110 box, a 100–120 box, and so forth. If any option gets out of line, it can be bought or sold and hedged using any appropriate combination of three other options to create long and short synthetic stock at two different strikes.

As with conversion or reversal, there are various ways of thinking about a box. They are listed in Table 8–2. It is important for market makers to recognize boxes under any and all of these descriptions because it allows them to compare prices for various spreads, seen as components of other spreads, as well as for individual options and their synthetic counterparts. A mispriced call bull spread or *mambo-combo* (an in-the-money call and an in-the-money put) can be turned into a box just as readily as a mispriced put-call pair can be turned into a conversion or a box.

Box Pricing

Like conversions and reversals, box spreads should generally be regarded as interest rate plays. They are arbitrage trades in the sense that they can be expected to produce a profit whenever (1) you pay a net debit for the options that will be more than offset by the interest income returned while you hold the position, or (2) you receive a net credit that exceeds your cost of carrying the position.

To state it differently, if you buy a box, (i.e., buy synthetic stock—buy call, sell put—at the lower strike price and sell synthetic stock—buy the put and sell the call at the higher strike price), you must buy an in-the-money call and/or an in-the-money put. You are selling less expensive, out-of-the-money options. You should then expect to pay approximately the total inherent value of the in-the-money options. Normally, the four options net out to make the cost of buying a box approximately equal to the difference between the strikes. A box with strikes 5 points apart costs about $5 because of parity in the in-the-money options, and a 10-point box costs about $10 in inherent values.

More precisely (assuming no early exercise), a 10-point box should trade for the present value of $10 at expiration ($10 minus the cost of carrying the $10 investment for the life of the options). This means that boxes, like conversions and reversals, are interest rate sensitive. The price of a box spread reflects both the cost of carry for the spread for the period until the options expire and the market maker's risk from interest rate fluctuations for that period (as well as any additional costs from entering or exiting the spread).

There are some important additional factors for a market maker to keep in mind. For instance, a box comprised of American options often involves buying or selling deep-in-the-money puts, and these puts are likely to be exercised prior to expiration. If this happens, it changes the cost of carry calculations for holding the spread.

Suppose you sell a 110–120 box with the stock trading at $100 and 30 days left until expiration. That is, you sell the $110 call and the $120 put and buy the $120 call and the $110 put. You receive something in the neighborhood of $10, which is the parity value in the box (the difference between $20 for the $120 puts that you sell and $10 for the $110 puts you buy).

The Bottom Line

The question in pricing the box is: How much less than $10 should you be willing to take, given that you earn interest on the proceeds? To answer, calculate that you can invest $10 for one month at 10 percent interest to earn about 8 cents. This implies that you might be willing to sell the box for anything in excess of $9.92—8 cents less than the $10 parity value.

But there is another risk here. The deep-in-the-money $120 put will almost certainly be exercised very soon, perhaps immediately. The box does not generate 8 cents in income, since you soon have the stock put to you and, instead of the 110–120 box, you are forced to carry the $110 conversion. (You have long stock, short the $110 synthetic stock, unless you decide to exercise your own $110 put.) Clearly, you need to demand more than $10, not less, if you want to sell the box.

As a general rule, if you are short a put and the corresponding call falls below the cost of carrying the conversion, you can expect to have the stock put to you. If you have established a short box position with this in mind (so that you have covered the expense of carrying the conversion in the event of early exercise), then, when the put is exercised, selling out the "left-over" long call can produce a bonus.

Extra Premium

As can be seen, if you are selling puts that are deep-in-the-money, you need to demand extra premium. Similarly, in-the-money puts on expensive stocks command extra premium because the carrying cost for holding the stock is higher. If you sell an in-the-money put on a high-priced stock—as part of a reversal, for instance—this means that you must demand more because the put may well be exercised early, ending the income from the reversal. A market maker who is not alert to these extra complications quickly learns the painful consequences.

Advantages

Trading in conversions, reversals, and boxes gives a market maker advantages in addition to the small arbitrage profits available from the spreads themselves. Holding positions with no net exposure, but involving many options, provides a market maker with a great deal of flexibility. He has a ready inventory of long and short options, making it much easier to trade in and out of positions as the market moves. It becomes easier for him to accept some small amount of direction exposure for a short time to take advantage of movement that he sees in the market.

Consider the following example of using a box spread in a bear market. A market maker is long a box spread. He bought synthetic stock at the lower strike and sold an out-of-the-money call and bought an in-the-money put at the higher strike. Meanwhile, the stock price has dropped to a point where the short out-of-the-money call is priced below the short stock interest rebate for the stock.

The market maker can now position himself to take advantage of *bounces* in the falling market (bounces are when the market begins to go back up). He can buy in his short call with the expectation of exercising his deep-in-the-money put very soon to establish a reversal. Now, if the market bounces after he has *covered* his short call, the market maker has two alternatives available. First, he can choose to go ahead with his initial strategy by early exercising his put to establish a reversal. On the other hand, he can decide to sell out the call once again. This re-establishes the short synthetic stock position for his original box. As such, this tactic allows him to re-establish his original box to capture a *scalp profit* from the amount the call price rose during the bounce.

Jelly Rolls and More

It is November. Suppose that a market maker finds two mispriced put–call pairs. This time they have the same strike price, but differ in expiration cycle. That is, he finds an expensive call and a relatively cheap put (with a January expiration) and a cheap call and expensive put (with an April expiration), all with a $100 strike price. He then does a conversion with one pair and a reversal with the other, just as he would to establish a box. In this case, he should sell synthetic stock using the January options and buy synthetic stock using the April options. To hedge, he could buy stock to offset his January options and sell stock to offset his April position. The stock positions net out, at least until January expiration, leaving him with short January synthetic stock and long April synthetic stock.

This position is called a *jelly roll,* commonly shortened to *roll.* It is the basic arbitrage that interrelates options across various expirations, and, together with conversions and box spreads, it serves as the basis for valuing all options in relation to other options.

Jelly rolls may sound like complicated spreads—long a call with one expiration, short a call with a second expiration, and the reverse with the corresponding puts. But they are fairly easy to spot because they can be seen as two *time spreads*. And time spreads trade frequently in the pits. (See the discussion of trading time spreads later in this chapter.)

Pricing jelly rolls is fairly straightforward, once you understand conversions and reversals. A long jelly roll like the one just described (long the April 100 call, short the put and short the January 100 call, long the put) simply turns into a reversal at January expiration. To see this, consider what happens at January expiration. Either the stock price is above $100, in which case the short January call is exercised, leaving the market maker short stock and long April synthetic stock; or the stock price is below $100, in which case the long put should be exercised to produce the same position. In either case, the market maker has a reversal with three months' life left in the options. Long or short jelly rolls are priced as if they were reversals or conversions with three-month carry periods.

Of course, there are more of these basic arbitrage spreads. A spread involving put-call pairs with different strikes as well as different expirations is called a *time box*. Such a combination is a box that lasts until near-term expiration and then turns into a conversion or reversal for the time remaining until the farther-term options expire.

In each case, there are risks and complications to consider. Arbitrage spreads can seem risk free at first glance, but experienced market makers know the hidden risks involved in each kind and can quickly price the spreads to compensate. They have learned from experience which spreads require a premium and which spreads shouldn't be entered into at all.

THEORETICAL VALUES AND VOLATILITY

Options have a host of uses for end users in controlling and modifying various forms of risk. Indeed, options are capable of repackaging risks in infinitely many ways and can be used to eliminate, accept, or transfer combinations of exposure and risk. A glance at Table 8–3 should make it clear that different spreads carry different degrees of exposure. Option position risks can be classified into four fundamental types:

1. Exposure to the direction of the underlying security's price moves.
2. Exposure to the volatility of stock prices—the amount of price movement without regard to its direction.
3. Exposure to the options' time decay—the tendency of options to lose time premium as they near expiration.
4. Exposure to changes in the cost of carry (changes that derive primarily from variations in short-term interest rates or changes that can result from inaccurately forecasted dividends).

In buying or selling options, market makers take on exposure to each of these forms of risk. They can then choose either to accept them or to hedge them away, totally or partially. The arbitrage spreads discussed earlier are examples of strategies for eliminating direction exposure and, in most cases, time decay and volatility exposure.

Market makers would be fulfilling their role in its simplest form if they simply bought whatever options were undervalued, sold options that were overvalued, and then proceeded to eliminate all the risks

TABLE 8–3
Risks (and Rewards) of Arbitrage Spreads

	Direction Risk/Reward	*Volatility Risk*	*Time Decay Risk*	*Interest Rate Risk*
Long/short stock*	High	—	—	Low
Long naked options*	Moderate to high	—	High	Moderate
Short naked options*	Moderate to high	High	—	Moderate
Bull/bear spreads*	Moderate	Moderate	Moderate	Low
Conversion/reversal*	Low to none	Low to none	Low to none	High
Long box*	Low to none	Low to none	Low to none	High
Short box*	Moderate	Low to none	Low to none	High
Jelly roll*	Low to none	Low to none	Low to none	High
Long time spread*	Low to moderate	Low	Low	Low
Short time spread*	Moderate	Moderate	Moderate	Moderate
Backspread (long options delta neutral)	—	—	High	Low
Vertical spread (short options delta neutral)	—	High	—	Low
Long butterflys*	Low	Low	Low to moderate	Low
Short butterflys*	Low to moderate	Low to moderate	Moderate to high	Low

* Denotes spreads that are one-to-one in nature and are regularly quoted as spreads in most option pits.

entirely. Of course, this is much too simple to be practicable. In fact, market makers accept uncertainty when they buy or sell options; and, in practice, they must leave some risks unhedged. Competition often forces them to accept some risks just to be included in trades. Sometimes there are no immediate and efficient means available to eliminate all the risks. If, for example, all options are underpriced for a period, there are no expensive options to sell that will enable the market maker both to establish a hedge and to lock in his edge.

More often, market makers accept and retain particular risks with studied intent. When they find options significantly underpriced, they may well be willing to accept certain risks in buying the options as long as they can eliminate the most dramatic and potentially devastating ones.

Most simply will not accept direction risk for more than a very short time. There are many, usually individuals, whose style is to *scalp* or *day trade*, trying to take advantage of intraday price trends by buying calls and selling puts when stock prices are on the way up, or reversing the tactic when prices fall. Even these traders trade out of their positions as quickly as possible as a means of minimizing danger, and none retain any heavy exposure to the direction of stock prices overnight. It's just too easy to sustain a devastating loss when taking on this kind of exposure.

On the other hand, most market makers are willing to accept some volatility exposure that comes with being net long or net short options. For the same reasons they are unwilling to accept direction exposure—largely because a sudden big price move in the wrong direction could put them out of business—they are willing to take on volatility exposure. In other words, if they can hedge away their immediate exposure to the direction of prices, a sudden move in underlying price is unlikely to result in a major loss. Although the volatility component in option premiums can increase or decrease dramatically, even a fairly large change in volatility would be unlikely to be devastating.

Now let's look at how market makers decide when to take on volatility exposure, taking a chance in expectation of a profit. To put it another way, we'll look at how traders decide when options are over- or underpriced, when the mispricing doesn't reflect some interest rate versus cost-of-carry considerations.

A Tool for Accepting Volatility Exposure

Earlier, you saw how interest rate and dividend considerations affect price relationships among different options, and between options and their underlying stocks. You saw how market makers determine theoretically correct option values, given current prices for other options, and how they act upon relative mispricings when they discover them to create spreads sensitive only to interest rate fluctuations (and perhaps changes in dividends).

Consider for a moment the factors that affect the price of an option—the variables in the option pricing models. These include:

- The current underlying stock price.
- The strike price.
- The time remaining in the option.

- The current interest rates.
- The expected dividend.
- The projected volatility of the underlying instrument.

One can make fairly reliable projections about short-term interest rates or dividends over the next few months, and it is simple to determine a value for the current stock price, strike price, and time remaining until expiration. The one determinant of option values difficult to ascertain—and even more difficult to project—is the volatility of the underlying instrument.

If you could correctly assess how volatility will contribute to the total value of options, you would have a handle on all the components of option value. You've already seen how market makers assess the value of the interest rate and dividend contributions. Knowing the volatility component would allow them to determine a single theoretically correct price for each option.

Indeed, this is just what many try to do. They purchase volatility research or, in the case of large firms, do their own research to project the volatility of the underlying instruments over the life of the options. Then they plug those volatility numbers into one of the option pricing formulas to generate a computer printout of theoretical values, or *sheets*, for the options they are trading. Armed with such a table, a professional can price options individually. He or she can decide that an option is mispriced, even though it is in line with the current prices of its counterparts.

This greatly increases flexibility. In addition to trading in the basic arbitrage spreads that take advantage of interest rate and other carrying costs, these market makers can compare market prices and theoretical values. Then they can buy and sell options one by one, intending to repackage them into appropriate bundles to eliminate risks. With a sound idea of a theoretically correct price, a market maker can buy underpriced options or sell overpriced ones. He or she can then decide independently to hedge away those unwanted risks and retain those he or she is willing to carry.

One way for market makers to think of a table of theoretical values is as a tool for deciding when to accept volatility exposure. If the volatility component in the option value is currently mispriced, market makers can position themselves to take advantage of this by buying or selling options and hedging away other forms of risk, especially direction exposure.

Volatility Premium

Assessing the value of options is fairly straightforward, except for the portion of the premium accounted for by volatility. It is easy to calculate the advantage of holding a deep-in-the-money $90 strike call option that costs a bit more than $10 in place of the $100 stock itself, and it is easy to compute the effect on the value of an in-the-money call when the stock pays a dividend.

It is much more difficult, both in theory and in practice, to determine the value of a call option that offers the opportunity to buy a stock currently trading at $100, if and only if the stock price is above $100 on a certain date in the future. This kind of calculation involves some fairly complex statistics and analysis of probabilities.

Briefly, the value of an option is a function of how likely it is to finish in-the-money and how far in-the-money. Historical research shows that, over time, stock prices approximate what statistics calls a "log normal distribution" or "bell curve." This tells a great deal about how likely a stock's price is to be at any given level two, three, or six months from now.

First, researchers know that the chance of a stock going up by $10 in a given time period is about the same as its dropping $10. We know then that a call that is $10 out-of-the-money ought to have about the same volatility premium as a put $10 out-of-the-money. Researchers also know the put-call parity thesis: Put price minus call price should equal parity, or, a put and a call with the same strike price should have the same volatility premium.

Furthermore, knowing that stock prices are normally distributed over time, it is possible to compute about how likely a stock is to be up or down by 5, 10, or 20 percent during the life of an option. The volatility (technically the standard deviation of the distribution) of an underlying stock of, for example, 25 percent simply means that the stock has a certain likelihood (about a one-third chance) of being up or down by 25 percent in any one-year period. From this it is easy to determine the probability of any size price move for any time period—in this case, the time left in the life of an option.

A volatility number indicates how much the underlying stock is expected to fluctuate. This in turn indicates the likelihood that an option has value prior to expiration, either because it is now out-of-the-money (but may finish in-the-money), or because it is now in-the-money and offers some protection. If, over a very long period, you bought options priced exactly at their (correct) theoretical values, i.e., with the correct volatility estimate, you could expect that on the average the rate of return on a typical option would be at least as great as the rate of return for the stock. This explains the justification for the option market: Expected returns from options should equal or exceed expected returns from stocks.

An Edge and a Hedge

Another way of looking at this is that, over the long run, you would do well if you bought underpriced options and sold overpriced ones. In fact, we can say just how well you should do. Over the long run, just enough options should finish in-the-money enough of the time that you should come out ahead by the total difference between actual market prices and theoretical values. Thus, buying options that are priced below theoretical value, or selling options that are priced above value, gives an investor a theoretical edge. The difficulty is to survive for the long run, so that trading options in relation to their theoretical values has the chance to pay off.

In the short run, any trade can go against you. Buying an underpriced call, for instance, may or may not pay off, depending primarily on whether the underlying price rises by expiration. The likelihood that it pays off enough to provide a return that corresponds exactly to its theoretical value is minuscule. Trading on the basis of theoretical values pays off only as a long-term strategy.

The market maker, who accepts volatility exposure and trades on the basis of a sheet of theoretical values, must find a way to reduce the risk that buying or selling options will produce disastrous short-term results. For this purpose, market makers use a trading strategy called *delta neutral spreading*. As the name implies, it is a technique to take the worst risks out of option trading by minimizing *delta* (short for direction exposure).

Delta

Many people acquainted with options know that the price of an option generally changes more slowly than the price of the underlying stock. If the stock rises $2, an at-the-money call option can rise by only $1 and an out-of-the-money call can increase by only a few cents. An in-the-money put might lose $1.50 and an out-of-the-money put might lose 25 or 50 cents.

The delta of an option is the measure of how its price changes in relation to a move in the price of the underlying stock. Technically, delta is the rate at which the option value increases or decreases for a given change in the underlying stock price. Delta tells you how much the option price should change, given a $1 move in the stock.

Thus, a 50 delta call can be expected to change in value by 50 percent of any change in the price of the stock; and a −25 delta put should rise by 25 percent of the amount of any fall in the stock price. This also means, of course, that two 50 delta options change price at the same rate (by 100 percent) as 100 shares of stock.

Many traders are familiar with delta in terms of the *hedge ratio*—the number of options it takes, given the current price of the stock and time left in the option, to hedge 100 shares of stock. It should be clear why delta provides the hedge ratio. It takes four −25 delta puts, each moving at −25 percent the rate of change in the stock price, to protect 100 shares of stock; it takes 80 shares of short stock to offset an 80 delta call. Similarly, two short 50 delta calls hedge 100 shares of long stock, and three long 33 delta calls offset the effect of a price move on 100 shares of short stock.

In other words, delta is the number of stock shares necessary to produce a change in dollar value equivalent to any dollar change in the option. You can be *long delta*—equivalent to holding a long stock position—or *short delta,* in which case your net delta is negative and is equivalent to a short stock position. Furthermore, it is often convenient to think of the underlying stock itself in terms of deltas. One hundred shares of stock will change value at the same rate as a 100 delta option. Stock can be thought of as having 100 deltas—its value changes at 100 percent the rate of its own price, and option deltas can be thought of in terms of equivalent shares of stock.

Knowing this, it is a simple matter to neutralize the price exposure of any stock or option position, however complex. You simply calculate the *net delta* by adding and subtracting the deltas of all the component options and the underlying stock.

For example, a position consisting of four long 75 delta calls, two long −50 delta puts, and 100 shares of long stock has a net delta of +300 deltas $(4 \times 75) + (2x - 50) + 100$, so the position gains or loses value at a rate three times any change in the stock price.

To take a second example, a position including three short 50 delta calls, two short −25 delta puts, and 100 shares of short stock has a net delta of −200, that is, (−3 × 50 − [2 × −25] − 100). The overall position loses 2 points for every 1 point gain in stock price, and it gains $1 for every 50 cents the stock declines.

Curve

Things aren't quite as simple as this, however. Hedging a position against price exposure can't be done once and for all. It is important to note that delta gives the correct hedge ratio (and relative rate of price change) *only for the current price of the underlying stock,* and only for the current volatility and time until expiration. Because option prices respond to changes in underlying price in a way that is nonlinear, or curved, there is a further risk that a hedged or delta neutral position will acquire direction risk by becoming unhedged.

The term *curve* refers to this characteristic of option positions to change their direction exposure with any large move in stock price. Any sizable move in stock price produces an accompanying change in the hedge ratio. A stock price move can cause a fully hedged or "riskless" position to take on direction exposure and to become unhedged at a different underlying price. The amount of curve, or change in price exposure, is indicated by the *gamma* of an option or option position.

A market maker who finds some expensive 50 delta, at-the-money calls can't just sell 20 calls and buy 1,000 shares of stock and be done with it. This will do as a start. But he must constantly adjust the hedge as the stock price changes, or as time decay or other factors change, for they produce concomitant changes in delta.

If the stock price suddenly runs up and the calls move into the money, their deltas rise. For example, if call deltas rise to 60, the trader would be long 1,000 shares of stock or 1,000 deltas, but would now be short 20 60-delta calls or −1,200 deltas (−20 calls × 60 deltas each). His position would have acquired a net delta of −200. He would be short the equivalent of 200 shares of stock while the stock price is rising.

The solution, of course, is to rehedge the position by buying 200 more shares of stock or by buying back about three short calls. Either of these adjustments probably means that he has lost money on the spread. Either he must buy more stock at a higher price to stay hedged, or he must buy back calls that have gone up in value.

A market maker can be *long curve* (long gamma) or *short curve* (short gamma). If a market maker's position is net long options or long curve, his position responds to an upward move in the stock price by increasing its delta (and responds to a price decline by decreasing the delta). A position that is long curve multiplies the bet in the direction of any price move. Conversely, a position that is short curve responds to a major price move by increasing the bet against a continuation of the trend. Either way, the position requires constant adjustment in the face of trending prices to remain hedged and avoid taking on price exposure.

Volatility Plays

The kind of "dynamic" option trading that requires constantly adjusting a long or short option position to retain minimal price exposure—to maintain a zero net delta—allows market makers to buy and sell options to act upon their projections about volatility, yet still avoid betting on the direction prices will move. Market makers typically use a *delta neutral* strategy to implement their views when they think the volatility premium in options is mispriced. That is, when current prices do not accurately reflect the volatility they expect over the life of the options.

Market makers are often willing to take a position based on volatility projections. Sometimes this is done tacitly by relying on theoretical values that incorporate a volatility estimate. Often they establish positions quite consciously because they believe implied volatility is too high or too low and that actual volatility will differ from implied.

In fact, those market makers who concentrate on using theoretical values in making markets come to think of option prices explicitly in terms of volatility. They think and speak of options in terms of their *implied volatilities* and compare the "implied" to their own projections for volatility over the near term. Implied volatility is simply another way of thinking about current prices; it is the volatility that the current option price "implies" that the underlying stock must have over the life of the option for the price to be correct. More technically, implied volatility is the number you get if you plug the current option price into a mathematical option pricing model and run the formula backward to solve for the volatility, instead of the option price.

High option prices reflect high implied volatility. An expensive option reflects the fact that the marketplace has built a high volatility estimate into the current price of the option. It shows that the market is expecting a lot of movement in the underlying stock before expiration to justify the increase.

What market makers are doing when they buy cheap options and decide to hedge them with the underlying stock—often called *back-spreading*—is anticipating that over time the options will pay off by finishing enough in-the-money (or by offering enough protection to a stock position) to more than compensate for their current price. Conversely, by selling expensive options against a stock position, they are anticipating against high volatility, prior to expiration.

Positioning to Accept Other Types of Exposure

By buying what they think are underpriced options, traders are positioned to profit if volatility rises. They often refer to such positions by saying they are *long volatility,* and they describe positions where they have sold overpriced options to take advantage of a decline in volatility premiums as being *short volatility*. Among other risks, then, a position that is long volatility is exposed if volatility declines. What's more, a trade in favor of volatility is a trade against time passing with no action. So a trader who is long volatility is exposed to time decay, even when implied volatility remains constant.

There are other ways to make volatility plays. Just as delta measures the rate at which option price changes with a change in stock price, another measure, usually called *vega* (or sometimes *kappa* or *tau*), indicates an option's sensitivity to changes in volatility itself.

Vega tells you the rate at which you can expect an option's price to change with a 1 percent change in underlying volatility. The higher the vega, the faster an option responds if volatility kicks up, and the quicker the option loses premium if volatility dies.

It follows that at-the-money contracts can be expected to have higher vegas than out-of-the-money or deep-in-the-money options. The volatility component of their premiums is much larger and is thus more sensitive to any change in volatility. It also follows that a farther-term option has a higher vega than a near-term option. The greater time remaining for volatility to act makes their premiums more responsive to changes in volatility.

This offers market makers a variety of ways to spread options against options, and vegas against vegas, to take advantage of the different rates at which options can be expected to respond to changes in volatility.

For example, time spreads can be used to make volatility plays. By buying a time spread, a market maker can act on an expectation that volatility premium will rise. In general, by spreading options with different expirations and, at the same time, keeping the overall position delta neutral, traders can construct low-risk positions that profit when the volatility premium in one option expands or contracts faster than another.

A market maker can also trade *vega neutral* and thus hedge away his exposure to volatility changes. When he finds a disparity between two implied volatilities, by spreading one option against the other in a ratio that produces a zero net vega, he can wait for the high and low implied volatilities to come back into line, without exposing himself to the risk that volatility will change drastically in either direction.

Akin to the delta and vega thermometers, there are measures of other kinds of sensitivity and risk. They can be used to indicate risks to be avoided or eliminated, or they can be used to search out ways to take on just the exposure a market maker wants to accept.

As pointed out earlier, the mathematical measure of the curve or direction instability of an option position is the *gamma*. This measure tells you the rate at which you can expect delta to change with stock price. It indicates how fast an option position can be expected to become unhedged, if there is a move in the underlying.

Gamma can be used to recognize unstable hedges and to anticipate the size of price moves that require quick readjustment of the hedge. By buying and selling options with offsetting gammas (to reduce curve), a market maker can greatly increase the stability of his hedge across a range of underlying prices.

Just as delta is dependent on the current price of the underlying stock, it is also dependent on the time left in the life of an option and on the volatility premium built into the current price of the option. Any delta neutral spread must be adjusted to maintain its neutrality as time decay occurs. Moreover, it must be rehedged as market conditions change to produce different implied volatilities.

Similarly, a market maker can hedge away his exposure to volatility or to time decay by trying to neutralize vega and *theta*, the measure of time decay, just as he can hedge away gamma. Of course, when he does, he no longer has a position that benefits from an increase in volatility. Once all the risks are hedged away, the position becomes a pure arbitrage. All this can, in turn, demand further adjustment by buying or selling stock to compensate for the effect on the net delta of the position in neutralizing the other forms of exposure. Table 8–4 summarizes the types of risks inherent in basic spread positions.

TABLE 8–4
Types of Exposure for Basic Spreads

	No Delta	*Long Delta*	*Short Delta*
No curve	Basic arbitrage spreads (conversion, box, jelly roll)	Long or synthetic stock	Short or synthetic stock
Long curve	Long option delta-neutral spreads; long options versus stock; long straddle or strangle; option-to-option ratio spreads; net long options	Long call	Long put
Short curve	Opposite to entry directly above	Short put	Short call
No volatility	Basic arbs	Long or synthetic stock	Short or synthetic stock
Long volatility	Long at-the-money time spread; delta-neutral spreads, net long options; long straddle or strangle; (*not* option-option ratio spreads)	Long call; long time spread with stock below strike	Long put; long time spread with stock above strike
Short volatility	Opposite to entry directly above	Short put; short time spread with stock above strike	Short call; short time spread with stock below strike
	No Curve	*Long Curve*	*Short Curve*
No volatility	Basic arbs	No such spreads	No such spreads
Long volatility	Long ratio time spread (e.g., +1 May, −2 Jan. options)	Net long options	Long a-t-m time spread
Short volatility	Opposite to entry directly above	Short a-t-m time spread	Net short options

TABLE 8–4 *(concluded)*

	Accompanying Risks		
No delta	No current price risk	No curve	No risk from price instability
Long delta	Downside price risk	Long curve	Risk after large price move; risk from time decay
Short delta	Upside price risk	Short curve	Risk from any large price move
No volatility	No exposure to changes in expectations		
Long volatility	Risk from decrease in volatility expectations; risk from time decay		
Short volatility	Risk from increase in volatility expectations		

Removing the Risks of Index Options

You've seen how market makers can use various combinations of equity options, together with underlying stocks, to selectively remove any or all of the risks inherent in buying and selling mispriced options. By eliminating risks selectively, they can construct positions that contain precisely the amount of exposure desired. Most frequently, they trade against the market's assessment of the volatility of a single underlying stock by buying or selling options. Then they use the stock itself to remove exposure to the direction of price movement.

In the index pits, market makers use the same approach to take positions on the volatility of the market as a whole—at least as measured by a particular index such as the S&P 100. They position themselves as net buyers or sellers of index options and then neutralize the index delta. This leaves them with no net exposure to market direction, but with a position that profits from an increase or decrease in volatility premium that reflects their own view of index volatility.

A dilemma arises when making markets in index options that traders don't encounter when they trade options against a single underlying stock. When market makers trade equity options, they have a good, "clean" underlying in the stock itself. They can be secure in the knowledge that their stock and option positions function as a bona fide hedge to offset each other because the options settle into the stock itself. Ultimately, options even turn into a stock position, either because short options are assigned or because long options are exercised directly into the stock.

On the other hand, for the S&P 100 (OEX) and other cash settled index options, there is no such underlying instrument available to provide a reliable hedge. The OEX underlying is a capitalization weighted index, containing different numbers of shares of 100 different stocks. OEX options do not settle into shares of the stocks themselves. Instead, a cash settlement at expiration compensates for the difference in value between the expiration-day index value and the strike price of the options. There is no perfect way to adopt a position in the underlying index itself, short of holding the appropriate number of shares of 100 different stocks—an alternative that is simply too cumbersome and too costly to be feasible.

Surrogates

As a result, market makers typically choose some surrogate for the underlying index. Most turn to the S&P 500 Index and use the S&P 500 Index Futures (an index futures traded at the Chicago Mercantile Exchange). Others use "baskets" of 70, 80, or more stocks as a representative sample of the 100, which they expect to move in tandem with the actual S&P 100 Index. Still others opt for some combination of stocks and futures to serve as an accurate representation to track the underlying index.

All these alternatives share the same drawback, to a greater or lesser extent. Every surrogate shows some tracking error in any given period and, consequently, all involve some *basis risk*. That is, the *basis* (or duplication in the price movement between the surrogate being used to replicate the 100 and the index itself) varies from period to period. For any given period, the surrogate can gain or lose value, relative to the S&P 100 Index itself. Therefore a market maker's hedge can gain or lose value, relative to the option position it is being used to offset. A market maker must take the risk that his hedge is ineffective to this extent every time he uses a substitute.

In addition to basis risk, market makers face problems maintaining their hedge when exercise occurs. When OEX options are exercised, it's a *cash settlement*. This means that the market makers' option positions are eliminated in favor of cash, yet the position adopted in the surrogate for the underlying S&P 100, whether a position in index futures or a basket of stocks, is unaffected by the exercise. The market maker, left with an unhedged position in his surrogate for the underlying index, must accept considerable exposure.

This represents a problem not only at expiration, but at any time the market maker (short options) finds options getting deep in-the-money. If the market maker is short deep-in-the-money, American options like the OEX, against a position in the actual stocks, the options can be exercised on any given day. This leaves the rest of the position in the stocks and equity options entirely unhedged because the index options settle for cash while the stock position remains unaffected by the early exercise. The unfortunate market maker starts the next day with a huge *leg,* totally exposed to any sudden move in the market.

Trading a Portfolio Delta-Neutral

You have seen that the basic strategy market makers use, whether they are trading equity or index options, is to buy or sell mispriced options and then to repackage options in bundles that eliminate unwanted risks. Such bundles can be small or large, combining an option or two with a position in the underlying instrument, or packaging together a number of options with different strike prices and expirations.

Furthermore, just as you can control the exposure of any position combining a single underlying stock or index and its options, you can also control various forms of exposure for a whole portfolio of stocks and options by treating the whole portfolio as one huge bundle of options and underlying instruments.

The same alternatives available for managing the exposure of a portfolio of stocks can be used to manage a portfolio of options. Fortunately, all the different types of exposure are simply additive. If volatility exposure on one contract is X and volatility exposure on another is Y, the total exposure to changes in volatility is just $X + Y$. This is also true for direction exposure and all other forms of risk. This means the overall delta or total exposure to market direction can be controlled with index products. Similarly, you can control the exposure of your portfolio as a whole to changes in market volatility and time decay with index options.

How to Do It

Starting with the most basic position, suppose you owned a portfolio of 50 or 60 stocks with no option position. Obviously such a portfolio's price exposure could be neutralized with S&P 100 (OEX) options. After all, controlling portfolio price exposure is precisely one of the purposes for which the OEX was designed.

To eliminate price exposure, first compute the *beta* of your stock portfolio relative to the S&P 100 Index, and calculate the number of options required to match the dollar value of your stock holdings. Then, by selling index calls which neutralizes the upside exposure and buying puts to protect the downside, you can design a hedge that neutralizes the portfolio against any price move.

The same general approach also works for a portfolio that includes equity options, along with the underlying stocks. However, the portfolio cannot be neutralized with this simple technique across a sizable range of market values. Remember that options change their own exposure with moves in the underlying stocks, as well as with changes in time and volatility.

At any given time and market level, the net delta for each stock, taken together with its options, indicates current exposure to price movement in that stock. Simply think of *option deltas* as shares of stock currently held. By totaling the current option deltas and the shares of actual stock held, you end up with a *net delta* which tells you your position in equivalent shares held. (Note again that this number changes over time and changes in stock price.)

If you know your current net delta stock by stock, you have a measure of your current exposure in each stock. This, in turn, enables you to neutralize your current market price exposure with index options, just as if you held a portfolio of the stocks alone. By selling index calls and buying puts, assuming your overall position is long (your portfolio's net delta is positive), you can maintain a zero net delta for the whole portfolio.

Of course, you are not restricted to using index options to control price exposure. Clearly, you can always buy and sell the stocks themselves. Furthermore, with some additional minor adjustments for beta, you can also use S&P 500 Index Futures to control your market direction exposure in much the same way you could adjust the net delta of a position in a single stock's options by buying and selling the underlying stock. You can use any index options that fit the makeup of your holdings, not only as one more tool for controlling direction exposure, but also for helping control other forms of exposure.

A good way to close this topic is with one final, provocative point. Market makers can control more risks than just their exposure to market direction at a portfolio level. A portfolio of stocks and options has a net gamma, a net vega, and a net exposure to time decay, just as it has a net delta. All these forms of risk can be addressed at both the micro-level of individual securities and at the macro-level with index products in the portfolio.

This is certainly not to say that the intricacies of how to go about controlling these risks at a portfolio level are easy, either in theory or in practice. It is to suggest, however, that market making in its purest form, where the market maker buys and sells options and eliminates all the risks it is possible to hedge, can be done in a wide variety of ways with a host of instruments.

Obviously, a market maker or market-making organization must have a fairly large position to even consider controlling exposure at a portfolio level, instead of stock by stock. Nearly all floor traders approach the task of managing their risk in discrete chunks, largely because they are standing in the pit where it's easier to control exposure a bit at a time. By bundling together combinations of options and stocks into groups (each of which is relatively free of those risks), a market maker can move on to other trades without undue concern over how each new purchase or sale will affect the exposure already inherent in the overall position.

TIME SPREADS, BUTTERFLIES, AND OTHER TRADING TOOLS

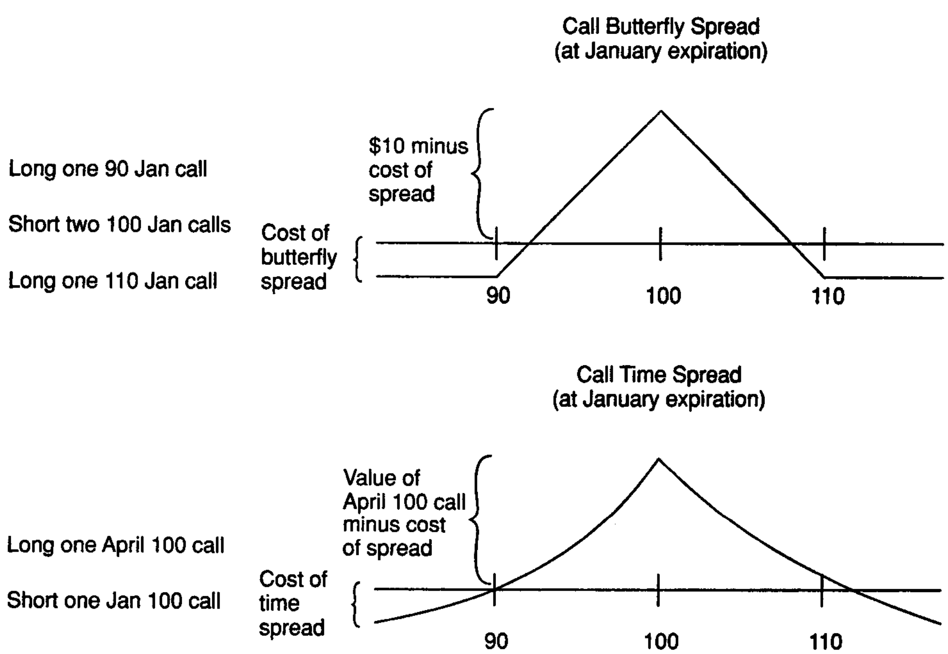
In theory at least, the basic arbitrage spreads have no exposure to underlying price movement—not to direction, size, or volatility. Often it's not easy to establish an arbitrage to lock in the edge from mispriced options. There are two other spreads that are not truly arbitrages, but that do deserve special discussion because they are staple items in a market maker's toolbox. They play a basic role in his or her strategies for bundling options into low-risk spreads to take advantage of mispricings and for trading in and out of other spread positions.

Butterflies and *time spreads* are themselves low-risk combinations of options. What's more, they can be recombined in various ways to produce arbitrage positions with even lower risks. For this reason, market makers learn to price and trade butterflies along with the basic arbitrage spreads even before they begin trading. Veteran traders keep their eyes on time spreads to give them a feel for price relations across different expirations.

While these two types of spreads retain some risks besides interest rate exposure, they are low-risk positions because all forms of exposure are at least partially hedged. However, establishing a time spread or a butterfly is to accept some risk. It is to take a position on both the price at expiration and the upcoming volatility of the underlying stock.

From Figure 8–1, it may be apparent that both kinds of spreads result in a profit or loss depending on whether the stock price lies within a particular range when expiration arrives. It might also be clear that there is indeed a volatility component to the pricing of these spreads, though it is dampened by the fact that the spreads include both long and short options.

FIGURE 8–1
Profit and Loss Profiles for Butterflies and Time Spreads



Time Spreads

A one-to-one time spread (also called a *calendar* or a *horizontal spread*) simply involves buying a call (or a put) with one expiration and selling the same strike call (put) with a different expiration. For example, buying a call time spread in November, which would result in a debit to the market maker's account, might involve buying a more expensive April call and selling a near-term January call with the same strike.

The value of a time spread at any given point during the life of the two options (including the moment of expiration for the near-term option) is just the difference between the values of the long and the short options. The spread value of a one-to-one call or put spread is the value of the more expensive farther-term option, minus the value of the nearer-term option. At near-term expiration, the expiring option is worth its intrinsic value. (If in-the-money, it is worth parity; if out-of-the-money, it is worth nothing.) At expiration, the spread is worth the value of the far-term option with parity netted out.

Assuming three months between the option expirations, the value of a time spread is three months' worth of time value or volatility premium. Note that this may not be the same as the time value of an option that expires three months from today. The particular three-month period covered is important. Whether dividends are expected or there is potential for important news during the period beginning with the near-term expiration and ending with the farther-out expiration, can make a major difference in spread value.

You may recall time spreads from the discussion of jelly rolls because a jelly roll arbitrage across two expirations can be seen as composed of two time spreads—a long (short) call time spread and a short (long) put time spread. Market makers often use jelly rolls as expiration approaches to *roll* other positions into the next expiration—hence the name *roll*. Doing so is simply a matter of trading in expiring options for others with more distant expirations—a matter of trading time spreads.

The important points to note for now are:

1. The availability of low-risk time spreads gives market makers a host of alternatives as expiration approaches besides closing out all their expiring option positions, or letting all their in-the-money options be exercised into stock positions.
2. Time spreads (and jelly rolls) allow market makers to extend pricing relationships across different expirations so that risks can be controlled, or even totally neutralized.

3. Time spreads allow market makers to manage their positions over different time periods. They can adjust their exposure in light of not only *what* they expect to happen, but also *when* they expect it to happen.
4. Time spreads, either one-to-one or in other ratios, can be used to manage other risks inherent in options besides just direction exposure. Hedging option positions with other options having different expirations provides a technique that is crucial for controlling exposure to volatility and time decay.

Primarily because they are so critical for controlling position risks, time spreads are frequently traded on the floor and priced as spreads. They are not nearly as important for their role as speculative vehicles as they are for their role as risk management tools.

Trading Time Spreads: A Conflict in Intuition

Time spreads are unusual among the strategies traders have at their disposal. They are rarely put on as freestanding spreads; more often they are used as a hedge in conjunction with other spreads. This stems from an odd combination of characteristics that make time spreads too inactive in price to make much money, but still capable of serving as an effective hedge.

It's curious that a spread that does not move enough to justify putting it on for its own sake is used to hedge something else. Although a time spread does not show the dramatic range in value that characterizes its counterparts, it responds predictably to changes in the market and can be relied on to offset the effects of another spread.

Nonetheless, time spreads are worth using as trading vehicles in their own right, and it is important to understand how they behave. These spreads have a peculiar kind of exposure to each of the various determinants of option price—underlying price, interest rates, dividends, volatility, and time. What's more, the nature of this exposure changes as time passes or as the spread moves farther in- or out-of-the-money.

Assume you're long a time spread with two months until near-term expiration (you're long a 120-day option and short a 60-day option with the same strike). Now take a look at the risks and the profit potential.

The spread, with 60 days left in the short options, does very little for a while unless something dramatic happens. An at-the-money time spread remains passive, earning little money as time decay slowly erodes the short options, until rapid time decay begins to affect the near-term options about five or six weeks prior to expiration. (In-the-money or out-of-the-money time spreads gain very little from time decay, since there is little time value to erode in the short options.) In this sense, the time spread is like a *vertical*—selling options against the underlying or against deeper in-the-money options; it profits from price stability as time goes by.

If a time spread is established at-the-money and the underlying price moves away from the strike, however, it can be expected to lose value since the spread is long time premium and the time premium in options that are away-from-the-money is much less than the time premium of those at-the-money. In this way, too, time spreads are like verticals: a move of the underlying away from the strike price produces a loss.

There are some important respects, however, in which time spreads are unlike verticals. In many ways, time spreads behave more like *backspreads*—the mirror images of verticals. This makes the behavior of time spreads seem counterintuitive to traders used to trading volatility by dealing in backspreads and verticals.

You expect a vertical, like a time spread, to gain from time decay and lose from a large price move, but in a vertical spread you are net short volatility premium. A time spread is long volatility premium. The value of the spread, after all, is just the difference in volatility premium between a long option with a lot of time (or volatility premium), and a short option with relatively little volatility premium. Consequently, a time spread is like a backspread and unlike a vertical in the way it responds to implied volatility: An increase in implied volatility benefits the spread and a decrease produces a loss or reduces the profit potential.

Yet, unlike a backspread, an at-the-money time spread is hurt by a large price move usually associated with high volatility. If prices move away from the strike, there is little of the volatility component left in the price of either option, so there is little difference between the two option prices and little value left in the spread. Not only do you lose more volatility premium in the far-term option, but there is less time value left in the near-term option left to decay. So room for profit from time decay has dried up.

For similar reasons, anything that might alter the effective expiration date—a large dividend, a takeover, a major restructuring—dramatically reduces the value of the time spread because the far-term options are worth no more than the near-terms. If this happens, the holder of the spread loses whatever he paid for it.

All this should help make clear why time spreads can seem so counterintuitive and even unpredictable. If you are long an at-the-money time spread, you want stability and you profit from time decay, despite the fact that you are long time premium. You are long volatility premium, but you don't want volatility—or at least not a big price move. You want higher implied volatility, but you don't want underlying prices to exhibit volatility by moving away from the strike price.

What makes a time spread attractive as a trading vehicle is that it allows you to bet in favor of stability and time decay, but with limited risk. You can lose only what you paid for the spread.

Furthermore, time spreads are quite predictable in various ways. Dividends and interest rate changes affect them in very predictable ways. For example, suppose you suspect interest rates are going up. Remember that a far-term call has a greater interest rate component than a near-term. An increase in interest rates benefits your far-term options more than the near-terms. You can play it the opposite way with puts where the effect of interest rates is negative.

The strategy can be inverted for dividend plays to anticipate a higher or lower dividend than generally expected. The value of calls, for example, involves subtracting the expected dividend. A dividend increase, assuming it affects two dividends prior to far-term expiration versus one before near-term expiration, reduces the price of the far-term option more than the near.

However, the most common scenario is one where nothing much changes very dramatically—not dividends, not interest rates, not implied volatility, and not any dramatic movement in underlying price. This is the kind of scenario where an at-the-money time spread can be established to produce a profit without much risk. The risk is simply that the spread value collapses if something dramatic does happen. When a time spread moves away from-the-money, it becomes very cheap.

This risk has a flip side: Time spreads that are already away from the money are very cheap, and they have the potential to expand dramatically under certain conditions. They can function as valuable hedges in combination with other spreads. They can provide cheap disaster insurance. If, for instance, your overall position has exposure at a particular price level above or below current prices, buying out-of-the-money time spreads at that level can be an effective hedge for that exposure. Out-of-the-money time spreads are a cheap hedge if the underlying price moves toward the strike.

Although they are a complex and sometimes counterintuitive trading tool, time spreads can also be extremely valuable to experienced traders who take the trouble to learn their intricacies.

Butterflies

A *butterfly spread* is a combination of four options (all calls or all puts) involving three strike prices, though just one expiration. A long butterfly—one that involves buying the "wings"—is composed of a long option, two short options at the next higher strike, and a long option at the strike above that. For example, a 50–55–60 call butterfly consists of a long $50 call, two short $55 calls, and a long $60 call. The corresponding put butterfly simply substitutes puts for calls, so it includes a long $50 put, two short $55 puts, and a long $60 put.

An alternative way to think of a butterfly is to pair the options as bull and bear spreads, also called *vertical spreads*. A long 50–55–60 butterfly is a $50–$55 call (put) bull spread combined with a $55–$60 call (put) bear spread.

Profit/Loss Profiles

Butterflies are limited risk, limited profit spreads. Taken by itself and carried to expiration, a butterfly spread succeeds or fails to make a profit depending on whether the underlying stock price closes at expiration within a particular range. The optimal result for a long butterfly is for the stock to close exactly at the middle strike price. In the example just given, having the stock close precisely at $55 would leave the two short $55 options and the long out-of-the-money option worthless with the in-the-money option worth a full $5. The spread would be worth $5 at expiration.

Any move away from the middle strike price makes the spread less valuable. The call butterfly, for instance, loses value from $55 down because the long in-the-money $50 call loses; it loses value from $55 up because the two short $55 calls produce twice as much loss as any gain from the single long $50 call.

Butterflies have limited stock price exposure, however. They cannot produce a loss greater than the premium initially paid for the spread. To return to the call butterfly at expiration, below $50 all the options, long or short, are worthless, so the spread cannot lose more than you have invested in it. At $60 the values of the long $50 call (worth $10) and the two short $55 calls (each worth −$5) cancel one another (while the $60 call is worthless). As the price escalates above $60, the two long options gain value at the same rate the two short options lose. In no case, then, should the spread result in a loss greater than the initial investment. Thus, a long butterfly is exposed to losses on either side of the middle strike price across the "body" of the butterfly, but the exposure is limited by the butterfly's "wings." Partly because of their limited loss features, butterflies are especially valuable as *inventory*—tools for trading in and out of other positions.

The way butterflies respond to price swings is unique. With options that have a great deal of time left, a butterfly does not react dramatically to moderate price moves. Only large moves produce a significant response in the spread price. So sensitivity to price movement is reduced to a minimum if expiration exceeds 60 days.

Volatility affects butterflies, but, again, their sensitivity is minimal as long as there is a lot of time remaining. Time decay does affect a butterfly, primarily because the out-of-the-money options become completely worthless, but most decay comes in the last few weeks before expiration.

This means that for the farther-out options a butterfly is a very effective tool for packaging trades into low-risk bundles to be thrown into *the spread hopper* and set aside until needed. Price movement won't hurt butterflies day by day, and they can always be taken back out of the hopper when there is an opportunity to use the inventory.

Typically, the same profit/loss profile as a butterfly can be achieved by selling the mid-strike straddle and buying the surrounding strangle—a spread nicknamed the *iron butterfly*. For example, the profit profile from a 50–55–60 call or put butterfly could be duplicated by selling the $55 straddle and buying the $50 put and $60 call or the 50–60 strangle.

You've seen how jelly rolls can be seen as combinations of time spreads, which in turn can be separated and recombined into other spreads. Similarly, butterflies can be seen as combinations of bull and bear spreads, which in turn can be recombined to form *boxes*. By buying a call butterfly, for instance, and hedging the risks by simultaneously selling a put butterfly, you can establish a *double box* or *double butterfly* spread (for example, a long 50–55 box and a short 55–60 box) that is free of direction and volatility exposure. (See Table 8–5 for a look at some of the various combinations.)

A look back at Figure 8–1 should make it clear that butterflies and time spreads have similar value (or profit/loss) profiles. For times well

TABLE 8–5
Some Ways to Think about Butterflies and Boxes

Long 50–55–60 call butterfly	Long 50 call		Short two 55 calls Long 60 call
		or	
	50–55 call bull spread		55–60 call bear spread
Long 50–55–60 put butterfly	Long 50 put		Short two 55 puts Long 60 put
		or	
	50–55 put bull spread		55–60 put bear spread
Long 50–55–60 iron butterfly	Long 50 put and 60 call		Short 55 call and short 55 put
		or	
	Long 50–60 strangle		Short 55 straddle
Double box or double butterfly	Long 50–55 box		Short 55–60 box
		or	
	Long 50–55–60 call butterfly		Long 50–55–60 put butterfly

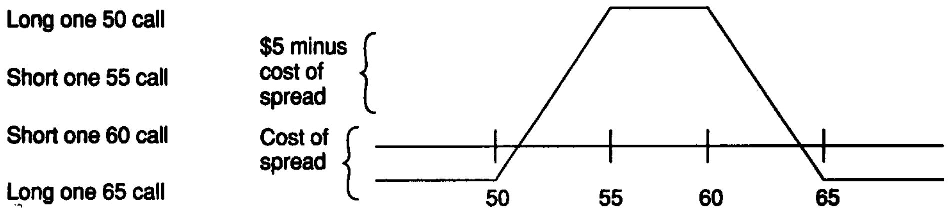
prior to near-term expiration, the way time spread values change with underlying price is virtually identical to the way butterflies respond to price changes.

This suggests that the two spreads might be used to offset each other's risks. Not only can call butterflies be hedged against put butterflies (to form double boxes or double butterflies), and call time spreads hedged with put time spreads (to form jelly rolls), but market makers can also trade time spreads and butterflies against each other to form an indefinite number of reduced-risk positions.

What's more, each of the spreads can be extended in various ways to produce an array of spreads with an array of risk profiles. Butterflies, for instance, need not be restricted to consecutive strikes. You might, for example, want to construct a 50–55–65–70 butterfly by getting long the 50–55 call spread and short the 65–70 call spread.

The combinations for constructing different versions of the basic butterfly are limited only by the number of strikes available. A common name for any of these elongated butterflies is the *condor*. Other nicknames for this sort of spread are the *top hat, flat-top,* or *pan-head butterfly*. Condors have elongated profit patterns, hence the name. (The body is longer than a mere butterfly.) Unlike the basic, consecutive-

FIGURE 8–2
Profit Profile for a Top Hat, Flat-Top, or Pan-Head Butterfly



strike butterfly, there is no single point at which the profit is maximum. Instead there is a fairly large range (determined by the strikes selected and their prices) over which the spread earns its maximum profit. The profit profile at expiration is illustrated in Figure 8–2. Typically, condors are much more expensive than basic, three-strike butterflies because they have an extended profit zone. This squares with intuition: Anyone willing to take a view about the stock that requires the price to fall within a narrow range should have to pay less than someone who wants to profit across a broader range.

Trading Butterflies

Butterflies offer the trader a multitude of alternatives and almost unlimited flexibility. To see this, take another look at the equivalence between a basic call and an iron butterfly.

If you start with a call butterfly (e.g., long the 50 call, short two 55s and long a 60), then sell a 50–55 box (a totally neutral addition), notice that you end up with an iron butterfly. You end up short the $55 straddle and long the $50 put and the $60 call. It follows from this that selling the straddle and buying the strangle should put a credit in your account because, in effect, you are short a box for a large credit and long a butterfly for a small debit.

The beauty of the butterfly is that it gives the market maker the ability to make a mistake—yet various ways to correct it. He has three other sides of a trade to make up for the errant initial trade. If, for example, he buys one option, and that trade seems to be going against him, he can sell two options and wait for the third side to come his way. On the other hand, if he sells a call option and it starts to go against him, he can buy a deeper call and wait to sell the higher bear spread at a better price.

The only way a trader really gets hurt moving in and out of butterflies is in very *whippy markets*. Then he can either buy the strangle and sell the straddle when it gets to his price; or he can sell the straddle when the market is whipping back and forth within a narrow range, then buy the strangle when it comes to his price.

Characteristics of butterflies change dramatically as time till expiration becomes short. What was a low-risk spread takes on several types of exposure that just weren't there before. But as a trading vehicle while there are several weeks left in the option contracts, butterflies are a nearly perfect trader's tool.

WHAT IT TAKES TO BECOME A MARKET MAKER

Becoming a market maker may seem a simple matter of joining an exchange and starting to trade, but there is a great deal more to it. Becoming a market maker amounts to starting a business—one that could range in size from one person trading his or her own small account independently, to a large and complex operation. Setting up such an operation requires both a heavy capital investment and a heavy investment in time, energy, and hard work.

More importantly, market-making demands some very special expertise. Developing that expertise requires native ability and a lot of homework, practice, and experience. The next part takes a careful look at the knowledge and skills market makers have to acquire. First, though, here's a brief look at some of the requirements for setting up a market-making business.

Costs and Commitments of Market Making

First, of course, are capital considerations. Trying to run any undercapitalized business is very risky. Market making is no exception; a market maker needs adequate trading capital to survive, even for the short term. Currently, ''adequate'' means an amount in excess of $100,000, even if the market maker plans to trade independently only in his own ''small'' account.

The second major capital consideration is arranging for a seat. Memberships on the major futures and options exchanges are now priced in the neighborhood of $300,000 to $500,000. In addition to full memberships, some exchanges offer less costly partial memberships or trading permits with trading rights for a limited number of products. Alternatively, seats can be leased for about $3,000 to $6,000 a month to leave capital free for trading.

Additional costs include initial fees in the neighborhood of $2,200, plus the on-going costs of doing business, such as securing office space, hiring a clerk, and obtaining computer facilities. Other daily costs to anticipate are paying the basic contract rate, arranging a volume discount, forking over fees for stock executions or index futures trades, and so on.

But it's more than a thousand dollars here, a thousand there. Ever think about where you train for trading pits? Well, nearly every business or profession has a structured and often institutionalized way to learn the ropes and get started. Doctors and lawyers go through professional schools and internships; engineers train on the job after mastering the technical material in undergraduate and graduate programs; and other businesses have lengthy formal training programs. Our industry, however, lacks a formal or standardized structure for initiating new traders into the business.

To make things worse, this is probably one of the most expensive businesses in which to get started because it involves such high financial risk. Part of the cost of entry into this business is the cost of inexperience. Not every market maker loses money in his first month, but a great many do; not every market maker blows out in his first month, but some do that too. Any tally of the cost of entry for the business of market making as a whole needs to reflect the enormous total cost of the collective experiences of all new traders.

When asked to add the total start-up costs involved for all neophytes— both the survivors and the bankrupt—to arrive at an average, the consensus among veterans is in the $50,000 to $100,000 range. That, most agree, is the *average cost* before a market maker turns the corner.

There are some ways to cut the cost of inexperience. The Options Institute at the CBOE conducts simulated trading for new market makers on its floor. Other learning tools include books, games, videotapes, seminars, classes, and paper trading. Computer-based trading simulators employ state-of-the-art technology to replicate the environment in which trading occurs. While these tools are no substitute for time on the trading floor, they offer knowledge and preparation that can contribute to the bottom line of a market maker's actual trading.

Clearly, the financial investment required for market making is substantial, and there are additional forms of investment required. Before you can trade, you need to be approved for exchange membership, a process that can take several weeks, and you need a letter of guarantee from a clearing firm. Selecting an exchange and a clearing firm are important and difficult decisions, decisions that require diligent homework.

Choosing an Exchange

The exchange the trader chooses determines the environment in which he or she will work. Every floor, indeed every pit, has a culture of its own. Although it may be hard to judge how a particular floor will feel as a place to spend long days standing in a crowd of traders, there are some key factors that determine the culture of a floor.

The first is whether an exchange is regulated by the Securities and Exchange Commission (SEC) or by the Commodity Futures Trading Commission (CFTC). This is important, not only because some of the rules are different, but also because the history and evolution of trading practices in the securities markets differ significantly from those in the futures markets. The New York Stock Exchange, as you know, is the dominant stock trading institution in the securities markets. Its long-established decorum and trading style, and its system that separates specialists providing liquidity from brokers filling customers' orders, have had an important impact on the development of SEC-regulated option markets, such as the CBOE. For example, a market maker on the CBOE, the dominant options trading institution, cannot act as both a broker (filling a customer order) and a market maker in options on the same underlying stock during the same day. This proscription has not been part of the tradition on futures exchanges, although some futures exchanges now have some restrictions on "dual trading." Capital requirements also differ between SEC and CFTC regulated exchanges.

Futures pits have a tradition where *locals* (individuals who trade for their own accounts) provide liquidity in an open outcry system that gives all those making markets equal access to trades and equal responsibility for providing liquidity and accepting risk. *Scalping*—accepting risk by simply holding unhedged long or short positions for brief periods during the day—has been the style in the futures markets for over a century. Traders can enter into spread positions to reduce their risk, but often they don't.

For that reason, trading options fits into a different environment on a futures' floor. That is not to say that there is anything about the theory of trading options on futures that makes it inherently more risky, or even very different from trading equity or cash-settled options. Options on futures do differ in some theoretical respects from equity options and from options on cash, but these are differences that a market maker can adjust to fairly quickly. Over the long term, it is the floor environment and culture that are more important considerations in choosing an exchange.

Other considerations include the volume and the volatility in the options you intend to trade. Not only does greater volume mean getting a chance at more trades, it also means that it is easier to transfer risk. Liquidity is crucial to reducing risk. On the other side of the coin is the fact that bid-ask spreads are typically wider when option volumes are lower (to compensate for the greater risk).

The volatility of the underlying instrument is important because it determines the premium and the fluctuations in premium for the options. Higher volatility produces higher premiums and more opportunities; low, steady, and unchanging volatility means that the value of options and the number of opportunities for profit are reduced. For example, CBOE's OEX is the most active option product in the world. Its volatility ranges typically between 10 and 20 percent, making it a relatively volatile product. Thus, OEX options offer both opportunities for profit and liquidity for controlling risk.

Choosing a Clearing Firm

A market maker's clearing firm plays a major role in his business. New market makers usually operate out of the clearing firm's office space, so the clearing firm influences all of his work time outside the pit. The cost structure that the market maker negotiates with the clearing firm has an impact on his cost of doing business and on his potential for success.

Many clearing firms offer a wide array of services. The basic services every one offers include clearing trades, accounting services (partial), and guaranteeing the market maker's trades. In addition, the firm might provide office space, secretarial services, educational facilities, and formal education programs. Different clearing firms offer different services and cost structures. And, of course, the costs rise with the amount of service. New traders ordinarily opt for an arrangement that offers the lowest clearing costs. Seasoned traders often demand more services, but generally they are also in a better position to negotiate rates.

An important consideration for new market makers is what a clearing firm offers to help them learn the business. Some have well developed education programs, including videotaped lectures, written materials, and perhaps even formal classes.

Partnerships and Backing

Adequate capital is crucial to success as a market maker. The arrangements between individual market makers and their backers vary greatly. In the past, backers typically negotiated a 50:50 split with a cutoff after a $50,000 loss. But in the past, a higher percentage of newcomers turned a profit. Today, typically only one out of five will be successful. A typical contract calls for a 30 percent cut for the market maker and a 70 percent cut for the backer to compensate the backer for his greater risk.

Frequently, sponsorship arrangements evolve out of an initial role as a clerk. A newcomer who learns the business by working for an experienced trader as a clerk often develops the relationship so that he takes more and more responsibility until he eventually becomes a market maker himself, backed by his mentor. Such arrangements vary from the new trader receiving a guaranteed salary and some minimal percent of profits to receiving a percentage of the profits based on a sliding scale. A typical scale might offer no participation for the first $50,000 in profits, 5 percent participation in the next $50,000, 10 percent for profits from $100,000 to $150,000, 15 percent from $150,000 to $250,000, and 20 percent above $250,000.

There are also partnerships among traders and arrangements where the backers play no role whatever in trading. An experienced team of market makers and clerks might arrange for backing up to several million dollars by negotiating participation in profits ranging anywhere from 30 percent to 70 percent.

Success

Successful traders are often asked, "What does it take to be a market maker?" Composure and the ability to respond intelligently to the unexpected, for starters. There's just no such thing as a "typical day" in the marketplace. There's rarely a day when everything goes as expected so that the market maker is prepared for everything that happens. Perhaps one of the key ingredients for being a market maker is enjoying that kind of daily variety. It's potentially very frustrating, but market makers are often people who enjoy the uncertainty, instability, and lack of structure.

What does it take to succeed instead of survive in the pits? It takes a combination of discipline and expertise, and discipline that outweighs expertise more than in most jobs. What marks the superior trader is the discipline to execute properly and the discipline to maintain the strategies he or she intended to employ. Success requires the ability to respond in a structured way in an unstructured environment.

Expertise is crucial too, especially today. Expertise among traders has risen dramatically, so competition has become very stiff, yet profit margins are small. A market maker who is going to stand out over the long run has to develop expertise out of experience. In particular, the experience the market maker gains from facing that first "crisis" is unsurpassed. How he handles it isn't as important for the long run as what he learns from it. That first crisis, and others that follow, mold a trader, and his talent for acquiring skill from experience is a major ingredient of success.

REFLECTIONS ON WHAT THE FUTURE HOLDS

The listed options business has evolved since its start in April 1973. Market makers who relied on "market feel" and "guts" have largely been replaced by arbitrage traders and mathematicians who trade for slight price discrepancies, rather than for "the big kill." This trend toward sophistication will continue, not only because of new technology, but also as a result of the increased awareness of price risk, which is inherent in any aspect of the securities business. Because the market maker's function is to transfer risk between longer-term investors, there will always be room for new and improved methods of managing this risk transfer role.

The collapse of the equity markets in October 1987 and 1989 and the shock waves sent through the currency markets with the ERM realignment in October 1992 are dramatic examples of price risk that is ever present in the securities business. In recent years, every major market has experienced similar volatility. From crude oil to Treasury bonds, and from agricultural commodities to currencies, every market in the world has attracted headlines at one time or another when price movements spell panic. The lesson for any participant is that risk management is crucial, and all investors and traders must be flexible enough to change with the evolving environment.

In addition to improved risk management, some challenges markets will face are the development of new trading techniques, applications of technology, trading structures, and extended trading hours.

New trading techniques can arise from new theoretical insights or from the listing of new products. Past milestones in the options business were the development of the Black-Scholes options pricing model, the introduction of put options, and the creation of cash-settled index options. Each created a new ball game at the time of its introduction. New products, such as exchange-traded "OTC" FLEX options, options on foreign indices, and long-dated equity options (LEAPS) have found their place with investors.

Current applications of technology continue to further the efficiency of analyzing and acting upon market information. Although computers may never replace the human decision-making process, there undoubtedly will be continuing discoveries of new ways to use the computer's ability to track prices and to identify price discrepancies. Undoubtedly, new developments will translate this information into trade execution.

Indeed, new trading structures will arise. Although the specialist system has historically dominated equity trading, and the open-outcry auction market system has been prominent in option trading, no one can say with certainty that these market structures will persist indefinitely. The CBOE has found success with the Designated Primary Market-Maker (DPM) system. More important, off-floor computer-based trading has challenged floor-based trading. Globex, in the United States, has brought electronic trading to the edge of the open outcry day and will serve to facilitate seamless trading. Trading procedures and rules for access that are suitable to computer usage will need to be adopted by the U.S. markets to hang on to the market share they currently hold.

Extended trading hours via longer hours of floor trading or via computer-based trading are the result of international financial markets. Trading around the world has grown in importance, and U.S. exchanges must face up to the challenge to maintain market share. Of course, extended hours are only part of meeting the global challenge. U.S. exchanges must continue to have markets with the most liquidity and with the highest integrity—or the business will go elsewhere.