

# SALOMON SMITH BARNEY

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Equity Derivative Sales

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## Exotic Equity

## Derivatives Manual

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*This report may be distributed only to persons who have received a copy of the booklet Characteristics and Risks of Standardized Options, published by the Options Clearing Corporation.*

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## Introduction

Salomon Smith Barney hopes that investors find this manual to be a useful reference and source of ideas. The intended audience is experienced institutional and other sophisticated investors. No single person is likely to trade every one of the structures shown, nor are they appropriate for every investor. Some of these instruments are extremely complex. Investors should use these financial instruments only if they fully understand both the instrument and the overall transaction and are able to bear the risks associated with each instrument and transaction.

These instruments involve significant risks, which are too numerous to describe in this manual. Since each instrument is unique, and the range of their possible uses is wide, it is impossible to list all of the factors that may affect the performance of each of these instruments.

Immediately following this Introduction is an important discussion of some of the risk factors relating to the swaps, options and other instruments described in this manual.

Each financial instrument (some of which are securities and some of which are not) is described in two pages. The first page is a standard template showing the most important information, including the payoff formula, maximum risks for the buyer and seller, complexity and variables that influence the value of the instrument. The second page gives an example of transacting in the instrument.

The manual begins with relatively less complex securities, emphasizing exposure to equity of non-U.S. issuers: local, quanto and ADR style options and swaps. This is followed by variations on vanilla options: forward start, Asian, lookback and split-fee options. Barrier options make up the next section, followed by relative performance options: outperformance, spread, better of and chooser options. Instruments that give ways of trading volatility are then examined: accrual options, range and volatility swaps. The last two transactions, par par and discount asset swaps, are discussed as ways of trading credit exposure.

Following the discussion of individual instruments, is a schematic giving the conceptual relationship among the instruments described and a table to help investors determine the most effective means of implementing a given strategy. A glossary appears at the end to explain some of the terms used throughout the manual.

Our aim is to make the contents exhaustive, but there are limits. The user can pick and choose features among the instruments shown to construct new variations; e.g., a quanto style accrual option on the spread between two assets, with a knock out provision on the accrual option. In addition, instruments may be customized to meet particular hedging, tax, credit and other needs. Just remember, not every conceivable instrument is tradeable and the more complex and customized an instrument, the more risk it may entail.

This manual is for information purposes only and is not intended to be complete and is not an offer to buy or sell any securities or other financial instruments. Salomon Smith Barney or any of their affiliates, directors, representatives and/or employees, may, at any point in time, hold a long or short position in any of the instruments mentioned in this Manual and may purchase or sell any other instruments from time to time as principal or agent. Salomon, Smith Barney and any other of their affiliates may make markets in securities or other financial instruments described in this Manual (to the extent that a market exists for such instruments which, in many if not most cases, one may not) as well as in securities of issuers underlying or related to such instruments. This Manual may not be reproduced, distributed or published for any purpose.

## **General Risk Factors Associated with Over the Counter Transactions**

In common with many other financial transactions, over-the-counter (OTC) derivative transactions, in addition to providing significant benefits, may involve a variety of significant risks.

The specific risks presented by a particular OTC derivative transaction necessarily depend upon the terms of that transaction and your circumstances. In general, all OTC derivative, structured note and warrant transactions involve risks, which include (among others) the risk of adverse or unanticipated market, financial, or political developments, risk of counterparty or issuer default and other credit and enforcement risks, and risk of illiquidity and related risks. In addition, you may be subject to operational risks in the event that you do not have in place appropriate internal systems and controls to monitor the various risks, funding and other requirements to which you may be subject by virtue of your activities in OTC derivatives, and other financial markets.

As in any financial transaction, you should ensure that you understand the requirements (including investment restrictions), if any, applicable to you that are established by your regulators or by your board of directors or other governing body. You should also consider the legal, tax and accounting implications of entering into any OTC derivative transaction. To the extent appropriate in light of the specific OTC derivative and your particular circumstances, you should consider consulting such advisers as may be appropriate to assist you in understanding the risks involved. If you are acting in the capacity of financial adviser or agent, you should evaluate the foregoing matters in light of the circumstances applicable to your client or principal and any obligations or limitations imposed on you as adviser or agent.

Neither Salomon Smith Barney Inc (Salomon Smith Barney) nor any of their affiliates is acting as an adviser to investors in respect of these instruments or transactions involving these instruments. Investors should study all materials provided by a proposed Salomon Smith Barney counterparty relating to a particular transaction and should consider and make an independent determination of the risks associated with the instrument and of their ability to manage such risks. In particular, you should take steps to understand the assumptions underlying the instrument involved in the particular transaction.

Swap and OTC option transactions permit precise customization to accomplish particular financial and risk management objectives that might otherwise be unachievable. Customization can, because of the individualized nature of such transactions, introduce significant liquidity risk and other risk factors of a complex character. Dealers may not always be willing to make markets in these transactions or terminate early existing positions. The value of an equity swap or OTC option may be established in a variety of ways. In any transaction, a specific valuation methodology is determined at the outset of that transaction. The benchmark is usually an exchange or market closing price.

Swaps and OTC options have individually tailored terms and are not transferable prior to maturity. Thus, the market for these transactions may be illiquid and may not be easily closed prior to termination.

Unlike exchange traded derivative contracts, in which parties have credit risk to an entire clearance system, swap and OTC option counterparties incur the credit risk of their counterpart when entering into a transaction. These transactions are usually subject to a Master Agreement (generally based on the form prepared by ISDA) which provides, among other things, for payments to be made on a net basis.

Since these swaps and OTC options are not exchange traded, prices and values must be calculated by a dealer as opposed to an exchange.

Swaps are cash settled financial instruments which derive their value from the value or a component of the value of, an underlying asset. Parties to a swap do not deliver or receive the underlying asset. Accord-

ingly, other attributes of an asset subject to a swap, such as voting rights related to that asset are not passed from one party to the other. In many option transactions, however, parties may elect at the outset to receive upon option exercise, either the asset underlying the option or the cash value of the option.

In most equity swaps the party receiving asset based returns receives the upside of the asset and pays the other party any depreciation in the value of the asset and an interest rate. US margin regulations require option sellers to post eligible margin. Since OTC options are transacted with a dealer and do not involve a clearinghouse margin deposits are posted with the dealer.

Both OTC and exchange traded options are generally subject to positions limits and reporting requirements which may constrain the ability of an investor to use these instruments vehicle.

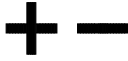
Cash settled OTC options and swaps may present certain enforceability risks due to local gaming and bucket shop laws, although certain exemptions from such laws may be available depending upon the terms of the instrument.

OTC Options may be structured as automatically exercisable or may require the buyer to take affirmative steps to exercise the option when a threshold has been reached and all conditions to exercise have been met. Options that are not automatically exercisable, thus, involve monitoring requirements and may involve communication risk.

## Legend



Used to indicate the importance of a factor. Completely filled diamonds indicate the greatest importance.



A plus means that a security is sensitive to the given factor in a positive way: its value rises with the factor. A minus means that the security is negatively correlated to the given factor; its value decreases as the factor increases.



Like the solid black plus or minus, but used in cases where the sensitivity may change under some conditions. For instance, the buyer of a knock out call option where the barrier is greater than the spot price has a position which is economically the same as being long the underlying stock until the stock trades close to the barrier.



Pluses and minuses are overlaid over A and B when there are two underlying stocks (A and B) to the derivative; e.g., outperformance and spread options. Plus over the A and minus over the B means that the buyer of the derivative is economically equivalent to being long stock A and is economically equivalent to being short stock B.

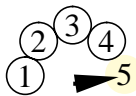
A and B are also used with barrier options to distinguish the period before (B) the option has knocked in/out and the period after (A) the option has knocked in/out.



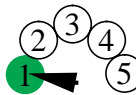
Pluses and minuses are overlaid over U and O for outside barrier options. U indicates the underlying stock and O is the security used to trigger the barrier. Plus over the U and minus over the O means that the buyer of the derivative is economically equivalent to being long the underlying stock and is economically equivalent to being short the outside barrier stock.



The deltas for accrual options and range swaps depend on where the stock is trading. L and H mean that the stock is trading at a low or high level, with the superimposed plus or minus indicating whether the security is long or short the underlying in this each case. The space between the L and H is used when the stock is trading at an intermediate level.



The complexity of the financial instruments is rated on a scale of one to five, one being the least complex and five the most complex. This rating is somewhat subjective and is not necessarily an accurate guide to the riskiness of any strategy. Moreover, the riskiness of any given instrument will depend on the way in which the instrument is used. A highly complex instrument rated "5", if used as a closely correlated hedge can be less risky than a relatively simple instrument rated "1" which is used directionally.



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Derivatives Manual



## *Equity Swap*

<b>Description</b>	Gives economic exposure to stock or index returns.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to the stock.</li> <li>• Where no futures are available, swaps may be a good alternative.</li> <li>• Can be used to give exposure to a basket of stocks in a single transaction.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to the stock.</li> <li>• Can be used as part of a tax management strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times (S - R)$ , where $N$ is the notional size of the trade, $S$ is the stock return over the life of the swap, and $R$ is a fixed or floating rate, usually LIBOR plus or minus a spread.
	<b>Trade Day</b>	No payments by either party.
	<b>Expiration</b>	Payments are usually exchanged periodically before expiration. One party receives stock returns, the other receives LIBOR plus or minus a spread.
<b>Key Concepts</b>	<b>Total/Price Return</b>	The exchange of payments can be made based on the total return (including dividends) or it can be based on the price return only of the stock or index.
	<b>Notional</b>	The size of the payments are determined by the notional times return.
	<b>Reset</b>	Longer term swaps generally reset quarterly, with the two parties exchanging payments based on the previous three months returns. This makes the long term swap equivalent to a series of three month swaps.
	<b>LIBOR</b>	LIBOR is generally used as the benchmark for one half of the swap.

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### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> Gains rise as the stock price increases.	<b>Unlimited.</b> Losses increase as the stock price falls. Maximum loss occurs if the stock reaches zero.
<b>Seller</b>	<b>Unlimited.</b> Seller gains as the stock price falls, reaching a maximum when the stock price is zero.	<b>Unlimited.</b> Losses increase as the stock price rises, without limit.

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### Sensitivities

	<b>Delta</b>	
<b>Buyer</b>	+	
<b>Seller</b>	-	
<b>Importance</b>	◆	

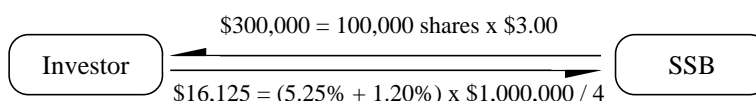
*See the discussion of Risk Factors on page 5 of this manual.*

### *Equity Swap*

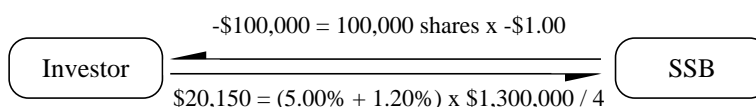
**Example:** An investor believes that the stock XYZ will increase in value over the next six months and acquires the economic equivalent of a long position in the stock with a swap of \$1,000,000 notional. Assume that the stock pays no dividends, so that total return and price return swaps are economically equivalent. If the stock is trading at \$10.00 per share when the swap is initiated, then the investor will receive payments equal to the returns above \$10.00 he would experience if he held 100,000 shares, while paying out LIBOR + 120 bps on \$1,000,000. Assume that payments are exchanged quarterly, so that a total of two payment exchanges (*resets*) occur.

The example assumes that stock moves from \$10.00 when the swap is initiated, to \$13.00 on the first reset date, then to \$9.00 at termination. LIBOR is 5.25% for the first quarter and 5.00% for the second quarter.

**First Quarter**      LIBOR: 5.25%  
                               Stock moves from \$10.00 to \$13.00  
                               Net payment to investor: \$283,875



**Second Quarter**      LIBOR: 5.00%  
                               Stock moves from \$13.00 to \$9.00  
                               Net payment from investor: \$420,150



In the second quarter, the stock price declined, so the investor receives a negative amount. That is, he must pay the financing cost of \$20,150 plus the stock returns of \$400,000. The notional amount on which the LIBOR payment is based grows or shrinks with the stock price. The value of the portfolio of 100,000 shares grew to \$1,300,000, so the payment is based on that reset notional amount. Also, for the purpose of the example, the LIBOR payments are based on dividing by four (four payments per year). Since LIBOR is an actual/360 rate, the actual value would be slightly different.

*See the discussion of Risk Factors on page 5 of this manual.*

*Stocks of Non-U.S. Issuers: Local Style Swap*

<b>Description</b>	Gives economic exposure to stock or index returns. Payments are exchanged in the local currency, so the investor does have exposure to currency risk.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to the stock.</li> <li>• Where no futures are available, swaps may be a good alternative.</li> <li>• Can be used to give exposure to a basket of stocks in a single transaction.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock.</li> <li>• Can be used as part of a tax management strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times (S - R)$ , where $N$ is the notional size of the trade, $S$ is the stock return over the life of the swap, and $R$ is a fixed or floating rate, usually LIBOR plus or minus a spread. All values are in terms of the local (foreign) currency.
	<b>Trade Day</b>	No payments by either party.
	<b>Expiration</b>	Payments are usually exchanged periodically before expiration. One party receives stock returns, the other receives LIBOR plus or minus a spread.
<b>Key Concepts</b>	<b>Total/Price Return</b>	The exchange of payments can be made based on the total return (including dividends) or it can be based on the price return only of the stock or index.
	<b>Notional</b>	The size of the payments are determined by the notional times return.
	<b>Reset</b>	Longer term swaps generally reset quarterly, with the two parties exchanging payments based on the previous three months returns. This makes the long term swap equivalent to a series of three month swaps.
	<b>LIBOR</b>	LIBOR is generally used as the benchmark for one half of the swap.
	<b>Currency Risk</b>	The value of the payments can be more or less, depending on the prevailing currency exchange rate.

<b>Market Risks</b>	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Gains rise as the stock price increases.</p>	<p><b>Unlimited.</b></p> <p>Losses increase as the stock price falls. Maximum loss occurs if the stock reaches zero.</p>
<b>Seller</b>	<p><b>Unlimited.</b></p> <p>Seller gains as the stock price falls, reaching a maximum which the stock price is zero.</p>	<p><b>Unlimited.</b></p> <p>Losses increase as the stock price rises, without limit.</p>

<b>Sensitivities</b>	<b>Delta</b>	<b>Currency<sup>a</sup></b>	<b>Complexity</b>
<b>Buyer</b>	+	-	
<b>Seller</b>	-	+	
<b>Importance</b>	◆	◇	

a. Expressed in USD terms and assuming that the buyer's swap is in the money. If the dollar weakens and the swap is in the money, it works to the benefit of the buyer.

*See the discussion of Risk Factors on page 5 of this manual.*

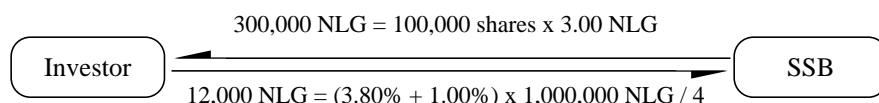
### *Stocks of Non-U.S. Issuers: Local Style Swap*

**Example:**

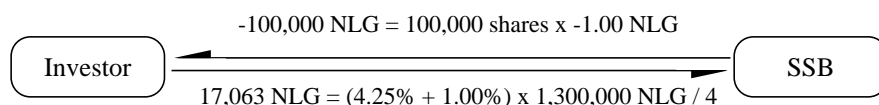
An investor believes that the Dutch stock XYZ will increase in value over the next six months and acquires the economic equivalent of a long position in the stock with a swap of 1,000,000 NLG (Dutch Guilder) notional. Assume that the stock pays no dividends, so that total return and price return swaps are economically equivalent. If the stock is trading at 10.00 NLG per share when the swap is initiated, then the investor will receive payments equal to the returns above 10.00 NLG he would experience by holding 100,000 shares, while paying out NLG LIBOR + 100 bps on 1,000,000 NLG. Assume that payments are exchanged quarterly, so that a total of two payment exchanges are made.

The example assumes that stock moves from 10.00 NLG when the swap is initiated, to 13.00 NLG on the first reset date, then to 12.00 NLG at termination. NLG LIBOR is 3.80% for the first quarter and 4.25% for the second quarter.

**First Quarter**      NLG LIBOR: 3.80%  
 Stock moves from 10.00 NLG to 13.00 NLG  
 Net payment to investor: 288,000 NLG



**Second Quarter**      NLG LIBOR: 4.25%  
 Stock moves from 13.00 NLG to 12.00 NLG  
 Net payment from investor: 117,063 NLG



In the second quarter, the stock price declined, so the investor receives a negative amount. That is, he must pay the financing cost of 17,063 NLG plus the stock returns of 100,000 NLG. The notional amount on which the LIBOR payment is based grows or shrinks with the stock price. The value of the portfolio of 100,000 shares grew to 1,300,000 NLG, so the payment is based on that reset notional amount for the second quarter. Also, for the purpose of the example, the LIBOR payments are based on dividing by four (four payments per year). Since LIBOR is an actual/360 rate, the actual value would be slightly different.

The payments are made in the local currency, NLG in this case, so the value of the payments in USD may vary.

*See the discussion of Risk Factors on page 5 of this manual.*

*Stocks of Non-U.S. Issuers: Quanto Style Swap*

<b>Description</b>	Gives economic exposure to stock or index returns. Payments are exchanged in USD by converting the payments of the local swap using an exchange rate fixed at swap initiation, which reduces the currency risk.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to the stock.</li> <li>• Where no futures are available, swaps may be a good alternative.</li> <li>• Can be used to give exposure to a basket of stocks in a single transaction.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock.</li> <li>• Can be used as part of a tax management strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times (S - R)$ , where $N$ is the notional size of the trade, $S$ is the stock return over the life of the swap, and $R$ is a fixed or floating rate, usually LIBOR plus or minus a spread. The notional value is expressed in USD; other values are in terms of the local (foreign) currency.
	<b>Trade Day</b>	No payments by either party.
	<b>Expiration</b>	Payments are usually exchanged periodically before expiration. One party receives stock returns, the other receives LIBOR plus or minus a spread.
<b>Key Concepts</b>	<b>Total/Price Return</b>	The exchange of payments can be made based on the total return (including dividends) or it can be based on the price return only of the stock or index.
	<b>Notional</b>	The size of the payments are determined by the notional times return.
	<b>Reset</b>	Longer term swaps generally reset quarterly, with the two parties exchanging payments based on the previous three months returns. This makes the long term swap equivalent to a series of three month swaps.
	<b>LIBOR</b>	LIBOR in the foreign market is used as the benchmark for one half of the swap.

<b>Market Risks</b>	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<b>Unlimited.</b> Gains rise as the stock price increases.	<b>Unlimited.</b> Losses increase as the stock price falls. Maximum loss occurs if the stock reaches zero.
<b>Seller</b>	<b>Unlimited.</b> Seller gains as the stock price falls, reaching a maximum when the stock price is zero.	<b>Unlimited.</b> Losses increase as the stock price rises, without limit.

<b>Sensitivities</b>	<b>Delta</b>	<b>Complexity</b>
<b>Buyer</b>	+	
<b>Seller</b>	-	
<b>Importance</b>	◆	

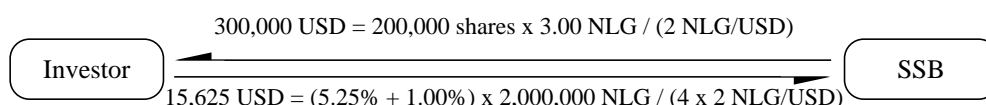
*See the discussion of Risk Factors on page 5 of this manual.*

### *Stocks of Non-U.S. Issuers: Quanto Style Swap*

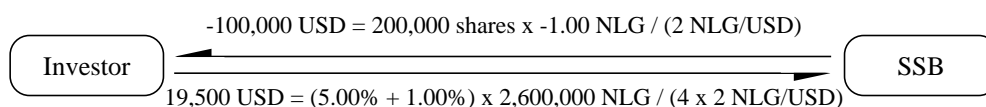
**Example:** An investor believes that the Dutch stock XYZ will increase in value over the next six months and acquires the economic equivalent of a long position in the stock with a swap of 1,000,000 USD notional. Assume that the stock pays no dividends, so that total return and price return swaps are economically equivalent. If the stock is trading at 10.00 NLG (Dutch Guilder) per share and the exchange rate is 2.00 NLG/USD when the swap is initiated, then the investor will receive payments equal to the returns above 10.00 NLG he would experience if he held 200,000 shares, while paying out NLG LIBOR + 100 bps on 2,000,000 NLG. Assume that payments are exchanged quarterly, so that a total of two payment exchanges are made.

The example assumes that stock moves from 10.00 NLG when the swap is initiated, to 13.00 NLG on the first reset date, then to 12.00 NLG at termination. USD LIBOR is 5.25% for the first quarter and 5.00% for the second quarter.

**First Quarter**      USD LIBOR: 5.25%  
 Stock moves from 10.00 NLG to 13.00 NLG  
 Net payment to investor: 284,375 USD



**Second Quarter**      USD LIBOR: 5.00%  
 Stock moves from 13.00 NLG to 12.00 NLG  
 Net payment from investor: 119,500 USD



In the second quarter, the stock price declined, so the investor receives a negative amount. That is, he must pay the financing cost of 19,500 USD plus the stock returns of 100,000 USD. The notional amount on which the LIBOR payment is based grows or shrinks with the stock price. The value of the portfolio of 200,000 shares grew to 2,600,000 NLG, so the payment is based on that reset notional amount. Also, for the purpose of the example, the LIBOR payments are based on dividing by four (four payments per year). Since LIBOR is an actual/360 rate, the actual value would be slightly different.

*See the discussion of Risk Factors on page 5 of this manual.*

*Stocks of Non-U.S. Issuers: ADR Style Swap*

<b>Description</b>	Gives economic exposure to stock or index returns. Payments are exchanged into USD by converting the level of the stock using a floating exchange rate. The investor has currency risk on the principal.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to the stock.</li> <li>• Where no futures are available, swaps may be a good alternative.</li> <li>• Can be used to give exposure to a basket of stocks in a single transaction.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock.</li> <li>• Can be used as part of a tax management strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times (S - R)$ , where $N$ is the notional size of the trade, $S$ is the stock return over the life of the swap, calculated using a floating exchange rate, and $R$ is a fixed or floating rate, usually LIBOR plus or minus a spread.
	<b>Trade Day</b>	No payments by either party.
	<b>Expiration</b>	Payments are usually exchanged periodically before expiration. One party receives stock returns, the other receives LIBOR plus or minus a spread.
<b>Key Concepts</b>	<b>Total/Price Return</b>	The exchange of payments can be made based on the total return (including dividends) or it can be based on the price return only of the stock or index.
	<b>Notional</b>	The size of the payments are determined by the notional times return.
	<b>Reset</b>	Longer term swaps generally reset quarterly, with the two parties exchanging payments based on the previous three months returns. This makes the long term swap equivalent to a series of three month swaps.
	<b>LIBOR</b>	LIBOR is generally used as the benchmark for one half of the swap.
	<b>Currency Risk</b>	The return of the swap is strongly dependant on fluctuations in the exchange rate.

**Market Risks**

	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<p><b>Unlimited.</b> Gains rise as the stock price increases.</p>	<p><b>Unlimited.</b> Losses increase as the stock price falls. Maximum loss occurs if the stock price reaches zero.</p>
<b>Seller</b>	<p><b>Unlimited.</b> Seller gains as the stock price falls, reaching a maximum when the stock price is zero.</p>	<p><b>Unlimited.</b> Losses increase as the stock price rises, without limit.</p>

**Sensitivities**

	<b>Delta</b>	<b>Currency<sup>a</sup></b>	<b>Complexity</b>
<b>Buyer</b>	+	+	
<b>Seller</b>	-	-	
<b>Importance</b>	◆	◆	

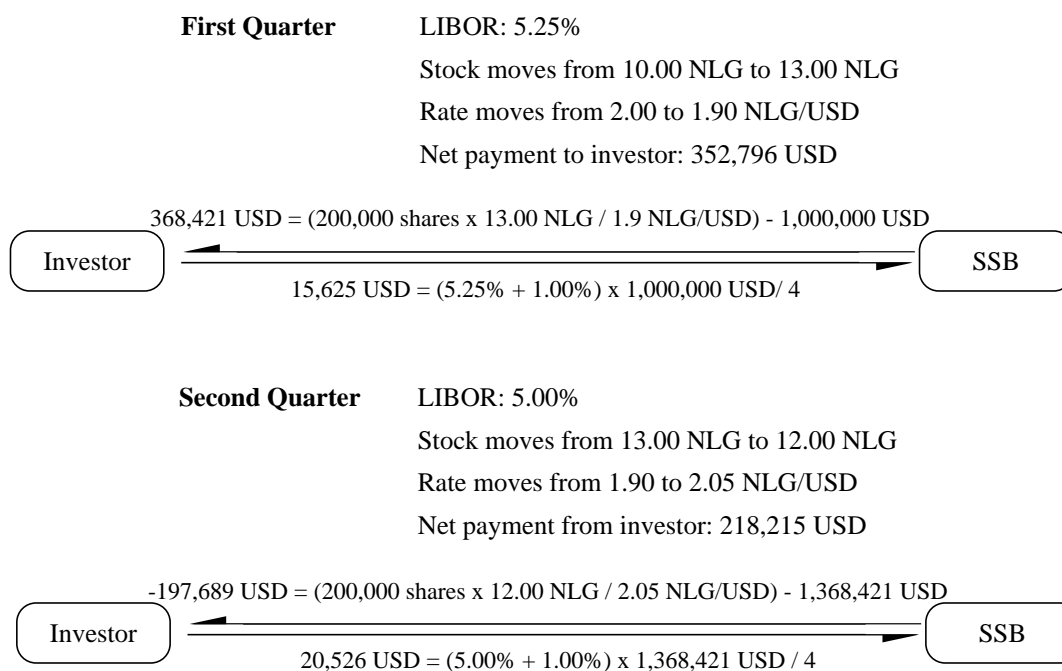
a. Expressed in USD terms. For example, if the dollar weakens, it works to the benefit of the buyer.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Stocks of Non-U.S. Issuers: ADR Style Swap*

**Example:** An investor believes that the Dutch stock XYZ will increase in value over the next six months and acquires economic equivalent of a long position in the stock with a swap of 1,000,000 USD notional. Assume that the stock pays no dividends, so total return and price return swaps are economically equivalent. If the stock is trading at 10.00 NLG (Dutch Guilders) per share and the exchange rate is 2.00 NLG/USD when the swap is initiated, then the investor will receive payments equal to the returns above 10.00 NLG he would experience if he held 200,000 ADRs (if they existed), while paying out LIBOR + 100 bps on 1,000,000 USD. Assume that payments are exchanged quarterly, so that a total of two payment exchanges are made.

The example assumes that the stock moves from 10.00 NLG when the swap is initiated, to 13.00 NLG on the first reset date, then to 12.00 NLG at termination, while the exchange rate moves from 2.00 NLG/USD to 1.90 NLG/USD on the first reset and 2.05 NLG/USD at termination. LIBOR is 5.25% for the first quarter and 5.00% for the second quarter.



The notional amount on which the LIBOR payment is based grows or shrinks with the stock price. The value of the portfolio of 200,000 shares grew to 1,368,421 USD, so the payment is based on that reset notional amount. In the second quarter, the stock price declined, so the investor receives a negative amount. That is, he must pay the financing cost of 20,526 USD plus the stock returns of 197,689 USD. Also, for the purpose of the example, the LIBOR payments are based on dividing by four (four payments per year). Since LIBOR is an actual/360 rate, the actual value would be slightly different.

*See the discussion of Risk Factors on page 5 of this manual.*



*Swaption*

<b>Description</b>	An option to enter a swap at levels agreed upon in advance. Economics are similar to an ordinary call or put.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure, with limited downside.</li> <li>• Investors profit from long call positions if the volatility of the security underlying the swaption increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy or if volatility is expected to decline.</li> <li>• Selling options is a way of being paid for implementing targeted sales or buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	If the option is exercised, the buyer will enter into a swap where the initial level of the stock is assumed to be $K$ , the strike price which is agreed on when the trade is initiated.
	<b>Trade Day</b>	Buyer pays the swaption premium.
	<b>Exercise Day</b>	If the buyer exercises, the buyer and seller enter into the swap.
	<b>Expiration</b>	The buyer and seller will have made interim and terminal swap payments.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price moves beyond the strike.</p>	<p><b>Limited.</b></p> <p>If the stock price does not move beyond the strike, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock price does not move beyond the strike, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price moves beyond the strike, potential losses are unlimited.</p>

**Sensitivities**

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	?	+	+	-	
<b>Seller</b>	?	-	-	+	
<b>Importance</b>	◆	◆	◇	◇	

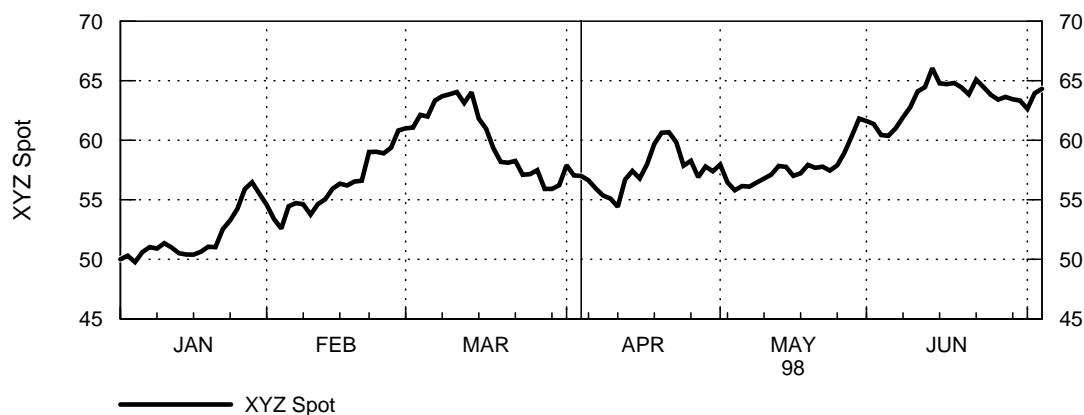
a. Buyer could be long or short depending on the direction of the swap. Delta is as with an ordinary option.  
 b. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## Swaption

**Example:** An investor buys a three month option on a three month swap on 100,000 shares of the stock XYZ. If the investor exercises the option, he will enter into a swap where he receives the return of the stock beyond a level which is 10% higher than the stock when the option is purchased, and will pay out LIBOR plus 150 bps. Economically, this is similar to a three month call option struck 10% out of the money. Assume that this is offered for 4.65%. If XYZ is trading at \$50.00 when the option is purchased, then the strike is 10% higher, or at \$55.00. The dollar cost of the option is  $\$2.33 = \$50.00 \times 4.65\%$  per share.

### Swaption: Possible Scenario



The vertical line indicates the exercise date for the option. XYZ is trading at \$57.00 on the exercise date, which is \$2.00 higher than the strike. So the investor exercises the option and enters into a swap lasting three more months. He will receive the return of 100,000 shares of XYZ beyond \$55.00 (and pay out any depreciation below \$55.00) and pay out LIBOR plus 150 bps on the value of the stock when the swap is initiated.

When the swap expires, the closing price of XYZ is \$64.25. So the investor receives  $\$925,000 = 100,000 \times (\$64.25 - \$55.00)$ . When the swap was initiated, three month LIBOR stood at 5.90%, so the investor must pay  $\$105,450 = 100,000 \times \$57.00 \times (5.90\% + 1.50\%) / 4$ . For the purpose of the example, the LIBOR payments are based on dividing by four (four payments per year). Since LIBOR is an actual/360 rate, the actual value would be slightly different.

*See the discussion of Risk Factors on page 5 of this manual.*

*Stocks of Non-U.S. Issuers: Local Style Call Option*

<b>Description</b>	Gives the buyer exposure to the upside in the underlying stock above the strike. The strike and spot prices are expressed in the local currency, so the investor has exposure to currency risk on any payout.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Investors profit from long call positions if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy or if volatility is expected to decline.</li> <li>• Selling calls is a way of being paid for implementing targeted sales.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$F \times \text{Max}(S - K, 0)$ , where $F$ is the foreign exchange ratio, $S$ is the spot price at expiration, in local terms, and $K$ is the strike price, in local terms. For a U.S. investor, $F$ would be expressed in the form USD/Local Currency Unit.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the stock is above the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the local stock price is important.
	<b>Currency Risk</b>	Any payout must be converted from local terms to the investor's currency.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price rises above the strike. Payment is made in the local currency.</p>	<p><b>Limited.</b></p> <p>If the stock fails to rally, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock fails to rally above the strike, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price rises above the strike, potential losses are unlimited.</p>

**Sensitivities**

	Delta	Vega	Currency <sup>a</sup>	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	+	+	-	+	-	
<b>Seller</b>	-	-	+	-	+	
<b>Importance</b>	◆	◆	◆	◇	◆	

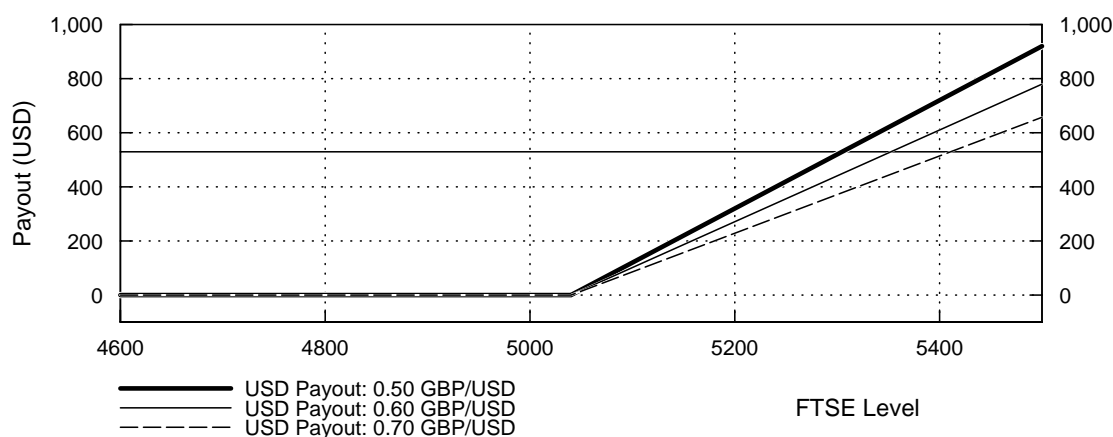
a. Expressed in USD terms. For example, if the dollars strengthens, it works against the buyer.  
 b. If the underlying is a foreign index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Stocks of Non-U.S. Issuers: Local Style Call Option*

**Example:** An investor buys a local style call on the U.K.'s FTSE-100. The call has six months to expiration and is struck 5% out of the money. Assume that this is offered for 6.62% of spot, in GBP. With the FTSE at 4800, this puts the strike at 5040 and the premium is 317.76 GBP. Using an exchange rate of 0.60 GBP/USD, the cost to the U.S. investor is 529.60 USD. At expiration, the dollar payout depends on the exchange rate at that time.

#### **Local Call: USD Payout versus Exchange Rate**



The breakeven depends on the prevailing exchange rate at expiration. If the exchange rate remains at 0.60 GBP/USD, then the break even is 317.76 points above the strike, or 5357.76. If the dollar weakens to 0.50 GBP/USD, then the breakeven decreases to 5309.29 ( $5040 + 538.58 \times 0.50$ ). If the dollar strengthens to 0.70 GBP/USD, then the breakeven increases to 5417.01 ( $5040 + 538.58 \times 0.70$ ).

*See the discussion of Risk Factors on page 5 of this manual.*

*Stocks of Non-U.S. Issuers: Local Style Put Option*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying stock below the strike. The strike and spot prices are expressed in the local currency, so the investor has exposure to currency risk on any payout.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Investors profit from long put positions if the volatility of the security underlying the option increases.</li> <li>• Hedging a long position in the underlying stock.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold if volatility is expected to decline.</li> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$F \times \text{Max}(K - S, 0)$ , where $F$ is the foreign exchange ratio, $S$ is the spot price at expiration, in local terms, and $K$ is the strike price, in local terms. For a U.S. investor, $F$ would be expressed in the form USD/Local Currency Unit.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the stock is below the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the local stock is important.
	<b>Currency Risk</b>	Any payout must be converted from local terms to the investor's currency.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price falls below the strike. Payment is made in the local currency.</p>	<p><b>Limited.</b></p> <p>If the stock does not fall below the strike, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock price does not fall below the strike, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price falls, can lose up to the amount of the strike, in local terms.</p>

**Sensitivities**

	Delta	Vega	Currency <sup>a</sup>	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	-	+	-	+	-	
<b>Seller</b>	+	-	+	-	+	
<b>Importance</b>	◆	◆	◆	◇	◆	

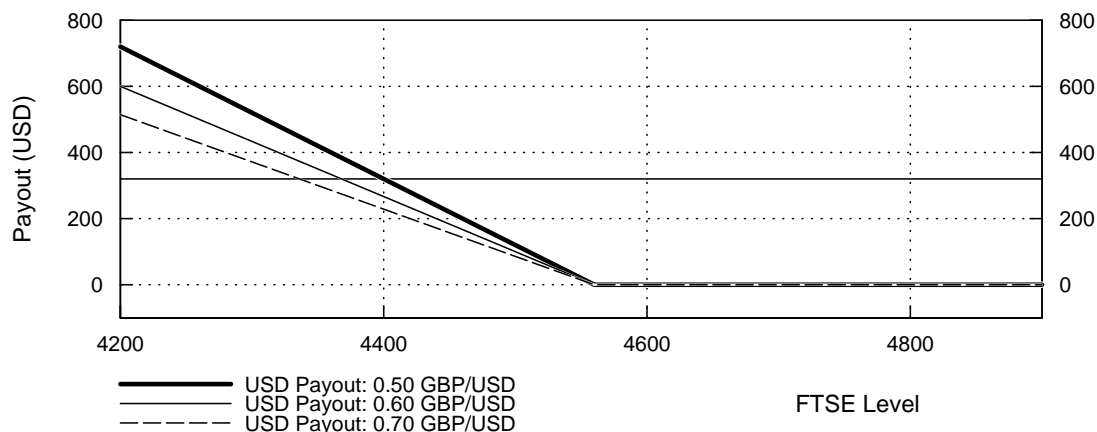
a. Expressed in USD terms. For example, if the dollars strengthens, it works against the buyer.  
 b. If the underlying is a foreign index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Stocks of Non-U.S. Issuers: Local Style Put Option*

**Example:** An investor buys a local style put on the U.K.'s FTSE-100. The put has six months to expiration and is struck 5% out of the money. Assume that this is offered for 4.00% of spot, in GBP. With the FTSE at 4800, this puts the strike at 4560 and the premium is 192 GBP. Using an exchange rate of 0.60 GBP/USD, the cost to the U.S. investor is 320 USD. At expiration, the dollar payout depends on the exchange rate at that time.

#### **Local Put: USD Payout versus Exchange Rate**



The breakeven depends on the prevailing exchange rate at expiration. If the exchange rate remains at 0.60 GBP/USD, then the break even is 192 points below the strike, or 4368. If the dollar weakens to 0.50 GBP/USD, then the breakeven decreases to 4400 ( $4560 - 320 \times 0.50$ ). If the dollar strengthens to 0.70 GBP/USD, then the breakeven increases to 4336 ( $4560 - 320 \times 0.70$ ).

*See the discussion of Risk Factors on page 5 of this manual.*

*Stocks of Non-U.S. Issuers: ADR Style Call Option*

<b>Description</b>	Gives the buyer exposure to the upside in the underlying stock above the strike, in USD terms, with exposure to currency risk on the level of the underlying stock. ADR style options are also known as crosses.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Investors profit from long call positions if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy or if volatility is expected to decline.</li> <li>• Selling calls is a way of being paid for implementing targeted sales.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(F \times S - K, 0)$ , where $F$ is the foreign exchange ratio, $S$ is the spot price at expiration, in local terms, and $K$ is the strike price, in USD terms. For a U.S. investor, $F$ would be expressed in the form USD/Local Currency Unit.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the stock is above the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the local stock price and currency and their correlation are important.
	<b>Currency Risk</b>	The level of the underlying stock is determined in part by the exchange rate.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the dollar price of the stock rises above the strike.</p>	<p><b>Limited.</b></p> <p>If the stock fails to rally, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock fails to rally, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price rises above the strike, potential losses are unlimited.</p>

**Sensitivities**

	Delta	Vega	Currency <sup>a</sup>	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	+	+	-	+	-	
<b>Seller</b>	-	-	+	-	+	
<b>Importance</b>	◆	◆	◆	◆	◆	

a. Expressed in USD terms. For example, if the dollars strengthens, it works against the buyer.

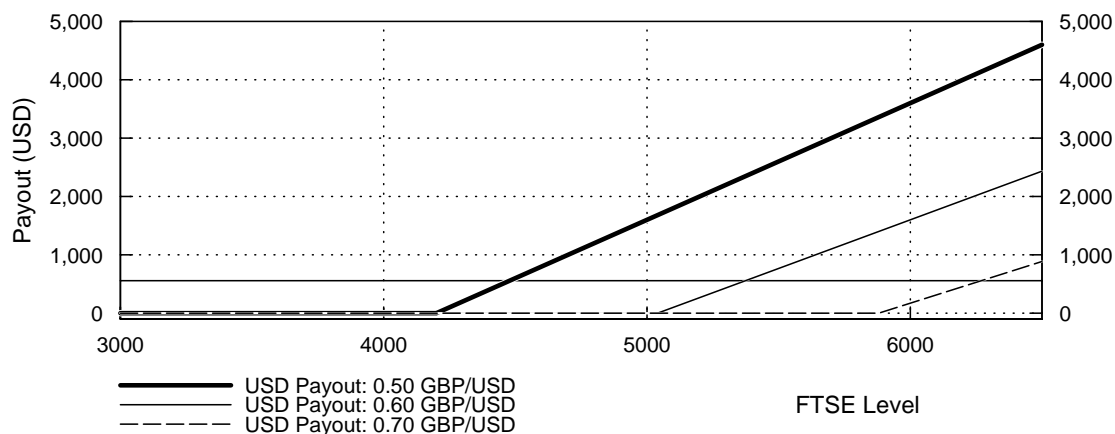
b. If the underlying is a foreign index, then the buyer is long correlation among the stocks in the index. Buyer is also long correlation between the stock and currency returns.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Stocks of Non-U.S. Issuers: ADR Style Call Option*

**Example:** A U.S. investor buys an ADR style call on the U.K.'s FTSE-100. The call has six months to expiration and is struck 5% out of the money. Assume that this is offered for 6.96% of spot, in USD. Using 0.60 GBP/USD as the exchange rate, with the FTSE at 4800 GBP or 8000 USD ( $4800 / 0.60$ ), this puts the strike at 8400 USD ( $4800 \times 1.05 / 0.60$ ) and the premium is 556.80 ( $8000 \times 6.96\%$ ) USD. The strike is fixed in USD and the underlying moves with changes in the local index level and the exchange rate.

### **ADR Style Call: USD Payout versus Exchange Rate**



The breakeven depends on the prevailing exchange rate at expiration. To break even, the option must pay off at least 556.80 USD. If the exchange rate remains at 0.60 GBP/USD, then the option pays off above 5040 ( $8400 \times 0.60$ ) points on the FTSE. In this case, the index must rise 334.08 ( $556.80 \times 0.60$ ) FTSE points above the strike, or to 5374.08. If the dollar weakens to 0.50 GBP/USD, then the index must rise beyond 4200 ( $8400 \times 0.50$ ) FTSE points, so the breakeven decreases to 4478.40 ( $4200 + 556.80 \times 0.50$ ). If the dollar strengthens to 0.70 GBP/USD, then the breakeven increases to 6269.76 ( $8400 \times 0.70 + 556.80 \times 0.70$ ).

*See the discussion of Risk Factors on page 5 of this manual.*



*Stocks of Non-U.S. Issuers: ADR Style Put Option*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying stock below the strike, in USD terms, with exposure to currency risk on the level of the underlying stock. ADR style options are also known as crosses.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Hedging a long position in the underlying stock.</li> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Investors profit from long put positions if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold if volatility is expected to decline.</li> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S \times F, 0)$ , where $F$ is the foreign exchange ratio, $S$ is the spot price at expiration, in local terms, and $K$ is the strike price, in USD terms. For a U.S. investor, $F$ would be expressed in the form USD/Local Currency Unit.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the stock is below the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the local stock price and currency and their correlation are important.
	<b>Currency Risk</b>	The level of the underlying stock is determined in part by the exchange rate.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price, in USD terms, falls below the strike.</p>	<p><b>Limited.</b></p> <p>If the stock price does not fall, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock price does not fall below the strike, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price falls, can lose up to the amount of the strike.</p>

**Sensitivities**

	Delta	Vega	Currency <sup>a</sup>	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	-	+	+	+	-	
<b>Seller</b>	+	-	-	-	+	
<b>Importance</b>	◆	◆	◆	◆	◆	

a. Expressed in USD terms. For example, if the dollars strengthens, it works to the benefit of the buyer.

b. If the underlying is a foreign index, then the buyer is long correlation among the stocks in the index. The buyer is also long correlation between the stock and currency returns.

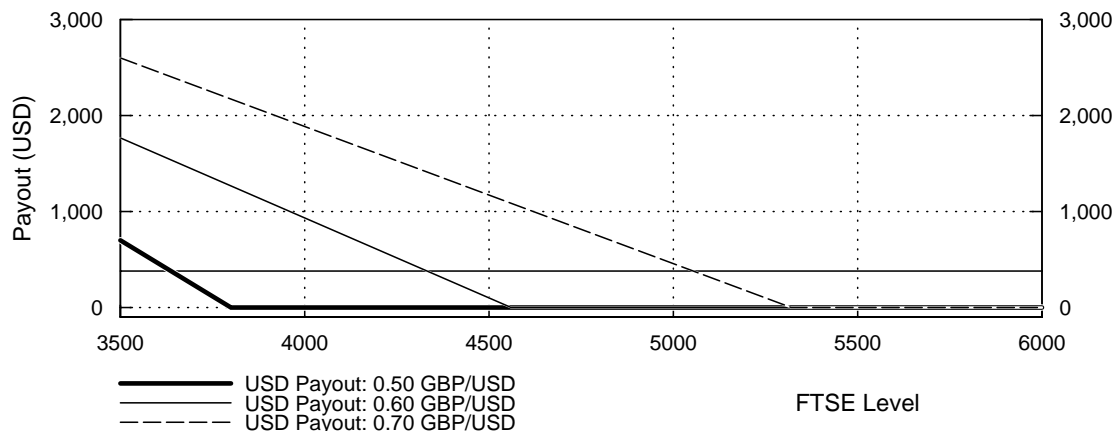
*See the discussion of Risk Factors on page 5 of this manual.*

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*Stocks of Non-U.S. Issuers: ADR Style Put Option*

**Example:** A U.S. investor buys an ADR style put on the U.K.'s FTSE-100. The put has six months to expiration and is struck 5% out of the money. Assume that this is offered for 4.75% of spot, in USD. Using 0.60 GBP/USD as the exchange rate, with the FTSE at 4800 GBP or 8000 USD ( $4800 / 0.60$ ), this puts the strike at 7600 USD ( $4800 \times 0.95 / 0.60$ ) and the premium is 380.00 USD ( $8000 \times 4.75\%$ ). The strike is fixed in USD and the underlying moves with changes in the local index level and the exchange rate.

**ADR Style Put: USD Payout versus Exchange Rate**



The breakeven depends on the prevailing exchange rate at expiration. To break even, the option must payoff at least 380.00 USD. If the exchange rate remains at 0.60 GBP/USD, then the option pays off below 4560 ( $7600 \times 0.60$ ) points on the FTSE. The index must fall 228.00 ( $380.00 \times 0.60$ ) FTSE points below this level, or to 4332.00. If the dollar weakens to 0.50 GBP/USD, then index must fall below 3800 ( $7600 \times 0.50$ ) FTSE points, so the breakeven decreases to 3610.00 ( $3800 - 380 \times 0.50$ ). If the dollar strengthens to 0.70 GBP/USD, then the breakeven increases to 5054.00 ( $7600 \times 0.70 - 380 \times 0.70$ ).

*See the discussion of Risk Factors on page 5 of this manual.*

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## *Stocks of Non-U.S. Issuers: Quanto Style Call Option*

<b>Description</b>	Gives the buyer exposure to the upside in the underlying stock above the local strike, with no exposure to currency risk on the payout.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Investors profit from long call positions if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy or if volatility is expected to decline.</li> <li>• Selling calls is a way of being paid for implementing targeted sales.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(F \times S - K, 0)$ , where $F$ is the foreign exchange ratio, which is fixed for the life of the option, $S$ is the spot price at expiration, in local terms, and $K$ is the strike price, in USD terms. For a U.S. investor, $F$ would be expressed in the form USD/Local Currency Unit.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the stock is above the strike and the option is exercised.
<b>Key Concepts:</b>	<b>Volatility</b>	The volatility of the local stock price and currency and their correlation are important.
	<b>Currency Risk</b>	Although the exchange rate is fixed, the value of the option is affected by the rate.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that the stock price rises beyond the strike.	<b>Limited.</b> If the stock fails to rally, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the stock fails to rally, keeps the premium.	<b>Unlimited.</b> If the stock price rises above the strike, potential losses are unlimited.

### Sensitivities

	Delta	Vega	Currency <sup>a</sup>	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	+	+	-	+	-	
<b>Seller</b>	-	-	+	-	+	
<b>Importance</b>	◆	◆	◇	◇	◆	

a. Expressed in USD terms. For example, if the dollars strengthens, it works against the buyer.

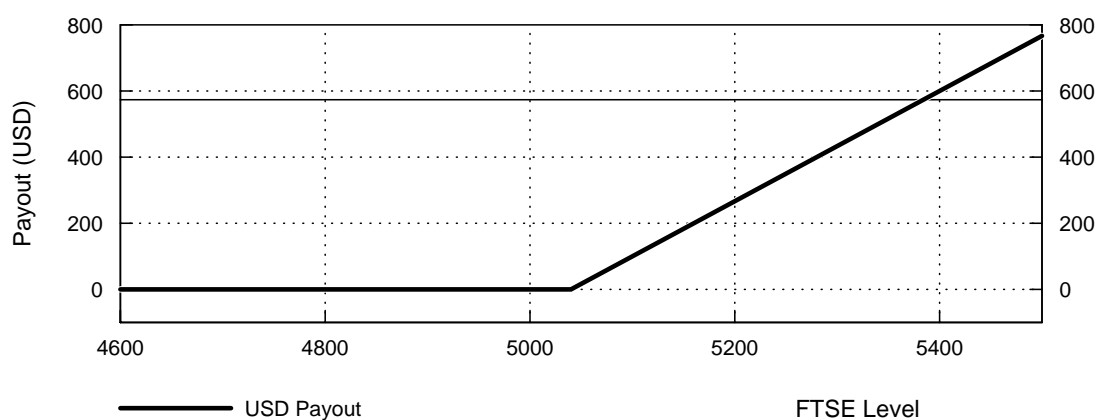
b. If the underlying is a foreign index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Stocks of Non-U.S. Issuers: Quanto Style Call Option*

**Example:** A U.S. investor buys a quanto style call on the U.K.'s FTSE-100. The call has six months to expiration and is struck 5% out of the money. Assume that this is offered for 7.17% of spot, in USD. Using 0.60 GBP/USD as the exchange rate, with the FTSE at 4800 GBP or 8000 USD ( $4800 / 0.60$ ), this puts the strike at 8400 USD ( $4800 \times 1.05 / 0.60$ ) and the premium is 573.60 USD. The strike is fixed in USD and the underlying is the FTSE level divided by the fixed exchange rate of 0.60 GBP/USD.

#### **Quanto Style Call: USD Payout**



The breakeven is independent of the prevailing exchange rate at expiration. To break even, the index must rise by approximately 7.17% (the cost of the option) beyond the strike in local terms. For instance, if the index rises to 5200 FTSE points, then the payoff is 266.67 USD ( $5200 / 0.60 - 8400$ ). The breakeven for this option is 344.16 ( $573.60 \times 0.60$ ) FTSE points above the strike in GBP, which is 5384.16 ( $344.16 + 8400 \times 0.60$ ).

*See the discussion of Risk Factors on page 5 of this manual.*

*Stocks of Non-U.S. Issuers: Quanto Style Put Option*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying stock below the local strike, with no exposure to currency risk on the payout.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Hedging a long position in the underlying stock.</li> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Investors profit from long put positions if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold if volatility is expected to decline.</li> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S \times F, 0)$ , where $F$ is the foreign exchange ratio, which is fixed for the life of the option, $S$ is the spot price at expiration, in local terms, and $K$ is the strike price, in USD terms. For a U.S. investor, $F$ would be expressed in the form USD/Local Currency Unit.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the stock is below the strike and the option is exercised.
<b>Key Concepts:</b>	<b>Volatility</b>	The volatility of the local stock price and currency and their correlation are important.
	<b>Currency Risk</b>	Although the exchange rate is fixed, the value of the option is affected by the rate.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price falls below the strike.</p>	<p><b>Limited.</b></p> <p>If the stock price does not fall, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock price does not fall below the strike, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price falls, can lose up to the amount of the strike.</p>

**Sensitivities**

	<b>Delta</b>	<b>Vega</b>	<b>Currency<sup>a</sup></b>	<b>Correlation<sup>b</sup></b>	<b>Time</b>	<b>Complexity</b>
<b>Buyer</b>	-	+	+	+	-	
<b>Seller</b>	+	-	-	-	+	
<b>Importance</b>	◆	◇	◇	◇	◇	

a. Expressed in USD terms. For example, if the dollars strengthens, it works to the benefit of the buyer.  
 b. If the underlying is a foreign index, then the buyer is long correlation among the stocks in the index.

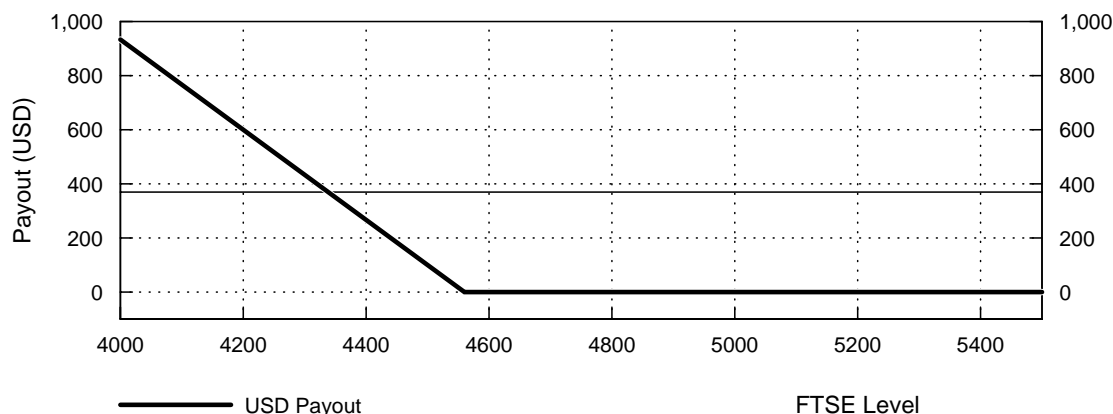
*See the discussion of Risk Factors on page 5 of this manual.*

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*Stocks of Non-U.S. Issuers: Quanto Style Put Option*

**Example:** A U.S. investor buys a quanto style put on the U.K.'s FTSE-100. The put has six months to expiration and is struck 5% out of the money. Assume that this is offered for 4.62% of spot, in USD. Using 0.60 GBP/USD as the exchange rate, with the FTSE at 4800 GBP or 8000 USD ( $4800 / 0.60$ ), this puts the strike at 7600 USD ( $4800 \times 0.95 / 0.60$ ) and the premium is 369.60 USD. The strike is fixed in USD and the underlying is the FTSE level divided by the fixed exchange rate of 0.60 GBP/USD.

**Quanto Style Put: USD Payout**



The breakeven is independent of the prevailing exchange rate at expiration. To break even, the index must fall by approximately 4.62% (the cost of the option) beyond the strike in local terms. For instance, if the index falls to 4400 FTSE points, then the payoff is 266.67 USD ( $7600 - 4400 / 0.60$ ). The breakeven for this option is 221.76 ( $369.60 \times 0.60$ ) FTSE points below the strike in GBP, which is 4338.24 ( $7600 \times 0.60 - 221.76$ ).

*See the discussion of Risk Factors on page 5 of this manual.*

## *Forward Start Call Option*

<b>Description</b>	Gives the buyer exposure to the upside in the underlying above the strike. The option is purchased forward; terms are agreed on at trade day, but payment is made at a future date. In dollar terms, the strike floats until the purchase date, at which time it becomes fixed.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• The buyer locks in an implied volatility and profits if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy.</li> <li>• The seller locks in an implied volatility and profits if volatility falls.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(S - K, 0)$ , where $S$ is the price of the underlying at expiration, and $K$ is the strike price.
	<b>Trade Day</b>	Neither party makes a payment (as with a futures contract).
	<b>Payment Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying closes above the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price rises above the strike.</p>	<p><b>Limited.</b></p> <p>If the stock fails to rally, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock fails to rally, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price rises above the strike, potential losses are unlimited.</p>

### Sensitivities

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time <sup>c</sup>	Complexity
<b>Buyer</b>	+	+	+	-	
<b>Seller</b>	-	-	-	+	
<b>Importance</b>	◆	◆	◇	◆	

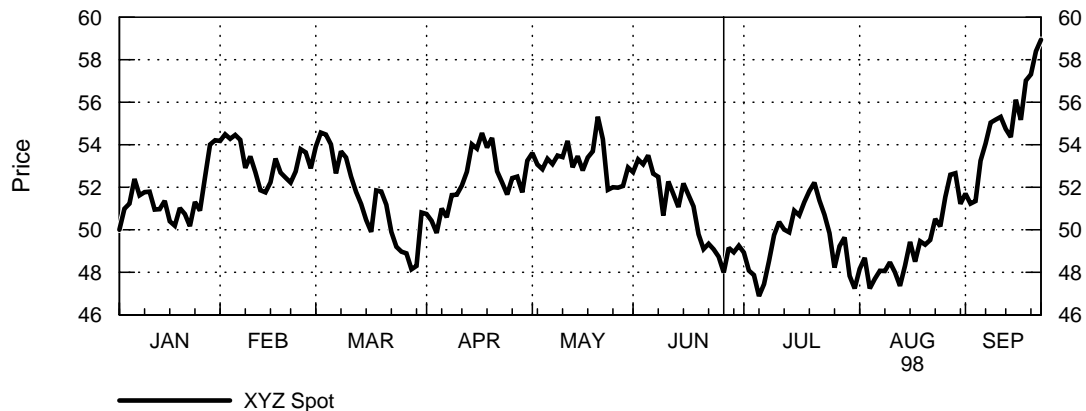
- a. Until the forward date is reached, the buyer is neither long nor short.
- b. If the underlying is an index, then the buyer is long correlation among the stocks in the index.
- c. Until the forward date is reached, the buyer is neither long nor short.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Forward Start Call Option*

**Example:** An investor buys a three month at the money call on the stock XYZ six months forward. Assume that this is offered for 8.45% forward. In six months time, the investor will receive a three month call with strike equal to the spot price of XYZ at that time, and the seller will receive 8.45% of the future spot on that date.

#### **Forward Start Call: Possible Scenario**



Six months after the trade is initiated, XYZ is trading at \$48.00. On that date, the investor pays \$4.06 ( $8.45\% \times \$48.00$ ) and receives a call with three months to expiration and a strike of \$48.00. Three months later, when the entire trade expires, XYZ is trading at \$59.00. So the investor receives  $\$11.00 = \$59.00 - \$48.00$ .

*See the discussion of Risk Factors on page 5 of this manual.*



## *Forward Start Put Option*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying below the strike. The option is purchased forward; terms are agreed on at trade day, but payment is made at a future date. In dollar terms, the strike floats until the purchase date, at which time it becomes fixed.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• The buyer locks in an implied volatility and profits if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> <li>• The seller locks in an implied volatility and profits if volatility falls.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S, 0)$ , where $S$ is the price of the underlying at expiration, and $K$ is the strike price.
	<b>Trade Day</b>	Neither party makes a payment (as with a futures contract).
	<b>Payment Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying closes below the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price falls below the strike.</p>	<p><b>Limited.</b></p> <p>If the stock price does not fall, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock price does not fall, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price falls below the strike, potential losses are unlimited.</p>

### Sensitivities

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time <sup>c</sup>	Complexity
<b>Buyer</b>	-	+	+	-	
<b>Seller</b>	+	-	-	+	
<b>Importance</b>	◆	◆	◇	◆	

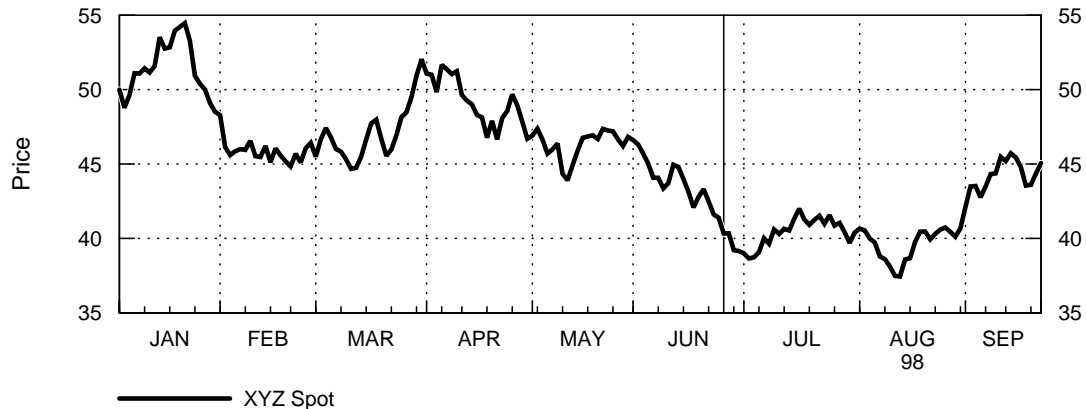
- a. Until the forward date is reached, the buyer is neither long nor short.
- b. If the underlying is an index, then the buyer is long correlation among the stocks in the index.
- c. Until the forward date is reached, the buyer is neither long nor short.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Forward Start Put Option*

**Example:** An investor buys a three month at the money put on the stock XYZ six months forward. Assume that this is offered for 7.45% forward. In six months time, the investor will receive a three month put with strike equal to the spot price of XYZ at that time, and the seller will receive 7.45% of the future spot on that date.

#### **Forward Start Put: Possible Scenario**



Six months after the trade is initiated, XYZ is trading at \$40.25. On that date, the investor pays \$3.00 ( $7.45\% \times \$40.25$ ) and receives a put with three months to expiration and a strike of \$40.25. Three months later, when the entire trade expires, XYZ is trading at \$45.00. Since this is greater than the strike of \$40.25, the investor receives nothing. If XYZ had closed at \$35.00, then the investor would have received  $\$5.25 = \$40.25 - \$35.00$ .

*See the discussion of Risk Factors on page 5 of this manual.*

## Asian Call Option

<b>Description</b>	Gives the buyer exposure to the upside in the underlying stock above the strike, with settlement based on an average stock price over some period.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Investors profit from long call positions if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy.</li> <li>• Selling calls is a way of being paid for implementing targeted sales.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(S - K, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. Either or both can be based on the average stock price over some period.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles above the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	Asian options are less sensitive to volatility than ordinary options.
	<b>Average</b>	The average of the stock price can be used to determine the terminal level and/or the strike. It can be measured over various periods and frequencies.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that the stock price rises above the strike.	<b>Limited.</b> If the stock fails to rally, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the stock fails to rally, keeps the premium.	<b>Unlimited.</b> If the stock price rises above the strike, potential losses are unlimited.

### Sensitivities

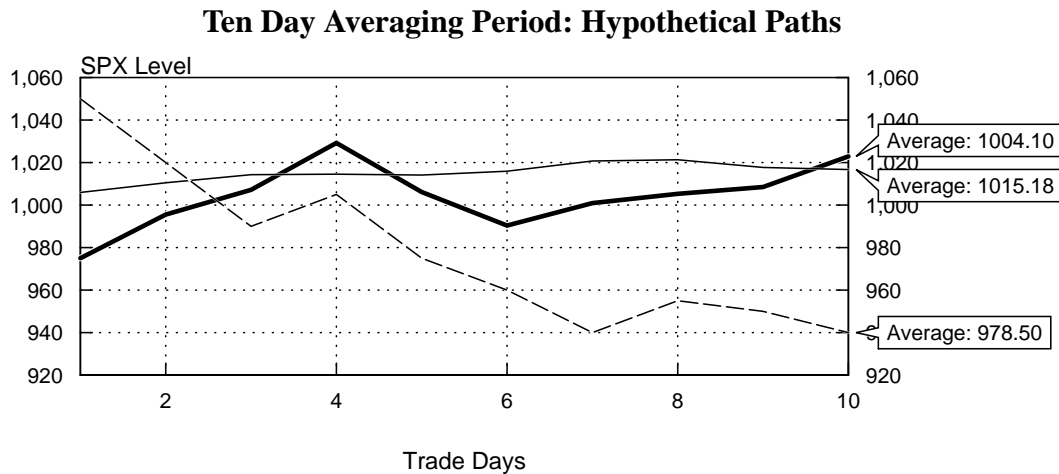
	Delta	Vega	Correlation <sup>a</sup>	Time	Complexity
<b>Buyer</b>	+	+	+	-	
<b>Seller</b>	-	-	-	+	
<b>Importance</b>	◆	◆	◇	◆	

a. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Asian Call Option*

**Example:** An investor buys an Asian style call on the S&P 500. The call has six months to expiration and is struck 5% out of the money. The strike is fixed on the trade date (not based on averaging) and the terminal level is taken as the average closing price over the last ten trading days up to expiration. Assume that this is offered for 6.20% of spot. With the index at 950, this puts the strike at 997.50 and the cost is 58.90 index points.



The first path begins well below the strike at 975 and ends about 25 points above the strike at 1022.89. The average over the ten days is 1004.10, so the option pays out 6.60 (1004.10 - 997.50) index points. If the option were ordinary (not Asian), then the payoff would be much higher: 25.39 (1022.89 - 997.50) index points. The second path moves in a tight range, starting at 1005.94 and ending at 1016.71. The average is 1015.18, so the option pays out 17.68 (1015.18 - 997.50) index points. In the third case, the index moves down from 1050 to 940 over the ten days, for an average of 978.50, which is below the option strike. So the option pays nothing in the third case.

The effect of averaging is to make the observed settlement level less volatile. Many investors use Asian options in case the market makes a large move on the day of expiration. Sellers of options sometimes like the settlement to be Asian since it makes them easier to unwind and hence less risky.

*See the discussion of Risk Factors on page 5 of this manual.*

*Asian Put Option*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying stock below the strike, with settlement based on an average stock price over some period.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Investors profits from long put positions if the volatility of the security underlying the option increases.</li> <li>• Hedging a long position in the underlying stock.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold if volatility is expected to decline.</li> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. Either or both can be based on the average stock price over some period.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles below the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	Asian options are less sensitive to volatility than ordinary options.
	<b>Average</b>	The average of the stock price can be used to determine the terminal level and/or the strike. It can be measured over various periods and frequencies.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that stock price rises above the strike.</p>	<p><b>Limited.</b></p> <p>If the stock fails to rally, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock fails to rally, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price rises above the strike, potential losses are unlimited.</p>

**Sensitivities**

	Delta	Vega	Correlation <sup>a</sup>	Time	
<b>Buyer</b>	-	+	+	-	
<b>Seller</b>	+	-	-	+	
<b>Importance</b>	◆	△	◇	▽	

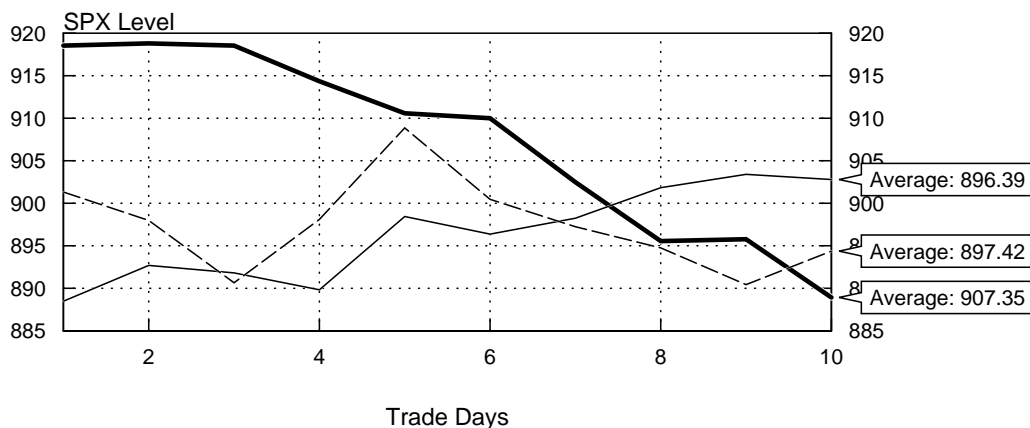
a. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Asian Put Option*

**Example:** An investor buys an Asian style put on the S&P 500. The put has six months to expiration and is struck 5% out of the money. The strike is fixed on the trade date (not based on averaging) and the terminal level is taken as the average closing price over the last ten trading days up to expiration. Assume that this is offered for 4.25% of spot. With the index at 950, this puts the strike at 902.50 and the cost is 40.375 index points.

### Ten Day Averaging Period: Hypothetical Paths



The first path begins well below the strike at 888.48, and ends about 15 points higher at 902.79. Although the index closes above the strike, the average over the ten trading days is 896.39, so the investor receives 6.11 ( $902.50 - 896.39$ ) index points. The second path fluctuates from about 12 points below the strike to six points above the strike. The average is 897.42, so the investor receives 5.08 index points. In the third case, the index begins the averaging period at 918.54, well above the strike, and trades down to 888.92. The average is 907.35, so the investor receives nothing. If the option were ordinary (not Asian), then the payoff would have been positive: 13.58 ( $902.50 - 888.92$ ) index points.

The effect of averaging is to make the observed settlement level less volatile. Many investors use Asian options in case the market makes a large move on the day of expiration. Sellers of options sometimes like the settlement to be Asian since it makes them easier to unwind and hence less risky.

*See the discussion of Risk Factors on page 5 of this manual.*

*Lookback Call*

<b>Description</b>	Gives the buyer exposure to the upside in the underlying above the strike, with the payout based on the maximum stock price achieved over the option’s life. For the buyer, this is like buying the stock at its level at expiration and selling it at the high over the option’s life.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Investors profit from long call positions if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy.</li> <li>• Selling calls is a way of being paid for implementing targeted sales.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(S - K, 0)$ , where $S$ is the maximum price achieved by the underlying over the life of the option, and $K$ is the strike price.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles above the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

<b>Market Risks</b>	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock rises above the strike.</p>	<p><b>Limited.</b></p> <p>If the stock fails to rally, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock fails to rally, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price rises above the strike, potential losses are unlimited.</p>

<b>Sensitivities</b>	<b>Delta</b>	<b>Vega</b>	<b>Correlation<sup>a</sup></b>	<b>Time</b>	<b>Complexity</b>
<b>Buyer</b>	+	+	+	-	
<b>Seller</b>	-	-	-	+	
<b>Importance</b>	◆	◆	◇	◇	

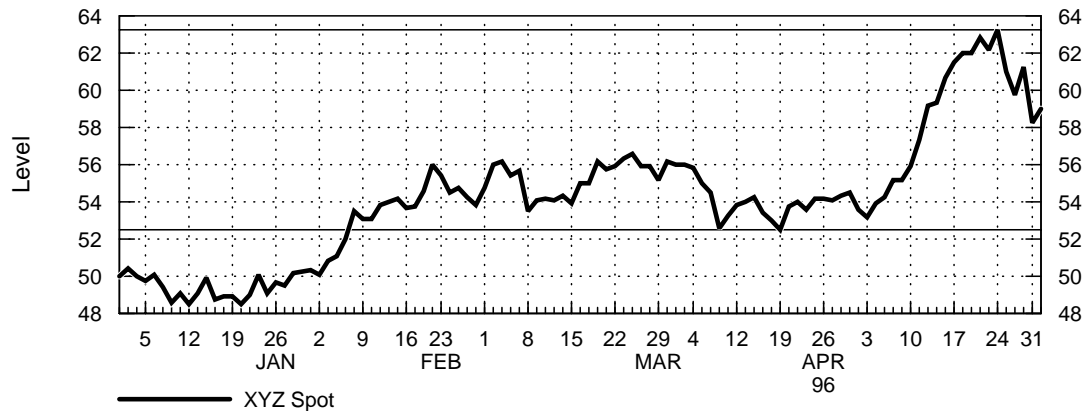
a. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Lookback Call*

**Example:** An investor buys a lookback call on the stock XYZ. The call has six months to expiration and is struck 5% out of the money. Assume that this is offered for 19.20% of spot. If XYZ is trading at \$50.00, the strike is \$52.50 and the cost is \$9.60.

### Lookback Call: Possible Scenario



The stock sells off initially, then moves to the upside. It first trades above the strike of \$52.50 in early January. Since the option is a lookback, the payoff is the maximum stock price seen over the six months, minus the strike. Once the stock moves above the strike, the payoff is certain to be positive. In this case, the maximum of \$63.25 is reached in mid-April. So the option's payoff is  $\$10.75 = \$63.25 - \$52.50$  even though the stock is trading at \$59.00 when the option expires.

*See the discussion of Risk Factors on page 5 of this manual.*



## *Lookback Put*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying below the strike, with the payout based on the minimum stock price achieved over the option's life. For the buyer, this is like buying the stock at the lowest price seen in the option's life and selling it at the expiration price.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Investors profits from long put positions if the volatility of the security underlying the option increases.</li> <li>• Hedging a long position in the underlying stock.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold if volatility is expected to decline.</li> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S, 0)$ , where $S$ is the minimum price achieved by the underlying over the life of the option, and $K$ is the strike price.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles below the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that the stock price falls below the strike.	<b>Limited.</b> If the stock price does not fall, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the stock price does not fall, keeps the premium.	<b>Unlimited.</b> If the stock price falls below the strike, potential losses are unlimited.

### Sensitivities

	Delta	Vega	Correlation <sup>a</sup>	Time	Complexity
<b>Buyer</b>	-	+	+	-	
<b>Seller</b>	+	-	-	+	
<b>Importance</b>	◆	◆	◇	◆	

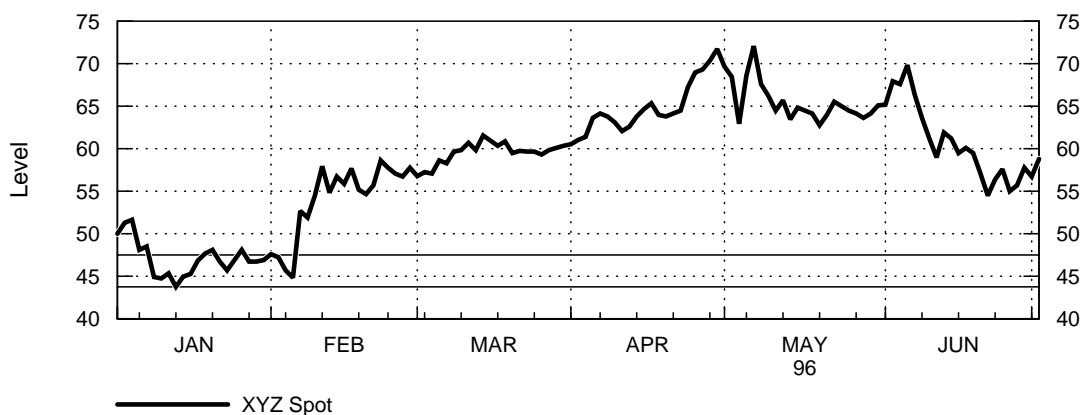
a. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Lookback Put*

**Example:** An investor buys a lookback put on the stock XYZ. The put has six months to expiration and is struck 5% out of the money. Assume that this is offered for 13.75% of spot. If XYZ is trading at \$50.00, the strike is \$47.50 and the cost is \$6.875.

#### **Lookback Put: Possible Scenario**



The stock sells off almost immediately, then recovers. The low over the life of the option is reached within the first two weeks and is \$43.75. Since the strike is \$47.50, the option pays off  $\$3.75 = \$47.50 - \$43.75$ . If this had been an ordinary option, the option would have paid nothing since the stock closed at \$58.75 at expiration.

*See the discussion of Risk Factors on page 5 of this manual.*

## Split-fee Call

<b>Description</b>	Gives the buyer exposure to the upside in the underlying above the strike, with increased leverage. Two payments are required. If the buyer chooses not to make the second payment, the option expires worthless. Also known as compound options.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives highly leveraged exposure to upside in the stock, with limited downside.</li> <li>• Investors profit from long call positions if the volatility of the security underlying the option increases.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold if volatility is expected to decline.</li> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(S - K, 0)$ , where $S$ is the price of the underlying when the option expires, and $K$ is the strike price. The option pays off only if the buyer makes both required payments.
	<b>Trade Day</b>	Buyer makes a single premium payment at trade initiation and has the option of making a second premium payment.
	<b>Second Payment</b>	If the buyer chooses not to make the second payment, the option expires worthless.
	<b>Expiration</b>	The seller may have to make a single payment if the underlying settles above the strike.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price rises beyond the strike.</p>	<p><b>Limited.</b></p> <p>If the stock fails to rally, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock fails to rally, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price rises above the strike, potential losses are unlimited.</p>

### Sensitivities

	Delta	Vega	Correlation <sup>a</sup>	Time	Complexity
<b>Buyer</b>	+	+	+	-	
<b>Seller</b>	-	-	-	+	
<b>Importance</b>	◆	◆	◇	◆	

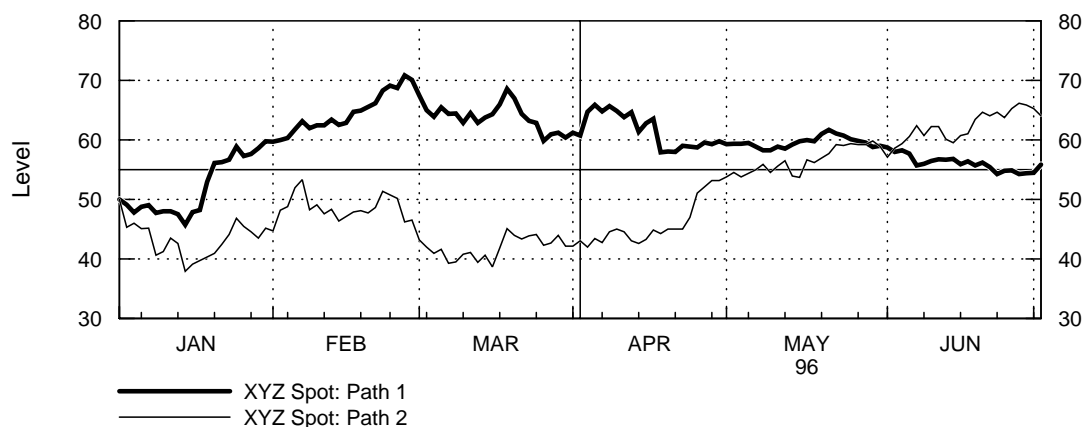
a. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Split-fee Call*

**Example:** An investor buys a split-fee call on the stock XYZ. The call has six months to expiration and is struck 10% out of the money. Assume that this is offered with an initial payment of 5% and a second payment three months into the option's life of 8%. This is consistent with the assumption that an ordinary 10% out of the money call on the same stock is offered for 8.50%. The investor thinks that the stock is likely to make a large jump to the upside, but wants to pay less for the option in case his view is wrong. In return for paying less up front, the investor must pay more later if he is right. The costs and strikes are quoted in terms of the stock's price on trade day. If XYZ is trading at \$50.00, then the strike is \$55.00 and the first premium payment \$2.50. The second premium payment (if the investor chooses to make it) is \$4.00.

### Split-fee Call: Possible Scenarios



The vertical line represents the date when the investor must decide whether to make the second payment of \$4.00. Under the first path, XYZ is trading at \$60.75 on the decision date. This puts the option \$5.00 in the money, so the investor is willing to make a \$4.00 payment. However, the stock trades down over the next three months, closing at \$56.00 when the option expires. In this case, the investor receives a payment of \$1.00 = \$56.00 - \$55.00 on the option.

Under the second path, the stock is trading at \$43.00 when the investor must decide whether to pay another \$4.00 on the option. The option is now \$12.00 out of the money. Since a vanilla option with three months to expiration and a strike of \$55.00 is only worth about \$1.35 when the stock is at \$43.00, the investor does not make the second payment and the option expires worthless.

*See the discussion of Risk Factors on page 5 of this manual.*

*Split-fee Put*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying below the strike, with increased leverage. Two payments are required. If the buyer chooses not to make the second payment, the option expires worthless. Also known as a compound option.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives highly leveraged exposure to downside in the stock, with limited downside.</li> <li>• Investors profits from long put positions if the volatility of the security underlying the option increases.</li> <li>• Hedging a long position in the underlying stock.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold if volatility is expected to decline.</li> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S, 0)$ , where $S$ is the price of the underlying when the option expires, and $K$ is the strike price. The option pays off only if the buyer makes both required payments.
	<b>Trade Day</b>	Buyer makes a single premium payment at trade initiation and has the option of making a second premium payment.
	<b>Second Payment</b>	If the buyer chooses not to make the second payment, the option expires worthless.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles below the strike and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price falls below the strike.</p>	<p><b>Limited.</b></p> <p>If the stock price does not fall, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock price does not fall, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price falls below the strike, potential losses are unlimited.</p>

**Sensitivities**

	Delta	Vega	Correlation <sup>a</sup>	Time	Complexity
<b>Buyer</b>	-	+	+	-	
<b>Seller</b>	+	-	-	+	
<b>Importance</b>	◆	◆	◇	◇	

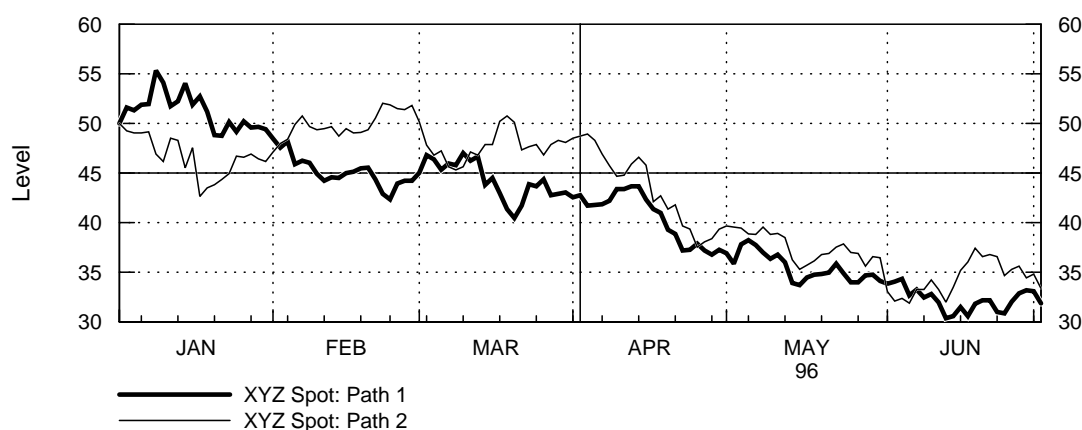
a. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Split-fee Put*

**Example:** An investor buys a split-fee put on the stock XYZ. The put has six months to expiration and is struck 10% out of the money. Assume that this is offered with an initial payment of 3% and a second payment three months into the option's life of 4%. This is consistent with the assumption that an ordinary 10% out of the money put on the same stock is offered for 5.70%. The investor thinks that the stock is likely to sell off dramatically, but wants to pay less for the option in case his view is wrong. In return for paying less up front, the investor must pay more later if he is right. The costs and strikes are quoted in terms of the stock's price on trade day. If XYZ is trading at \$50.00, then the strike is \$45.00 ( $\$50.00 \times 90\%$ ) and the first premium payment \$1.50 ( $\$50.00 \times 3\%$ ). The second premium payment (if the investor chooses to make it) is \$2.00 ( $\$50.00 \times 4\%$ ).

### Split-fee Put: Possible Scenarios



The vertical line represents the date when the investor must decide whether to make the second payment of \$2.00. Under the first path, XYZ is trading at \$42.75 on the decision date. This puts the option \$2.25 in the money, so the investor is willing to make a \$2.00 payment. The stock continues to trade down over the next three months, closing at \$31.88 when the option expires. In this case, the investor receives a payment of  $\$13.12 = \$45.00 - \$31.88$  on the option.

Under the second path, the stock is trading at \$48.75 when the investor must decide whether to pay another \$2.00 on the option. The option is now \$3.75 out of the money. Since a vanilla option with three months to expiration and a strike of \$45.00 is worth about \$1.90 when the stock is at \$48.75, the investor does not make the second payment as the same option could be purchased more cheaply directly. So the split-fee option expires worthless.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Knock in Call Option*

<b>Description</b>	Gives the buyer exposure to the upside in the underlying above the strike, but only if the stock reaches a barrier level; otherwise, the option expires worthless.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Since the option has no value until the barrier is breached, the option is cheaper than a conventional option.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(S - K, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. If the stock price never crosses the barrier, the option has zero value.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles above the strike, the barrier is breached and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the stock is the most important factor after moneyness.
	<b>Barrier</b>	If the stock price never crosses the designated barrier, the option expires worthless. The barrier can be above or below the stock price at trade initiation. The price can be compared to the barrier continuously or at expiration.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Once knock in occurs, profits to the extent that the stock price rises beyond the strike.</p>	<p><b>Limited.</b></p> <p>If the stock fails to rally or the option never knocks in, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If the stock fails to rally or the option never knocks in, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price rises above the strike and knock in occurs, potential losses are unlimited.</p>

Sensitivities	Delta vs. Barrier <sup>a</sup>		Vega	Correlation <sup>b</sup>	Time	Complexity
	Bar > Spot	Bar < Spot				
<b>Buyer</b>	<b>BA</b> +	<b>BA</b> +	+	+	-	
<b>Seller</b>	<b>BA</b> -	<b>BA</b> -	-	-	+	
<b>Importance</b>	◆	◆	◆	◇	◆	

a. B indicates the time before knock in and A is for the time after knock in.

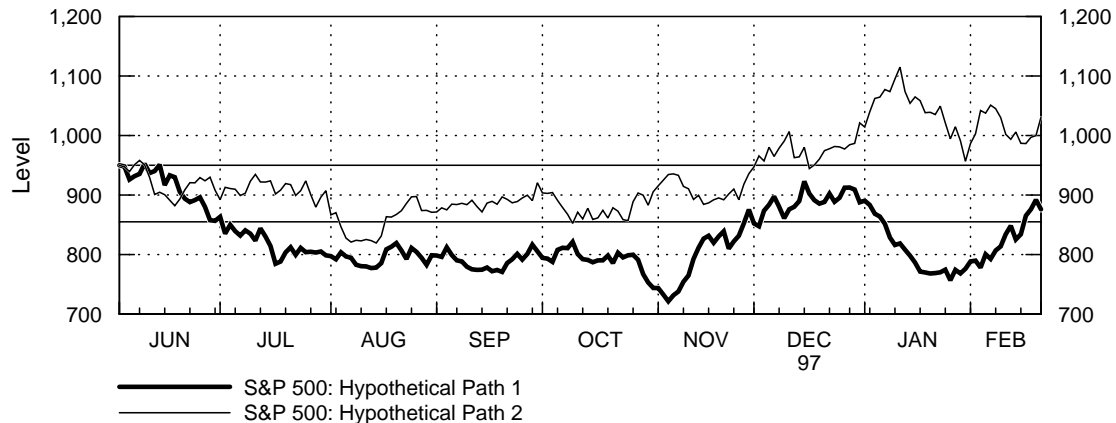
b. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Knock in Call Option*

**Example:** An investor buys a knock in call on the S&P 500. The call has six months to expiration, is struck at the money and knocks in when the index falls 10% from its initial level. Assume that this is offered for 0.94%. With the index at 950, this puts the strike at 950, the barrier at 855 and the premium is 8.93 index points.

#### **Knock in Call: Hypothetical Paths**



The first path dips down to a low of 721, crossing the barrier at 855 in late June. However, at expiration, the index is at 876.05. Since the strike is at 950, the option would expire worthless under the first path.

The second path also knocks in, crossing below the 855 level in early August. At expiration, the level of the index is 1030.78, so the option pays out  $80.78 = 1030.78 - 950.00$  index points.

*See the discussion of Risk Factors on page 5 of this manual.*



*Knock in Put Option*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying below the strike, but only if the stock reaches a barrier level; otherwise, the option expires worthless.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Since the option has no value until the barrier is breached, the option is cheaper than a conventional option.</li> <li>• Investors profit from long put positions if the volatility of the security underlying the option increases.</li> <li>• Hedging a long position in the underlying stock.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• May be sold as part of a spread strategy; e.g., a knock-in put spread.</li> <li>• Can be sold if volatility is expected to decline.</li> <li>• Selling puts is a way of being paid for implementing targeted buys.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. If the stock price never crosses the barrier, the option has zero value.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles below the strike, the barrier is breached and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the stock is the most important factor after moneyness.
	<b>Barrier</b>	If the stock price never crosses some barrier, the option expires worthless. The barrier can be above or below the stock price at trade initiation. The price can be compared to the barrier continuously or at expiration.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b> Once the option knocks in, profits to the extent that the stock price falls below the strike.</p>	<p><b>Limited.</b> If the stock fails to rally or the option never knocks in, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b> If the stock price does not fall or the option never knocks in, keeps the premium.</p>	<p><b>Unlimited.</b> If the stock price falls below the strike, potential losses are unlimited.</p>

<b>Sensitivities</b>	<b>Delta vs. Barrier<sup>a</sup></b>				<b>Time</b>	<b>Complexity</b>
	<b>Bar &gt; Spot</b>	<b>Bar &lt; Spot</b>	<b>Vega</b>	<b>Correlation<sup>b</sup></b>		
<b>Buyer</b>	<b>BA</b> + -	<b>BA</b> - -	+	+	-	
<b>Seller</b>	<b>BA</b> - +	<b>BA</b> + +	-	-	+	
<b>Importance</b>	◆	◆	◊	◊	◊	

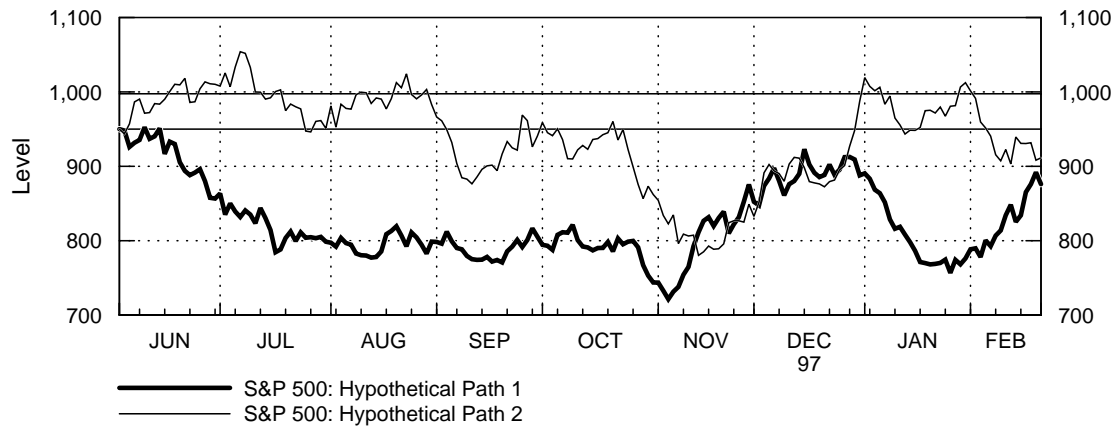
a. B indicates the time before knock in and A is for the time after knock in.  
 b. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Knock in Put Option*

**Example:** An investor buys a knock in put on the S&P 500. The put has six months to expiration, is struck at the money and knocks in when the index rises 5% from its initial level. Assume that this is offered for 2.60%. With the index at 950, this puts the strike at 950, the barrier at 997.50 and the premium is 24.70 index points.

### Knock in Put: Hypothetical Paths



The first path never reaches a level greater than 952.53, much less than the knock in barrier at 997.50. Under the first path, the option expires worthless even though the level of the index at expiration is below the strike.

The second path does knock in, crossing above the 977.50 level in mid June. At expiration, the level of the index is 911.40, so the option pays out  $38.60 = 950.00 - 911.40$  index points.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Knock out Call Option*

<b>Description</b>	Gives the buyer exposure to the upside in the underlying above the strike, but only if the stock never reaches a barrier level; if it does, then the option expires worthless.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Since the option has no value if the barrier is breached, the option is cheaper than a conventional option.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(S - K, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. If the stock price ever crosses the barrier, the option has zero value.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles above the strike, the barrier is never breached and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the stock is the most important factor after moneyness.
	<b>Barrier</b>	If the stock price ever crosses the designated barrier, the option expires worthless. The barrier can be above or below the stock price at trade initiation. The price can be compared to the barrier continuously or at expiration.
	<b>Rebate</b>	Knock out options may include provision for a fixed rebate payment if knock out occurs.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

<b>Market Risks</b>	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that the stock price rises beyond the strike, assuming knock out does not occur.	<b>Limited.</b> If the stock fails to rally or the option knocks out, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the stock fails to rally or the option knocks out, keeps the premium.	<b>Unlimited.</b> If the stock price rises above the strike, potential losses are unlimited.

<b>Sensitivities</b>	<b>Delta vs. Barrier<sup>a</sup></b>					<b>Complexity</b>
	<b>Bar &gt; Spot</b>	<b>Bar &lt; Spot</b>	<b>Vega<sup>b</sup></b>	<b>Correlation<sup>c</sup></b>	<b>Time</b>	
<b>Buyer</b>			+	+	-	
<b>Seller</b>			-	-	+	
<b>Importance</b>						

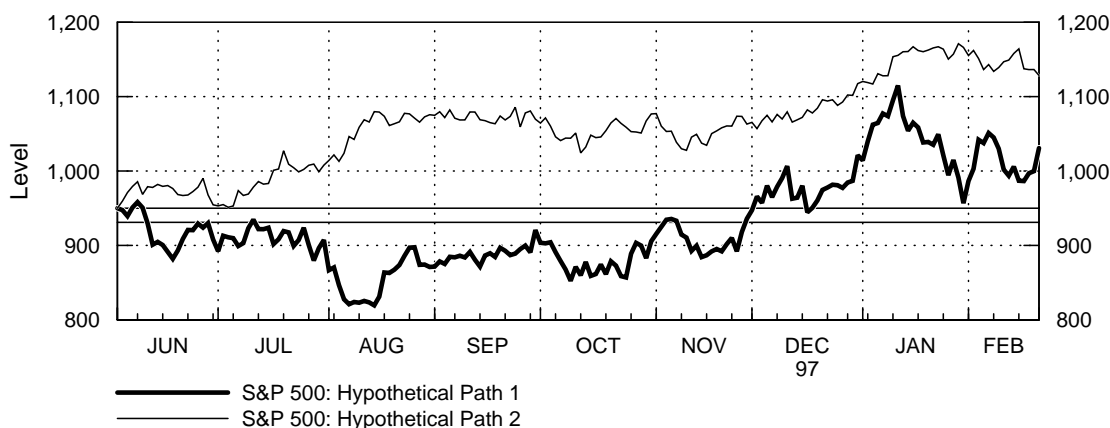
- a. If the barrier is above the strike price, then the buyer will be short the stock when the stock trades close enough to the barrier.
- b. As with the delta, the holder of the option will be short volatility when the stock price nears the barrier.
- c. If the underlying is an index, then the buyer is long correlation among the stocks in the index, unless the stock is trading close to the barrier.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Knock out Call Option*

**Example:** An investor buys a knock out call on the S&P 500. The call has six months to expiration, is struck at the money and knocks out when the index falls 2% from its initial level. The investor believes that the index is about to shoot up and continue to rise. Assume that this is offered for 2.15%. With the index at 950, this puts the strike at 950, the barrier at 931 and the premium is 20.43 index points.

### **Knock out Call: Hypothetical Paths**



In both cases, the investor was correct in his view that the index was headed up in the long term, but under the first path, the index fell below the barrier at 931 almost immediately. The option knocked out and expired worthless in the first case.

Under the second path, the low of the index is 950. The 931 level is never reached, so the option does not knock out. At expiration, the index is at 1128.43, so the option pays out  $178.43 = 1128.43 - 950.00$  index points.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Knock out Put Option*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying below the strike, but only if the stock never reaches a barrier level; if it does, then the option expires worthless.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Since the option has no value if the barrier is breached, the option is cheaper than a conventional option.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• May be sold as part of a spread strategy; e.g., a knock-in put spread.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. If the stock price ever crosses the barrier, the option has zero value.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller may have to make a single payment if the underlying settles below the strike, the barrier is never breached and option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the stock is the most important factor after moneyness.
	<b>Barrier</b>	If the stock price ever crosses some barrier, the option expires worthless. The barrier can be above or below the stock price at trade initiation. The price can be compared to the barrier continuously or at expiration.
	<b>Rebate</b>	Knock out options may include provision for a fixed rebate payment if knock out occurs.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

#### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that the stock price falls beyond the strike, assuming knock out does not occur.	<b>Limited.</b> If the stock price does not fall or the option knocks out, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the stock price does not fall or the option knocks out, keeps the premium.	<b>Unlimited.</b> If the stock price falls below the strike, potential losses are unlimited.

<b>Sensitivities</b>	<b>Delta vs. Barrier<sup>a</sup></b>					<b>Complexity</b>
	Bar > Spot	Bar < Spot	Vega <sup>b</sup>	Correlation <sup>c</sup>	Time	
<b>Buyer</b>	—	—	+	+	—	
<b>Seller</b>	+	+	—	—	+	
<b>Importance</b>	◆	◆	◆	◇	◆	

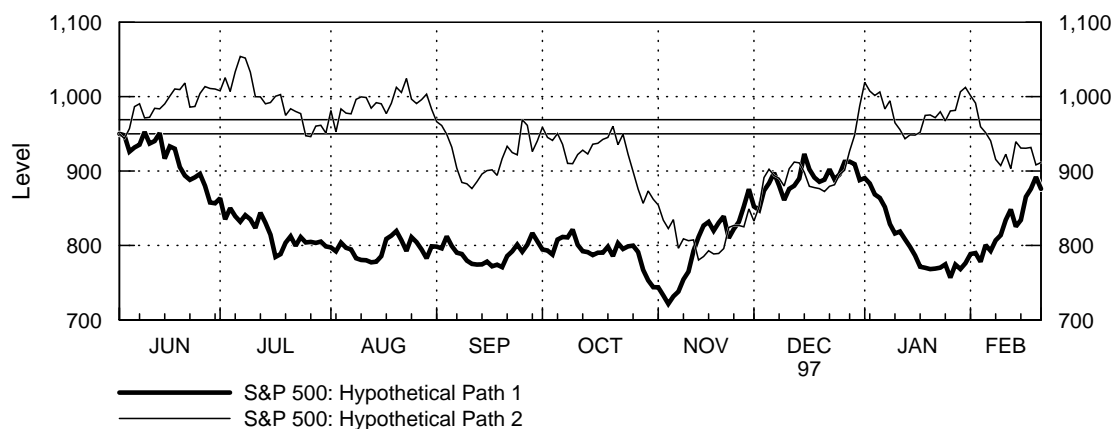
- a. If the barrier is below the strike price, then the buyer will be long the stock when the stock trades close enough to the barrier.
- b. As with the delta, the holder of the option will be short volatility when the stock price nears the barrier.
- c. If the underlying is an index, then the buyer is long correlation among the stocks in the index, unless the stock is trading close to the barrier.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Knock out Put Option*

**Example:** An investor buys a knock out put on the S&P 500. The put has six months to expiration, is struck at the money and knocks out when the index rises 2% from its initial level. The investor believes that the index is about to fall with no recovery. Assume that this is offered for 1.50%. With the index at 950, this puts the strike at 950, the barrier at 969 and the premium is 14.25 index points.

### Knock out Put: Hypothetical Paths



In both cases, the investor was correct in his view that the index was headed down in the long term, but under the second path, the index rose above the barrier at 969 almost immediately. The option knocked out and expired worthless in the first case.

Under the first path, the high of the index is 952.53. The 969 level is never reached, so the option does not knock out. At expiration, the index is at 876.05, so the option pays out  $73.95 = 950.00 - 876.05$  index points.

*See the discussion of Risk Factors on page 5 of this manual.*

*Knock in Call Option: Outside Barrier*

<b>Description</b>	Gives the buyer exposure to the upside in the underlying above the strike, but only if a second security reaches a barrier level; otherwise, the option expires worthless.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Since the option has no value until the barrier is breached, the option is cheaper than a conventional option.</li> <li>• The choice of assets tailors the option to the investor’s view.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(S - K, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. If the second security never crosses the barrier, the option has zero value.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles above the strike, the barrier is breached and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the stock is the most important factor after moneyness.
	<b>Barrier</b>	If the second security never crosses some barrier, the option expires worthless. The price can be compared to the barrier continuously or at expiration.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b> If the option knocks in, profits to the extent that the stock price rises above the strike.</p>	<p><b>Limited.</b> If the stock fails to rally or the option never knocks in, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b> If the stock fails to rally or the option never knocks in, keeps the premium.</p>	<p><b>Unlimited.</b> If the stock price rises above the strike and the barrier is breached, potential losses are unlimited.</p>

<b>Sensitivities</b>	<b>Delta vs. Outside Barrier<sup>a</sup></b>					
	<b>Bar &gt; Spot</b>	<b>Bar &lt; Spot</b>	<b>Vega<sup>b</sup></b>	<b>Correlation<sup>c</sup></b>	<b>Time</b>	<b>Complexity</b>
<b>Buyer</b>			+	+	-	
<b>Seller</b>			-	-	+	
<b>Importance</b>						

a. The buyer is always long the underlying stock and could be long or short the second security, depending on where the knock in barrier is set.

b. The buyer is long volatility in both assets.

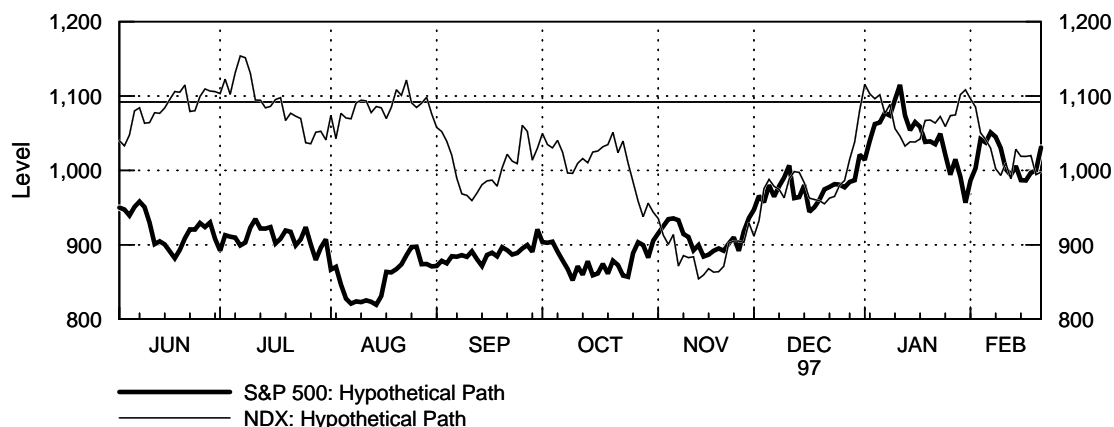
c. If the underlying is an index, then the buyer is long correlation among the stocks in the index. The buyer is also long correlation among the stocks in the second security if it is an index. If the barrier is above the spot price of the second security, the buyer is long correlation between the underlying and second security; otherwise short.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Knock in Call Option: Outside Barrier*

**Example:** An investor buys a knock in call on the S&P 500. The call has six months to expiration, is struck at the money and knocks in when the NDX (Nasdaq 100) index rises 5% from its initial level. The investor believes that a rally in the NDX will signal a rally in the S&P 500. Assume that this is offered for 7.40% of the S&P 500 spot. With S&P 500 at 950 and the NDX at 1040, this puts the strike at 950 (S&P 500), the barrier at 1092 (NDX) and the premium is 70.30 S&P 500 index points.

#### **Knock in Call with Outside Barrier: Hypothetical Paths**



The high of the NDX over the life of the option is 1153.87, so the option knocked in, crossing the 1092 level for the first time in mid June. If this level had never been crossed, the option would have expired worthless.

Since the option knocked in, the call becomes an call on the S&P 500 struck at 950. Since the S&P 500 traded at 1030.78 at expiration, the option's payout is  $80.78 = 1030.78 - 950.00$  S&P 500 index points.

*See the discussion of Risk Factors on page 5 of this manual.*



*Knock in Put Option: Outside Barrier*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying below the strike, but only if a second security reaches a barrier level; otherwise, the option expires worthless.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Since the option has no value until the barrier is breached, the option is cheaper than a conventional option.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• May be sold as part of a spread strategy; e.g., a knock-in put spread.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. If the second security never crosses the barrier, the option has zero value.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles below the strike, the barrier is breached and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the stock is the most important factor after moneyness.
	<b>Barrier</b>	If the second security never crosses the designated barrier, the option expires worthless. The price can be compared to the barrier continuously or at expiration.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

Market Risks	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> If the option knocks in, profits to the extent that the stock price falls below the strike.	<b>Limited.</b> If the stock fails to rally or the option never knocks in, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the stock fails to rally or the option never knocks in, keeps the premium.	<b>Unlimited.</b> If the stock price falls below the strike and the option knocks in, potential losses are unlimited.

Sensitivities	Delta vs. Outside Barrier <sup>a</sup>					
	Bar > Spot	Bar < Spot	Vega <sup>b</sup>	Correlation <sup>c</sup>	Time	Complexity
<b>Buyer</b>			+	+	-	
<b>Seller</b>			-	-	+	
<b>Importance</b>	◆	◆	◆	◆	◆	

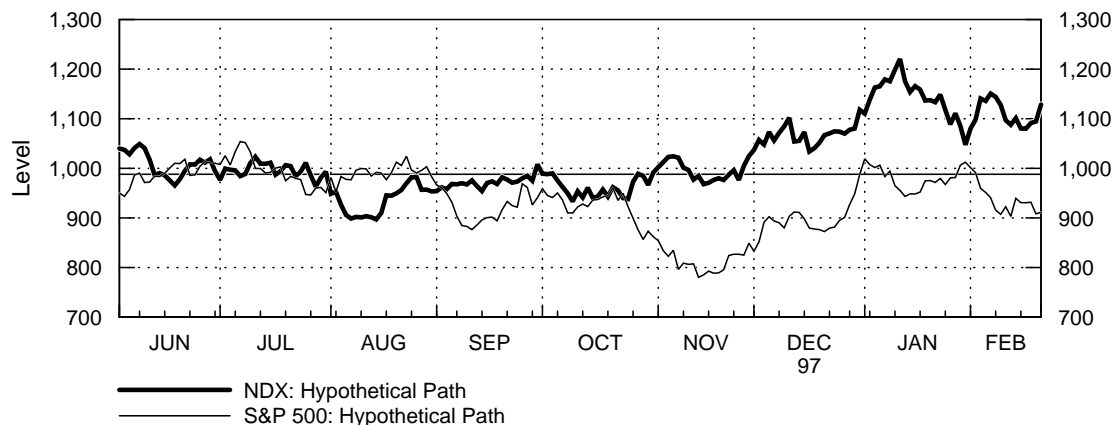
- a. The buyer is always short the underlying stock and could be long or short the second security, depending on where the knock in barrier is set.
- b. The buyer is long volatility in both the underlying and outside asset.
- c. If the underlying is an index, then the buyer is long correlation among the stocks in the index. The buyer is also long correlation among the stocks in the second security if it is an index. If the barrier is above the spot price of the second security, the buyer is long correlation between the underlying and second security; otherwise short.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Knock in Put Option: Outside Barrier*

**Example:** An investor buys a knock in put on the S&P 500. The put has six months to expiration, is struck at the money and knocks in when the NDX (Nasdaq 100) index falls 5% from its initial level. The investor believes that a sell-off in the NDX is a sign that the S&P 500 will sell off as well. Assume that this is offered for 5.50% of the S&P 500 spot. With S&P 500 at 950 and the NDX at 1040, this puts the strike at 950 (S&P 500), the barrier at 988 (NDX) and the cost is 52.25 S&P 500 index points.

#### **Knock in Put with Outside Barrier: Hypothetical Paths**



The low of the NDX over the life of the option is 897.02, so the option knocked in, crossing the 988 level for the first time in mid June. If this level had never been crossed, the option would have expired worthless.

Since the option knocked in, the put becomes a put on the S&P 500 struck at 950. Since the S&P 500 traded at 911.40 at expiration, the option's payout is  $38.60 = 950.00 - 911.40$  S&P 500 index points.

*See the discussion of Risk Factors on page 5 of this manual.*

## Knock out Call Option: Outside Barrier

<b>Description</b>	Gives the buyer exposure to the upside in the underlying above the strike, but only if a second security never reaches a barrier level; if it does, the option expires worthless.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stock, with limited downside.</li> <li>• Since the option has no value if the barrier is breached, the option is cheaper than a conventional option.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(S - K, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. If the second security ever crosses the barrier, the option has zero value.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles above the strike, the barrier is never breached and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the stock is the most important factor after moneyness.
	<b>Barrier</b>	If the second security ever crosses some barrier, the option expires worthless. The barrier can be above or below its price at trade initiation and the price can be compared to the barrier continuously or at expiration.
	<b>Rebate</b>	Knock out options may include provision for a fixed rebate payment if knock out occurs.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

<b>Market Risks</b>	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that the stock price rises above the strike, assuming knock out does not occur.	<b>Limited.</b> If the stock fails to rally or the option knocks out, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the stock fails to rally or the option knocks out, keeps the premium.	<b>Unlimited.</b> If the stock price rises above the strike, potential losses are unlimited.

<b>Sensitivities</b>	<b>Delta vs. Outside Barrier<sup>a</sup></b>		<b>Vega<sup>b</sup></b>	<b>Correlation<sup>c</sup></b>	<b>Time</b>	<b>Complexity</b>
	<b>Bar &gt; Spot</b>	<b>Bar &lt; Spot</b>				
<b>Buyer</b>	+ -	+ +	+	+	-	
<b>Seller</b>	- +	- -	-	-	+	
<b>Importance</b>	◆	◆	◆	◆	◆	

a. The buyer is always long the underlying stock and could be long or short the second security, depending on where the knock in barrier is set.

b. The buyer is always long volatility in the underlying and will generally be short volatility in the second asset.

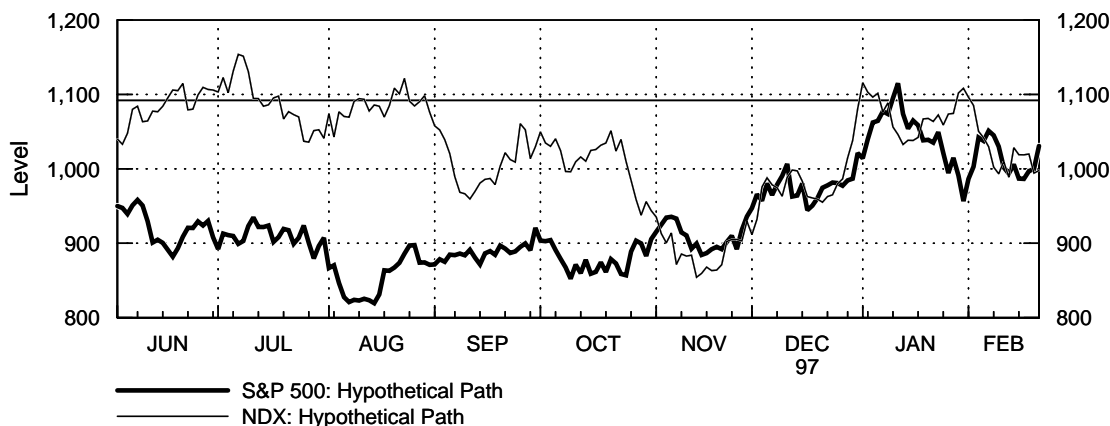
c. If the underlying is an index, then the buyer is long correlation among the stocks in the index. The buyer is also short correlation among the stocks in the second security if it is an index. If the barrier is above the spot price of the second security, the buyer is short correlation between the underlying and second security; otherwise long.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Knock out Call Option: Outside Barrier*

**Example:** An investor buys a knock out call on the S&P 500. The call has six months to expiration, is struck at the money and knocks out when the NDX (Nasdaq 100) index rises 5% from its initial level. This makes sense if the investor believes that the S&P 500 is poised to show outstanding returns, while the NDX shows modest gains at most. Assume that this is offered for 0.50% of the S&P 500 spot. With the S&P 500 at 950 and the NDX at 1040, this puts the strike at 950 (S&P 500), the barrier at 1092 (NDX) and the premium is 4.75 S&P 500 index points.

#### **Knock out Call with Outside Barrier: Hypothetical Paths**



The high of the NDX over the life of the option is 1153.87, so the option knocked out, crossing the 1092 level for the first time in mid June. As a result, the option expired worthless.

If the option had not knocked out, the put would have paid off  $80.78 = 1030.78 - 950.00$  since the S&P 500 was trading at 1030.78 at expiration.

Another strategy that may make sense is buying calls that knock out if the yield on the 30 year bond rises by a certain amount, the idea being that when bond yields are rising, investors must be selling bonds and buying stock.

*See the discussion of Risk Factors on page 5 of this manual.*

*Knock out Put Option: Outside Barrier*

<b>Description</b>	Gives the buyer exposure to the downside in the underlying below the strike, but only if a second security never reaches a barrier level; if it does, the option expires worthless.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stock, with limited downside.</li> <li>• Since the option has no value if the barrier is breached, the option is cheaper than a conventional option.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• May be sold as part of a spread strategy; e.g., a knock-in put spread.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$\text{Max}(K - S, 0)$ , where $S$ is the level of the underlying at expiration, and $K$ is the strike price. If the second security ever crosses the barrier, the option has zero value.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying settles above the strike, the barrier is never breached and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	The volatility of the stock is the most important factor after moneyness.
	<b>Barrier</b>	If the second security ever crosses the designated barrier, the option expires worthless. The barrier can be above or below its price at trade initiation and the price can be compared to the barrier continuously or at expiration.
	<b>Rebate</b>	Knock out options may include provision for a fixed rebate payment if knock out occurs.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

<b>Market Risks</b>	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that the stock price falls below the strike, assuming knock out does not occur.	<b>Limited.</b> If the stock price does not fall or the option knocks out, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the stock price does not fall or the option knocks out, keeps the premium.	<b>Unlimited.</b> If the stock price falls below the strike, potential losses are unlimited.

<b>Sensitivities</b>	<b>Delta vs. Outside Barrier<sup>a</sup></b>						
	<b>Bar &gt; Spot</b>	<b>Bar &lt; Spot</b>	<b>Vega<sup>b</sup></b>	<b>Correlation<sup>c</sup></b>	<b>Time</b>	<b>Complexity</b>	
<b>Buyer</b>			+	+	-		
<b>Seller</b>			-	-	+		
<b>Importance</b>							

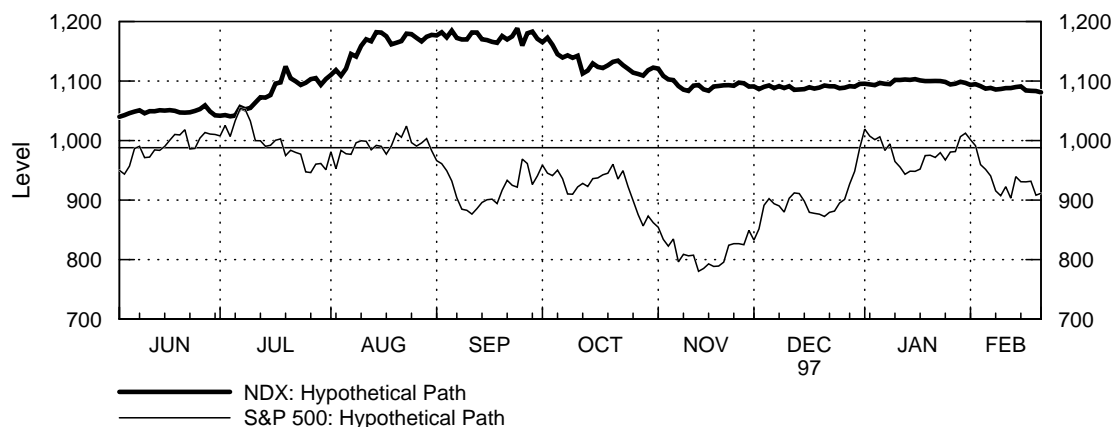
- a. The buyer is always short the underlying stock and could be long or short the second security, depending on where the knock in barrier is set.
- b. The buyer is long volatility in the underlying and short volatility in the second asset.
- c. If the underlying is an index, then the buyer is long correlation among the stocks in the index. The buyer is also short correlation among the stocks in the second security if it is an index. If the barrier is above the spot price of the second security, the buyer is short correlation between the underlying and second security; otherwise long.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Knock out Put Option: Outside Barrier*

**Example:** An investor buys a knock out put on the S&P 500. The put has six months to expiration, is struck at the money and knocks out when the NDX (Nasdaq 100) index falls 5% from its initial level. This makes sense if the investor believes that the S&P 500 is about to decline, while any declines on the NDX are modest. Assume that this is offered for 0.50% of the S&P 500 spot. With the S&P 500 at 950 and the NDX at 1040, this puts the strike at 950 (S&P 500), the barrier at 988 (NDX) and the premium is 4.75 S&P 500 index points.

#### **Knock out Put with Outside Barrier: Hypothetical Paths**



The low on the NDX over the life of the option is 1040. The option never knocked out since the NDX never fell below 988. The S&P 500 was trading at 911.40 when the option expired, so the payoff is  $38.60 = 950.00 - 911.40$  S&P 500 index points.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Binary Option*

<b>Description</b>	Gives the buyer exposure to movement of the underlying to a specific level. If the level is reached, then the buyer receives a fixed payment. Also called a digital option.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Allows the buyer to receive payments based on precise targets.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Seller is paid up front for taking the view that stock will not reach a certain level.</li> <li>• May be sold to pay for other options.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	If the stock price moves beyond the strike, holder receives a fixed payment. The stock price can be compared to the strike on a close-to-close or intraday basis, or the strike can be compared to the stock price at expiration.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if the underlying reaches the level of the strike.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Exercise Style</b>	When (and if) the barrier is breached, the holder of the option may receive payment immediately or at the maturity of the option. If payment is made immediately, the option is American; otherwise, European.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Limited.</b> Potential upside is the fixed payment if the stock reaches the target.	<b>Limited.</b> If the target is not reached, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If the target is not reached, keeps the premium.	<b>Limited.</b> Can lose no more than a fixed amount.

Sensitivities	Delta vs. Barrier <sup>a</sup>				Time	Complexity
	Bar > Spot	Bar < Spot	Vega	Correlation <sup>b</sup>		
<b>Buyer</b>	+	-	+	+	-	
<b>Seller</b>	-	+	-	-	+	
<b>Importance</b>	◆	◆	◊	◊	◊	

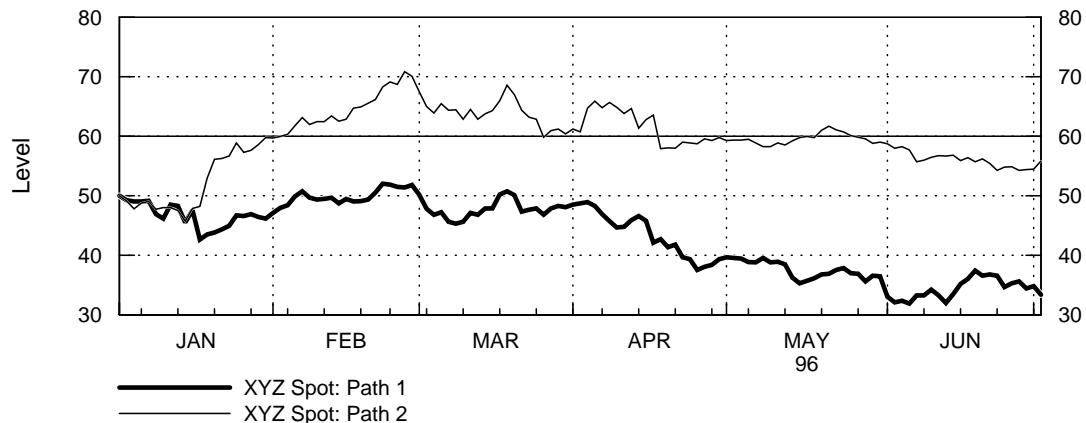
- a. If the strike is above the stock price, the buyer is long the stock; if the strike is below the stock, the buyer is short.  
 b. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## Binary Option

**Example:** An investor buys a binary option on the stock XYZ. The option has six months to expiration with the barrier 20% higher than the stock's level on trade day. Assume that this is offered for 50% of the potential payoff. If XYZ is trading at \$50.00, the strike is \$60.00 (\$50.00 x 120%). If the stock ever trades at \$60.00 or above at any time over the option's life, the investor immediately receives the payoff and the option expires. Since payment is made immediately, this is an American style option. The investor wants to receive \$100,000 if the stock reaches \$60.00, so the option costs 50% of this amount, or \$50,000.

### Binary Option: Possible Scenarios



Under the first path, the investor was right: the stock did trade higher than \$60 at some point in the option's life. In early February, the stock first traded above the strike. At that point, the investor immediately receives a payment of \$100,000 and the option expires.

At no point during the second path did the stock ever trade as high as \$60.00. In this case, the investor receives nothing and the option expires worthless.

*See the discussion of Risk Factors on page 5 of this manual.*



## Outperformance Call Option

<b>Description</b>	Gives the buyer leveraged exposure to the upside in the outperformance of one asset over another, where the relative performance is expressed in percent.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to outperformance, with limited downside.</li> <li>• The two assets can be chosen to precisely reflect the investor's views.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Sellers take in premium and keep it if stock fails to outperform.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times \text{Max}(R_A - R_B - K, 0)$ , where $R_A$ and $R_B$ are the returns of the two stocks over the life of the trade, $K$ is the strike price and $N$ is the notional size. The strike and returns are expressed in percent. The buyer anticipates that stock A will outperform stock B.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if stock A outperforms stock B by at least $K$ percent.
	<b>Key Concepts</b>	
	<b>Volatility</b>	The volatilities of the two stocks are important.
	<b>Correlation</b>	If the stocks have high correlation, the option has less value.
	<b>Total/Price Return</b>	The return of the stocks can be based on total returns (including dividends) or it can be based on the price return only.
	<b>Breakeven</b>	This is the minimum degree of outperformance needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that stock A outperforms stock B beyond the strike.	<b>Limited.</b> If the outperformance is less than the strike, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If outperformance is limited, the seller keeps the premium.	<b>Unlimited.</b> If stock A outperforms stock B, potential losses are unlimited

### Sensitivities

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	+ -	+	-	-	
<b>Seller</b>	- +	-	+	+	
<b>Importance</b>	◆	◆	◆	◆	

a. Buyer is long stock A and short stock B.

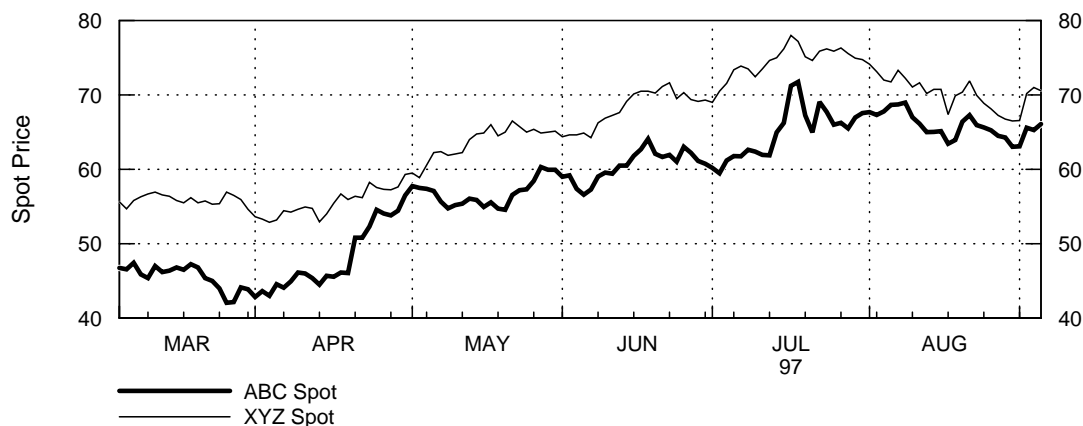
b. Buyer is short correlation between the two stocks. If either underlying is an index, then the buyer is long intra-index correlation in the underlying indices.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Outperformance Call Option*

**Example:** An investor buys a \$1,000,000 notional call on the outperformance of ABC over XYZ. The call has six months to expiration and is struck 5% out of the money. If the volatility of the stock is about 40% and the correlation is 0.50, this might be offered for 8.97%. The dollar cost is then \$89,700 and the return of ABC must be greater than those of XYZ by at least five percentage points for the buyer to receive any payout.

### **Outperformance Call: Stock Performance**



Stock ABC rose from \$46.75 to \$66.125 while XYZ rose from \$55.625 to \$70.50 over the life of the option. This translates to returns of 41.44% for ABC and 26.74% for XYZ. The payout on the option is then  $\$97,000 = \$1,000,000 \times (0.4144 - 0.2674 - 0.0500)$ .

If the two stocks had fallen in value with ABC losing less value than XYZ, the payout could still be positive. For instance, if ABC lost 10% of its value while XYZ lost 20%, then the payout would be  $\$50,000 = \$1,000,000 \times (-0.10 - (-0.20) - 0.05)$ .

To breakeven, stock A must outperform stock B by at least 13.97%, since there must be 5% outperformance to receive any payout, and an additional 8.97% of outperformance so as to receive the amount paid for the option.

An outperformance put is the same thing as an outperformance call. The expectation that A will outperform B is the same as the expectation that B will underperform A.

*See the discussion of Risk Factors on page 5 of this manual.*

## Spread Option

<b>Description</b>	Gives the buyer leveraged exposure to the upside in the outperformance of one stock over another, where the relative performance is expressed in dollar terms.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to outperformance, with limited downside.</li> <li>• The two assets can be chosen to precisely reflect the investor's views.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Sellers take in premium and keep it if stock fails to outperform.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times \text{Max}(m_A S_A - m_B S_B - K, 0)$ , where $S_A$ and $S_B$ are the prices of the two stocks at expiration, $m_A$ and $m_B$ are the number of shares of each stock, $K$ is the strike price and $N$ is the notional size. The buyer anticipates that stock A will outperform stock B.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if stock A outperforms stock B by a margin greater than the strike.
	<b>Volatility</b>	The volatilities of the two stocks are important.
<b>Key Concepts</b>	<b>Correlation</b>	If the stocks have high correlation, the option has less value.
	<b>Share Ratio</b>	The number of shares of stock A and stock B ( $m_A$ and $m_B$ ) also determines whether the option is in or out of the money.
	<b>Breakeven</b>	This is the minimum degree of outperformance needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> Profits to the extent that stock A outperforms stock B beyond the strike.	<b>Limited.</b> If the outperformance is less than the strike, can lose no more than the premium paid for the option.
<b>Seller</b>	<b>Limited.</b> If outperformance is limited, the seller keeps the premium.	<b>Unlimited.</b> If stock A outperforms stock B, potential losses are unlimited

### Sensitivities

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	+ - AB	+	-	-	
<b>Seller</b>	- + BA	-	+	+	
<b>Importance</b>	◆	◆	◆	◆	

a. Buyer is long stock A and short stock B.

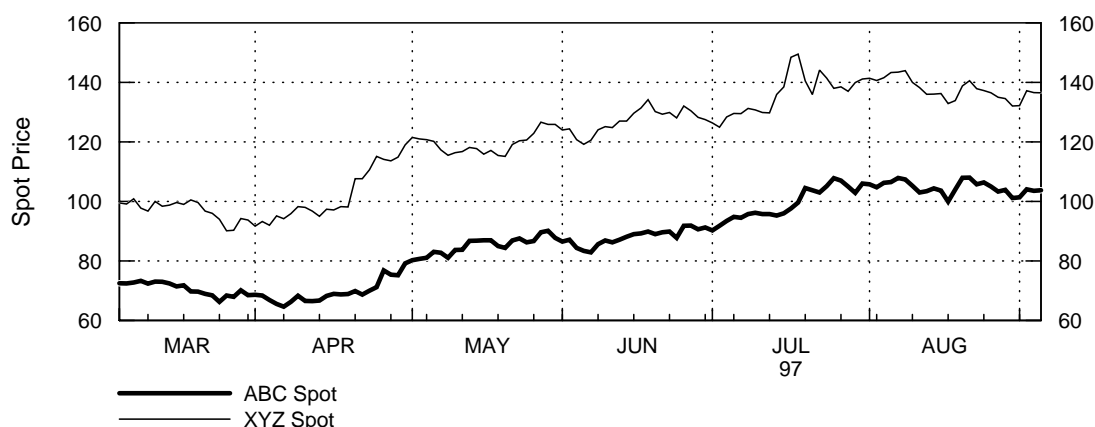
b. Buyer is short correlation between the two stocks. If either underlying is an index, then the buyer is long intra-index correlation in the underlying indices.

*See the discussion of Risk Factors on page 5 of this manual.*

## Spread Option

**Example:** An investor buys a call on the outperformance of ABC over XYZ, using three shares of ABC for every two shares of XYZ. The call has six months to expiration and is struck \$10.00 out of the money. If the volatility of the stock is about 40% and the correlation is 0.50, this might be offered for \$28.01 for every three shares of ABC and two shares of XYZ. The investor wants exposure to 30,000 shares of ABC and 20,000 shares of XYZ, for a total cost of \$280,900 ( $\$28.09 \times 30,000 / 3$ ).

### Spread Option: Stock Performance



Stock ABC rises from a spot price of \$72.50 to \$103.75 at expiration while XYZ moves from \$99.50 to \$136.50. At expiration, three shares of ABC are worth \$311.25 and two shares of XYZ are worth \$273.00. The value of the ABC shares is \$38.25 ( $\$311.25 - \$273.00$ ) more than the value of the XYZ shares. Since the strike is \$10.00, the investor receives \$28.25 for every three shares of ABC and two shares of XYZ. Since the exposure was to 30,000 shares of ABC, the total payout is \$282,500 ( $\$28.25 \times 30,000 / 3$ ).

Although the spot prices of the two stocks are important when the trade is initiated, at expiration, the return of the stocks over the life of the option is not important. Only the prices of the two stocks are needed to determine the payout. This is unlike an outperformance option.

To break even, the value of three shares of ABC must exceed the value of two shares of XYZ by at least \$38.01, where this includes the premium of \$28.01 and an additional \$10 due to the strike.

A spread put option is the same thing as a spread call option. The expectation that A will outperform B is the same as the expectation that B will underperform A.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Better of Call Option*

<b>Description</b>	Gives the buyer exposure to the upside of one of two or more stocks above the strike. At expiration, the single stock with the greatest return is used to determine the pay-off.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to upside in the stocks, with limited downside.</li> <li>• The buyer does not have to decide which of several stocks will show the best performance. The option does it for him.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Can be sold as a part of a hedging/overwriting strategy, especially when an investor believes that an entire sector will show negative to mediocre returns.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times \text{Max}(S - K, 0)$ , where $S$ is the return at expiration of the underlying stock with the highest return, $K$ is the strike price, expressed in percent and $N$ is the notional size.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if any of the underlying stocks experienced returns greater than the strike.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Correlation</b>	The greater the correlation among the underlying stocks, the less the value of the option exceeds the value of an ordinary call option.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that one of the stocks' price rises beyond the strike.</p>	<p><b>Limited.</b></p> <p>If all the stocks fail to rally, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If all the stocks fail to rally, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If any of the stocks rise above the strike, potential losses are unlimited.</p>

### Sensitivities

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	+	+	-	-	
<b>Seller</b>	-	-	+	+	
<b>Importance</b>	◆	△	△	△	

a. The buyer is always long all of the underlying stocks.

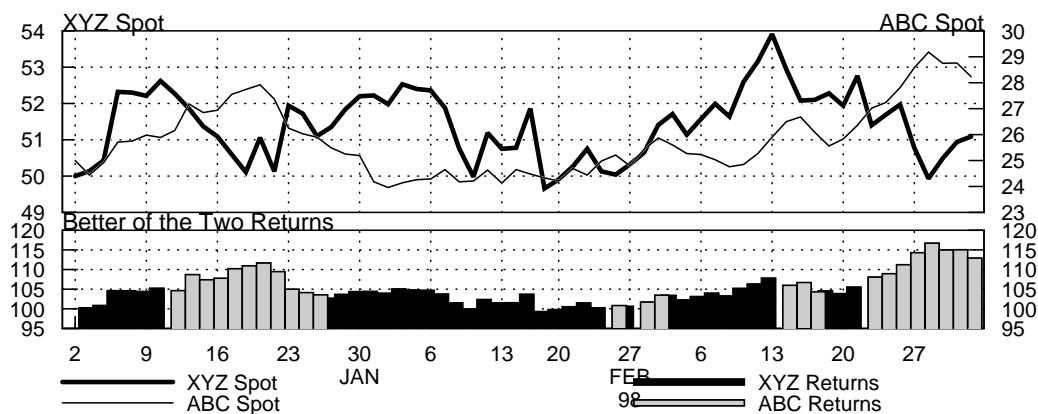
b. If the underlying is an index, then the buyer is long correlation among the stocks in the index. The buyer is always short correlation between the underlying stocks.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Better of Call Option*

**Example:** An investor buys a three month better of call struck 10% out of the money with a notional size of \$10,000,000. There are two stocks underlying the call: XYZ and ABC. Assume that this is offered for 5.95%. A call on a single one of these stocks might be offered for about 4.65%. The investor believes that the stocks are going to rally, and is willing to pay a bit more since he is uncertain which of the two will show the greatest returns. The dollar cost is then  $\$595,000 = \$10,000,000 \times 5.95\%$ .

#### Better of Call: Possible Scenario



XYZ is trading at \$50.00 and ABC at \$25.00 when the option is purchased. The graph shows the path of their two spot prices and which of the two has shown the greatest return on any given date.

At expiration, XYZ is trading at \$51.00 and ABC is at \$28.25. This puts the return of XYZ at 2% ( $\$51.00 / \$50.00$ ) and of ABC at 13% ( $\$28.25 / \$25.00$ ). ABC had the best returns over the three months, so the payoff of the option is  $\$300,000 = \$10,000,000 \times (13\% - 10\%)$ .

*See the discussion of Risk Factors on page 5 of this manual.*

## *Better of Put Option*

<b>Description</b>	Gives the buyer exposure to the downside of one of two or more stocks below the strike. At expiration, the single stock with the lowest return is used to determine the payoff.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to downside in the stocks, with limited downside.</li> <li>• The buyer does not have to decide which of several stocks will show the worst performance. The option does it for him.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Seller believes that none of the stocks in the basket is likely to fall.</li> <li>• Can be sold as a part of a collaring or spreading strategy.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times \text{Max}(K - S, 0)$ , where $S$ is the return at expiration of the underlying stock with the lowest return, $K$ is the strike price, expressed in percent, and $N$ is the notional size.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller will have to make a single payment if any of the underlying stocks experienced returns lower than the strike.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Correlation</b>	The greater the correlation among the underlying stocks, the less the value of the option exceeds the value of an ordinary put option.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that one of the stocks' price falls below the strike.</p>	<p><b>Limited.</b></p> <p>If none of the stocks' price falls, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>If none of the stocks' price falls, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If any of the stocks' price falls below the strike, potential losses are unlimited.</p>

### Sensitivities

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time	
<b>Buyer</b>	-	+	-	-	
<b>Seller</b>	+	-	+	+	
<b>Importance</b>	◆	◆	◆	◆	

a. The buyer is always short all of the underlying stocks.

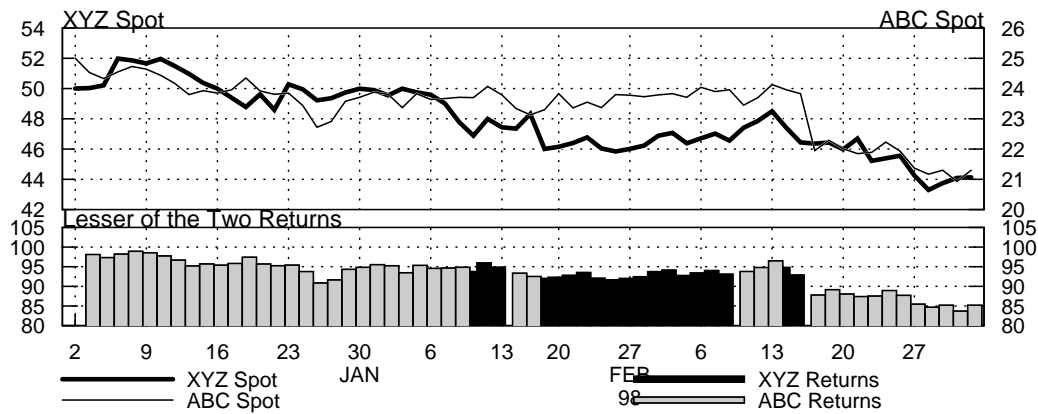
b. If the underlying is an index, then the buyer is long correlation among the stocks in the index. The buyer is always short correlation between the underlying stocks.

*See the discussion of Risk Factors on page 5 of this manual.*

*Better of Put Option*

**Example:** An investor buys a three month better of put struck 10% out of the money with a notional size of \$10,000,000. There are two stocks underlying the call: XYZ and ABC. Assume that this is offered for 4.00% A put on a single one of these stocks could be offered for about 3.30%. The investor believes that the stocks are going to fall, and is willing to pay a bit more since he is uncertain which of the two will fall the most. The dollar cost is then \$400,000 = \$10,000,000 x 4.00%.

**Better of Put: Possible Scenario**



XYZ is trading at \$50.00 and ABC at \$25.00 when the option is purchased. The graph shows the path of their two spot prices and which of the two has shown the lowest return on any given date.

At expiration, XYZ is trading at \$44.13 and ABC is at \$21.25. This puts the return of XYZ at - 11.74% ( $\$44.13 / \$50.00$ ) and of ABC at -15% ( $\$21.25 / \$25.00$ ). ABC had the lowest returns over the three months, so the payoff of the option is \$500,000 = \$10,000,000 x (15% - 10%).

*See the discussion of Risk Factors on page 5 of this manual.*



*Chooser Option*

<b>Description</b>	Gives the buyer exposure to the upside or downside, at the investor's choice, of a stock beyond the strike. On some fixed date prior to expiration, the investor must decide whether the chooser option is to be a call or a put.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Gives leveraged exposure to moves in the stock, with limited downside.</li> <li>• The buyer does not have to decide which direction the stock will take when the option is purchased. This is similar to a straddle, but cheaper.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Sellers profit if the volatility of the security underlying the option declines.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	Max( $S - K_C, 0$ ) if the investor chooses a call, or Max( $K_P - S, 0$ ) if the investor chooses a put, where $S$ is the stock price at expiration, $K_C$ and $K_P$ are the strike prices in each case.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Decision Date</b>	This is the date when the holder must decide whether the option is to be a call or put. No payments are made on this date.
	<b>Expiration</b>	The seller will have to make a single payment if the stock moved in the direction chosen by the investor (up if call chosen, down if put chosen) and the option is exercised.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Breakeven</b>	This is the minimum move needed for the payout of the option to equal the initial cost.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>Profits to the extent that the stock price moves in the direction chosen by the investor.</p>	<p><b>Limited.</b></p> <p>If the stock price does not move in the chosen direction, can lose no more than the premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>At best, keeps the premium.</p>	<p><b>Unlimited.</b></p> <p>If the stock price moves in the direction chosen by the buyer, potential losses are unlimited.</p>

**Sensitivities**

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	?	+	-	-	
<b>Seller</b>	?	-	+	+	
<b>Importance</b>	◆	△	△	△	

a. Before the investor chooses call or put, he will be long if the stock has risen, short if it has fallen. Once the choice is made, sensitivities are as for a vanilla option.

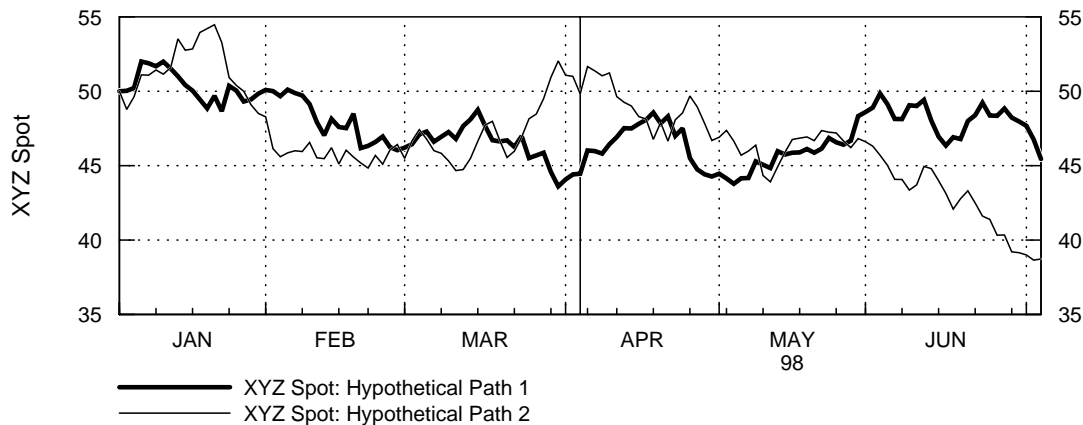
b. If the underlying is an index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

## Chooser Option

**Example:** An investor buys a six month chooser option on the stock XYZ struck 5% out of the money on both sides. Three months after the option is purchased, the investor must choose whether he wants a call or a put. Assume that this is offered for 15.75%. A six month strangle with strikes 5% out of the money on each side on the same stock might cost 17.75%. When the chooser option is purchased, XYZ is trading at \$50.00, so the strikes are \$52.50 and \$47.50 and the dollar premium is  $\$7.88 = \$50.00 \times 15.75\%$ , somewhat less than the premium of a comparable straddle.

### Chooser Option: Possible Scenarios



The vertical line indicates the date when the investor must choose whether the option is to be a call or put. Under the first path, the investor chose a put since the stock has fallen to \$44.50, which is below the lower strike. At expiration, XYZ is trading at \$45.50. Since this is less than the put strike, the investor receives  $\$2.00 = \$47.50 - \$45.50$ , which is less than the breakeven.

Under the second path, XYZ is trading at \$49.75 on the decision date. Comparing the value of a three month call struck at \$52.50 to a put struck at \$47.50, the investor finds that the call is worth more, so he chooses the call. At expiration, the stock is trading at \$38.75. This is far below the strike of the call, so the investor receives nothing.

*See the discussion of Risk Factors on page 5 of this manual.*

*Accrual Option*

<b>Description</b>	The buyer is paid a fixed amount for each day that the underlying trades within some range.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Allows the buyer to receive payments based on a precise range.</li> <li>• When the trade is initiated, the buyer is short volatility.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• Seller is paid up front for taking the view that the stock will soon move outside the range.</li> <li>• A seller is using one of the few ways an investor can be paid to be long volatility.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	$N \times P$ , where $P$ is the dollars paid for every day within the range and $N$ is the number of days during which the stock traded in the range. The range in which payments are made is usually fixed for the life of the option. Payments may be made at expiration or quarterly.
	<b>Trade Day</b>	Buyer makes a single premium payment.
	<b>Expiration</b>	The seller makes a series of payments, one for each day the stock trades in the range.
<b>Key Concepts</b>	<b>Volatility</b>	After moneyness, this is the most important factor determining the value.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.
	<b>Breakeven</b>	For an accrual option, this is the number of days the stock must trade in the range for the buyer to recoup the cost of the option.

**Market Risks**

	Upside	Downside
<b>Buyer</b>	<p><b>Limited.</b> Maximum upside occurs if the stock trades in the accrual range every day of the option's life.</p>	<p><b>Limited.</b> If stock immediately moves outside the accrual range, can lose no more than premium paid for the option.</p>
<b>Seller</b>	<p><b>Limited.</b> If the stock moves out of the accrual range, keeps the premium.</p>	<p><b>Limited.</b> Can lose no more than the amount due if the stock trades in the range every day of the option's life.</p>

**Sensitivities**

	Delta <sup>a</sup>	Vega <sup>b</sup>	Correlation <sup>c</sup>	Time	Complexity
<b>Buyer</b>	$\oplus \circ -$	$\oplus - \oplus$	$\oplus - \oplus$	-	
<b>Seller</b>	$\ominus \circ +$	$\ominus + \ominus$	$\ominus + \ominus$	+	
<b>Importance</b>	◆	◆	◇	◆	

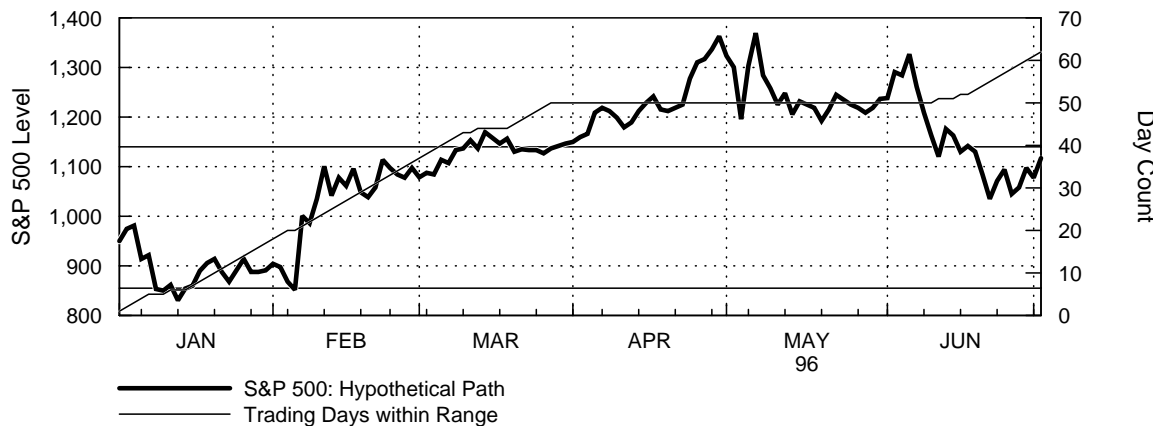
- a. When the stock price is low (close to or below the lower bound), the buyer is short. When the stock price is high (close to or above the upper bound), the buyer is short.
- b. If the stock is outside the range, the buyer is long vega; otherwise short.
- c. If the underlying is a stock index, then the buyer is long or short correlation, according as he is long or short vega.

*See the discussion of Risk Factors on page 5 of this manual.*

### Accrual Option

**Example:** An investor buys an accrual option on the S&P 500. The option has six months to expiration and pays \$5,000 for each day that the index closes in the range from 10% below to 25% above the current spot on the index. With the index at 950, the buyer will receive \$5,000 for every day that the index trades in the range 855 (950 x 90%) to 1187.50 (950 x 125%). Assume that this is offered for \$472,500. For the investor to break even, the S&P 500 must trade within the accrual range for 95 (472,500 / 5,000) trading days.

#### Accrual Option: Possible Scenarios



The horizontal lines show the accrual range. For every day for which the index closes in this range, the investor collects \$5,000. Except for a few days, the index spends the first two and a half months within the range. It then moves out of the range and doesn't return until near the end of the six months. The total number of days in which the index closed within the range is 62, so the investor receives  $310,000 = 62 \times \$5,000$ , which is 33 days short of the breakeven.

*See the discussion of Risk Factors on page 5 of this manual.*

## Range Swap

<b>Description</b>	Swap is based on the realized range (high minus low) of the underlying over the swap's life. If the range is wider than the strike, the buyer receives the difference; if narrower, the seller receives the difference.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Allows the buyer to go long the high vs. low volatility of the underlying.</li> <li>• Unlike some other ways of buying volatility, there is no upfront cost to being long volatility.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• The seller must expect the underlying to trade in a tight range.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	The buyer receives $N \times (H - L - K)$ , where $N$ is the notional size of the trade, $H$ is the high and $L$ is the low of the underlying over the life of the swap and $K$ is the strike for the range. Both $H$ and $L$ are expressed in percent terms, relative to the level of the underlying at trade initiation. If this value is negative, the buyer pays the seller.
	<b>Trade Day</b>	Buyer makes no premium payments.
	<b>Expiration</b>	Payment could flow from the buyer to seller or seller to buyer, depending on whether the range is more or less wide than $K$ .
<b>Key Concepts</b>	<b>Volatility</b>	This is the most important factor determining the strike.
	<b>Path Dependent</b>	The value of the option depends on the exact path followed by the stock.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> If the range of the underlying exceeds the strike, upside is unlimited.	<b>Limited.</b> Can lose no more than the notional times the strike if the range is zero.
<b>Seller</b>	<b>Limited.</b> Can make no more than the notional times the strike if the range is zero.	<b>Unlimited.</b> Potential losses are unlimited if the range of the underlying exceeds the strike.

### Sensitivities

	Delta <sup>a</sup>	Vega	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	$L \circ +$	+	+	-	② ③ ④
<b>Seller</b>	$+ \circ H$	-	-	+	① ③ ⑤
<b>Importance</b>	◆	◆	◇	◆	

a. When the stock price is low (close to or below the lower bound), the buyer is short. When the stock price is high (close to or above the upper bound), the buyer is short.

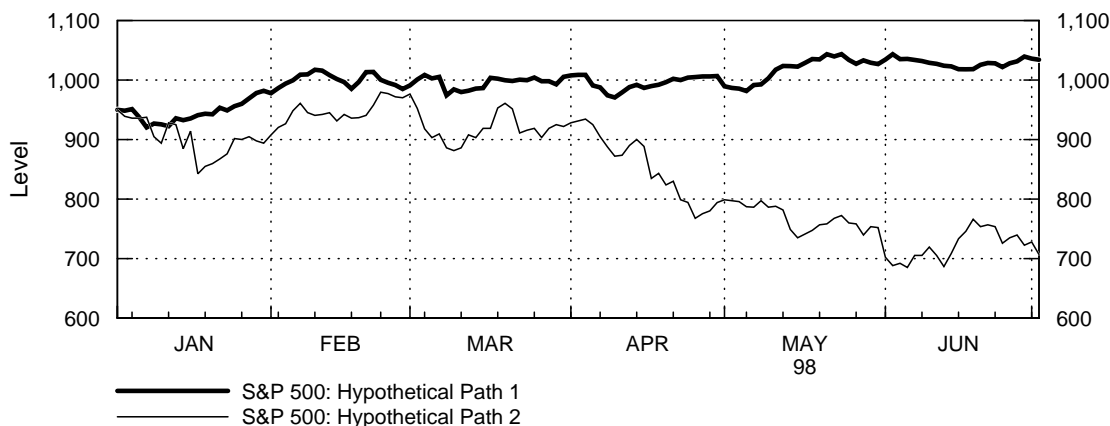
b. If the underlying is a stock index, then the buyer is long or short correlation, according as he is long or short vega.

*See the discussion of Risk Factors on page 5 of this manual.*

## Range Swap

**Example:** An investor goes short the range of the S&P 500 for six months via a range swap with a notional value of \$100,000 per percentage point. Assume that this is offered at a strike of 24%. If the range of the index is less than 24%, then the investor receives \$100,000 times the difference between 24% and the actual high minus low range. If the range is more than 24%, then he must pay \$100,000 times the difference.

### Range Swap: Possible Scenarios



The first path is obviously less volatile. The high over the six months of the option's life is 1043.52 and the low is 920.44. The range is then  $123.08 = 1043.52 - 920.44$  index points or  $12.96\% = 123.08 / 950.00$ . This is less than 24%, so the investor receives  $\$1,104,000 = \$100,000 \times (24.00 - 12.96)$ .

The second path had a much wider range. The high was 979.60 and the low was 685.12. So the range is  $294.48 = 979.60 - 685.12$  index points or  $31.00\% = 294.48 / 950.00$ . Since this is higher than 24%, the investor must pay  $\$700,000 = \$100,000 \times (31.00 - 24.00)$ .

*See the discussion of Risk Factors on page 5 of this manual.*

## Realized Volatility Swap

<b>Description</b>	Swap is based on the realized volatility of the underlying over the swap's life. If the volatility is greater than the strike, the buyer receives the difference; if less, the seller receives the difference.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Allows the buyer to go long the realized volatility of the underlying.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• The seller must expect the volatility to be lower than the strike.</li> <li>• Holders of convertible securities (for instance) can sell volatility through a swap as a hedge.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	<p>The buyer receives <math>N \times (V - K)</math>, where <math>N</math> is the notional size of the trade, <math>V</math> is the realized volatility of the underlying, calculated over the life of the swap, and <math>K</math> is the strike. If this value is negative, the buyer pays the seller. <math>V</math> is given by</p> $\sqrt{252 \times \frac{1}{M} \sum_{i=1}^M (\log r_i)^2}$ <p>where <math>M</math> is the total number of trading days over the swap's life and <math>r_i</math> is the return on day <math>i</math>.</p>
	<b>Trade Day</b>	Buyer and seller make no premium payments.
	<b>Expiration</b>	Payment could flow from the buyer to seller or seller to buyer, depending on whether realized volatility is more or less wide than $K$ .
<b>Key Concepts</b>	<b>Volatility</b>	Implied volatility is the most important factor determining the strike and the mark. As time passes, and more of the realized volatility is known, the implied volatility becomes less important.

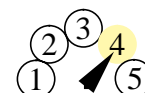
### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Unlimited.</b> If the volatility of the underlying exceeds the strike, the upside is unlimited.	<b>Limited.</b> Can lose no more than the notional times the strike if the volatility is zero.
<b>Seller</b>	<b>Limited.</b> Can make no more than the notional times the strike if the volatility is zero.	<b>Unlimited.</b> Potential losses are unlimited if the volatility of the underlying exceeds the strike.

### Sensitivities

	Delta <sup>a</sup>	Vega <sup>b</sup>	Correlation <sup>c</sup>	Time
<b>Buyer</b>	○	+	+	-
<b>Seller</b>	○	-	-	+
<b>Importance</b>	◇	◆	◇	◆

### Complexity



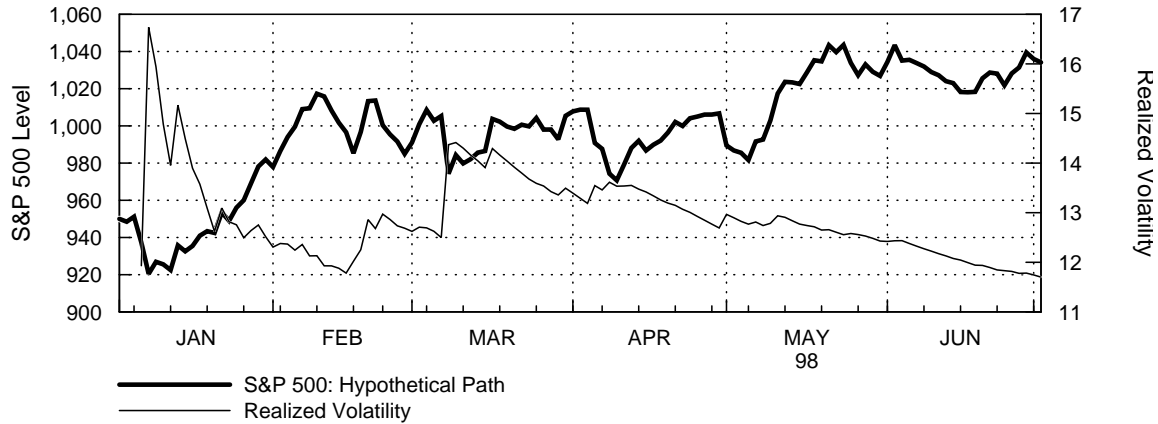
- a. Since volatility is calculated close-to-close, there can be a small intraday delta.
- b. The buyer is long *realized* volatility. Initially, the mark will be most sensitive to implied volatility.
- c. If the underlying is a stock index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Realized Volatility Swap*

**Example:** An investor goes short the volatility of the S&P 500 for one year via a volatility swap with a notional value of \$100,000 per percentage point. Assume that this is offered at a strike of 20%. If the volatility of the index is less than 20%, then the investor receives \$100,000 times the difference between 20% and the realized volatility. If the volatility is more than 20%, then he must pay \$100,000 times the difference.

#### Volatility Swap: Possible Scenarios



The graph shows both the index level and the realized volatility. The volatility is calculated on a rolling basis with the first day fixed. So, the high of 16.74% includes only the first four days of data and the value reported at the end of May (12.42%) includes the returns of the first five months.

The realized volatility over the entire period is 11.70%. Since this is less than the strike of 20%, the investor receives an amount proportional to the difference. This is  $\$830,000 = \$100,000 \times (20.00 - 11.70)$ .

*See the discussion of Risk Factors on page 5 of this manual.*



## Capped Volatility Swap

<b>Description</b>	Swap is based on the realized volatility of the underlying over the swap's life. If the volatility is greater than the strike, the buyer receives the difference; if narrower, the seller receives the difference. The amount that could be paid by the seller is capped at a fixed level.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Allows the buyer to go long the realized volatility of the underlying.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• The seller must expect the volatility to be lower than the strike. The cap reduces the risk to the seller.</li> <li>• Holders of convertible securities (for instance) can sell volatility through a swap as a hedge.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	<p>The buyer receives <math>N \times (\text{Max}(C, V) - K)</math>, where <math>N</math> is the notional size of the trade, <math>V</math> is the realized volatility of the underlying, calculated over the life of the swap, <math>C</math> is the cap and <math>K</math> is the strike. If this value is negative, the buyer pays the seller. <math>V</math> is given by</p> $\sqrt{252 \times \frac{1}{M} \sum_{i=1}^M (\log r_i)^2}$ <p>where <math>M</math> is the total number of trading days over the life of the swap and <math>r_i</math> is the return on day <math>i</math>.</p>
	<b>Trade Day</b>	Buyer and seller make no premium payments.
	<b>Expiration</b>	Payment could flow from the buyer to seller or seller to buyer, depending on whether realized volatility is more or less wide than $K$ .
<b>Key Concepts</b>	<b>Volatility</b>	Implied volatility is the most important factor determining the strike and the mark. As time passes, and more of the realized volatility is known, the implied volatility becomes less important.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<b>Limited.</b> If the volatility of the underlying exceeds the strike, then the upside is limited by the cap.	<b>Limited.</b> Can lose no more than the notional times the strike if the volatility is zero.
<b>Seller</b>	<b>Limited.</b> Can make no more than the notional times the strike if the volatility is zero.	<b>Limited.</b> Potential losses are limited by the cap.

### Sensitivities

	Delta <sup>a</sup>	Vega <sup>b</sup>	Correlation <sup>c</sup>	Time	Complexity
<b>Buyer</b>	○	+	+	-	
<b>Seller</b>	○	-	-	+	
<b>Importance</b>	◇	◆	◇	◆	

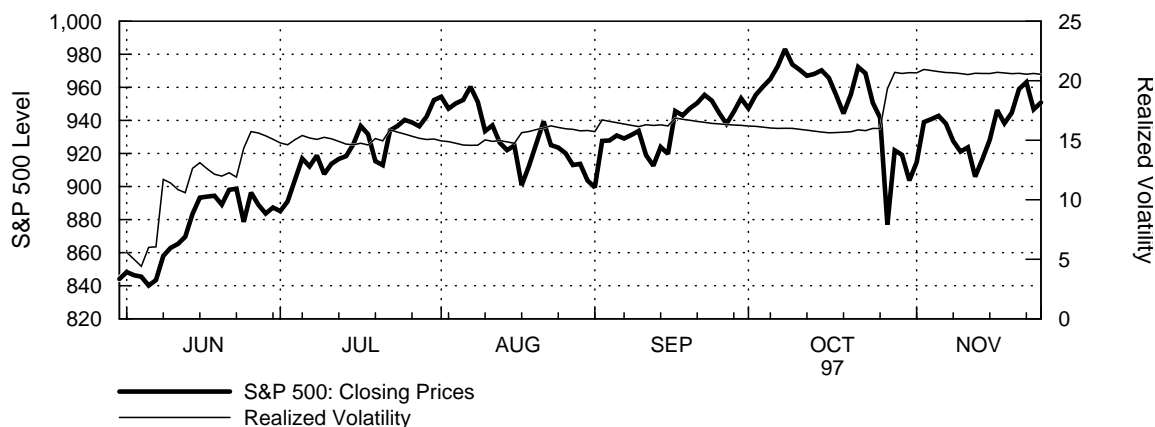
- Since volatility is calculated close-to-close, there can be a small intraday delta.
- The buyer is long *realized* volatility. Initially, the mark is most sensitive to the implied volatility. Once the cap is exceeded, the buyer and seller are neutral relative to realized volatility.
- If the underlying is a stock index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Capped Volatility Swap*

**Example:** An investor goes short the volatility of the S&P 500 for one year via a volatility swap with a notional value of \$100,000 per percentage point and a cap at 30%. Without the cap, this might be offered at a strike of 20%. With the cap at 30%, assume that this is offered at a strike of 19%. If the volatility of the index is less than 19%, then the investor receives \$100,000 times the difference between 19% and the realized volatility. If the volatility is more than 19%, then he must pay \$100,000 times the difference, up to a maximum of \$1,100,000 ( $\$100,000 \times (30 - 19)$ ).

#### **Capped Volatility Swap: Possible Scenarios**



The graph shows both the index level and the realized volatility. The volatility is calculated on a rolling basis with the first day fixed. So, the low of 4.40% includes only the first three days of data and the value reported at the end of August (15.72%) includes the returns of the first three months.

The realized volatility over the entire period is 20.54%. Since this is more than the strike of 19%, the investor must pay an amount proportional to the difference. This is  $\$154,000 = \$100,000 \times (20.54 - 19.00)$ . Because the swap is capped at 30%, the most the investor could have owed is  $\$1,100,000 = \$100,000 \times (30 - 19)$ .

*See the discussion of Risk Factors on page 5 of this manual.*

## *Implied Volatility Swap*

<b>Description</b>	Swap is based on the implied volatility of a fixed maturity of the underlying over the swap's life. If implied volatility is greater than the strike, the buyer receives the difference; if narrower, the seller receives the difference.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Allows the buyer to go long the implied volatility of the underlying.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• The seller must expect the implied volatility to be lower than the strike.</li> <li>• Holders of convertible securities (for instance) can sell volatility through a swap as a hedge.</li> </ul>
<b>Mechanics</b>	<b>Equation</b>	The buyer receives $N \times (V - K)$ , where $N$ is the notional size of the trade, $K$ is the strike and $V$ is the implied volatility of the underlying, of a fixed duration; e.g., three month implied volatility. If this value is negative, the buyer pays the seller.
	<b>Trade Day</b>	Buyer and seller make no premium payments.
	<b>Expiration</b>	Payment could flow from the buyer to seller or seller to buyer, depending on whether implied volatility is more or less wide than $K$ .
<b>Key Concepts</b>	<b>Volatility</b>	The level and term structure of implied volatility is the most important factor determining the strike.

### Market Risks

	Upside	Downside
<b>Buyer</b>	<p><b>Unlimited.</b></p> <p>If the implied volatility of the underlying exceeds the strike, then the upside is unlimited.</p>	<p><b>Limited.</b></p> <p>Can lose no more than the notional times the strike if the implied volatility is zero.</p>
<b>Seller</b>	<p><b>Limited.</b></p> <p>Can make no more than the notional times the strike if the implied volatility is zero.</p>	<p><b>Unlimited.</b></p> <p>Potential losses are unlimited if the implied volatility of the underlying exceeds the strike.</p>

### Sensitivities

	Vega <sup>a</sup>	Correlation <sup>b</sup>	Time	Complexity
<b>Buyer</b>	<b>+</b>	<b>+</b>	<b>-</b>	
<b>Seller</b>	<b>-</b>	<b>-</b>	<b>+</b>	
<b>Importance</b>	<b>◆</b>	<b>◇</b>	<b>◆</b>	

a. The buyer is long *implied* volatility.

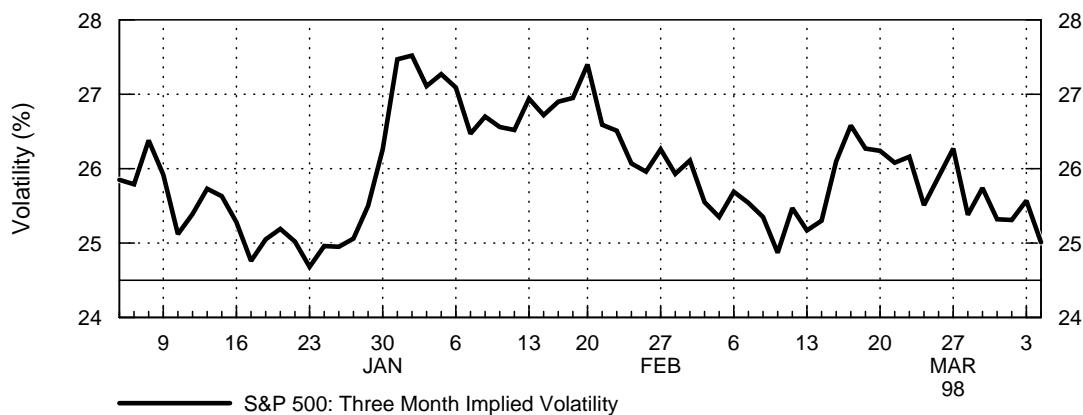
b. If the underlying is a stock index, then the buyer is long correlation among the stocks in the index.

*See the discussion of Risk Factors on page 5 of this manual.*

### *Implied Volatility Swap*

**Example:** An investor goes long the three month implied volatility of the S&P 500 via an implied volatility swap with a notional value of \$100,000 per percentage point and three months to expiration. Assume that this is offered at a strike of 24.50%. If, three months after initiation of the swap, the three month implied volatility of the index is more than 24.50%, then the investor receives \$100,000 times the difference between 24.50% and the implied volatility. If the volatility is less than 24.50%, then he must pay \$100,000 times the difference.

#### **Implied Volatility Swap: Possible Scenarios**



Three month implied volatility begins the swap at a level of 25.85%. The hypothetical course of three month implied ends at 25.01%, meaning that at the beginning of April, implied volatility for options expiring three months later, at the start of July, stands at 25.01%. Since the investor was long implied volatility, he receives  $\$51,000 = \$100,000 \times (25.01 - 24.50)$ .

*See the discussion of Risk Factors on page 5 of this manual.*

*Par Par Asset Swap*

<b>Description</b>	The buyer receives LIBOR plus a spread depending on the credit rating of the convertible bond, while the seller keeps any optionality of the convert.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Buyer is paid for assuming credit exposure.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• The seller keeps any optionality built into the convert.</li> <li>• By eliminating the credit exposure, the leverage of the convert is increased.</li> </ul>
<b>Mechanics</b>	<b>Trade Day</b>	Buyer delivers the par amount to the seller and the seller delivers the physical bond to the buyer.
	<b>Reset Dates</b>	Buyer passes the convert coupons through to the seller, while receiving LIBOR plus a spread on the par amount.
	<b>Expiration</b>	The buyer returns the bond to the seller and receives back the par amount from the seller. Terms if the company calls early or defaults are subject to negotiation when the swap is initiated.
<b>Key Concepts</b>	<b>Credit Risk</b>	If the company that issued the bond defaults, the buyer will suffer severe losses.
	<b>LIBOR</b>	LIBOR is generally used as the benchmark for one half of the swap.

**Market Risks**

	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<p><b>Limited.</b></p> <p>Receives a LIBOR enhanced return assuming no default.</p>	<p><b>Unlimited.</b></p> <p>If the bond defaults, could lose as much as par.</p>
<b>Seller</b>	<p><b>Unlimited.</b></p> <p>The optionality kept by the seller could lead to unlimited returns.</p>	<p><b>Limited.</b></p> <p>At worst, pays out the LIBOR enhancement with no additional upside.</p>

**Sensitivities**

	<u>Delta<sup>a</sup></u>	<u>Vega<sup>b</sup></u>	<b>Complexity</b>
<b>Buyer</b>	○	○	
<b>Seller</b>	?	?	
<b>Importance</b>	◆		

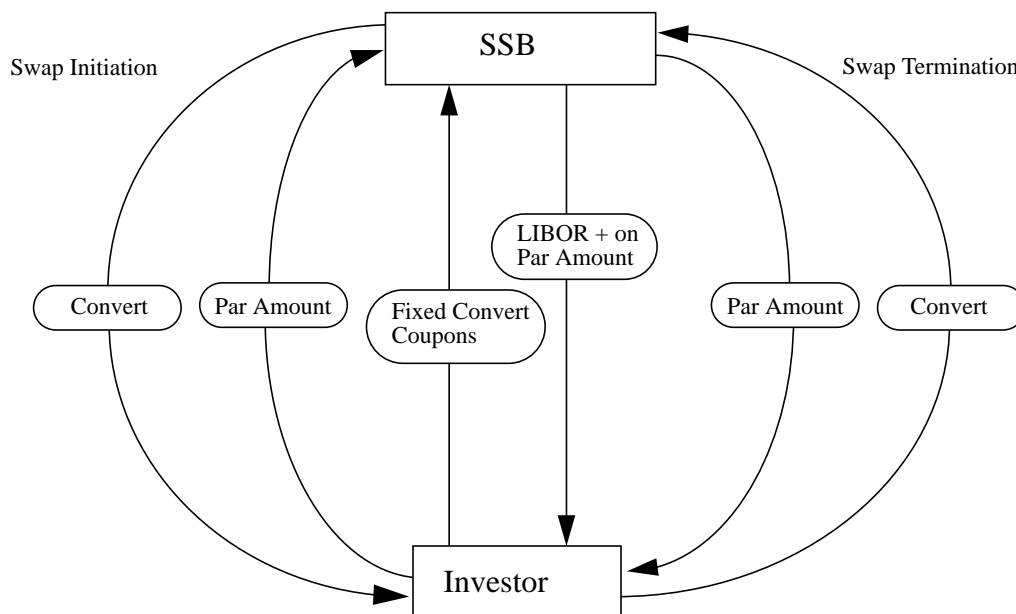
- a. The optionality embedded in the convert may make the seller long or short the underlying stock.
- b. If the convert has an embedded option, the seller is likely to be long volatility.

*See the discussion of Risk Factors on page 5 of this manual.*

## *Par Par Asset Swap*

**Example:** An investor buys a par par asset swap on the XYZ convertible bond on a total par value of \$10,000,000. The bond pays a 6% coupon and has six months of call protection remaining. The investor is to receive 150 bps over LIBOR.

### Overall Picture of Par Par Asset Swap



### Payment Flows over Life of Swap

- Trade Initiation**
- Buyer delivers \$10,000,000 to seller and receives an equivalent number of bonds in return.
- First Reset**
- LIBOR is at 5.75%.
  - The buyer receives \$150,000 ( $6\% \times \$10,000,000 / 4$ ) in quarterly coupons. These are passed through to the seller.
  - The seller pays the buyer \$181,250 ( $\$10,000,000 \times (5.75\% + 1.50\%) / 4$ ).
- Termination**
- LIBOR is at 5.50%.
  - The buyer receives \$150,000 ( $6\% \times \$10,000,000 / 4$ ) in quarterly coupons. These are passed through to the seller.
  - The seller pays the buyer \$175,000 ( $\$10,000,000 \times (5.50\% + 1.50\%) / 4$ ).
  - The company called the convert, so the swap terminates. As a result, the buyer returns the bonds to the seller and the seller returns the \$10,000,000 par amount to the buyer.

*See the discussion of Risk Factors on page 5 of this manual.*

<b>Description</b>	The buyer receives the fixed coupon of a convertible bond, in return for the market value of an equivalent vanilla bond. The value the buyer receives at maturity or early conversion accretes up to the par value.	
<b>Motivation</b>	<b>Buyer</b>	<ul style="list-style-type: none"> <li>• Buyer is paid for assuming credit exposure.</li> </ul>
	<b>Seller</b>	<ul style="list-style-type: none"> <li>• The seller keeps any optionality built into the convert.</li> <li>• By eliminating the credit exposure, the leverage of the convert is increased.</li> </ul>
<b>Mechanics</b>	<b>Trade Day</b>	Buyer delivers the market value of an equivalent vanilla bond to the seller and the seller delivers the physical bond to the buyer.
	<b>Reset Dates</b>	Buyer keeps any convert coupons.
	<b>Expiration</b>	The buyer returns the bond to the seller and receives the accreted value of the amount paid on the trade day, where accrual occurs at a fixed rate agreed to on the trade date. Terms if the company calls early or defaults are subject to negotiation when the swap is initiated.
<b>Key Concepts</b>	<b>Credit Risk</b>	If the company that issued the bond defaults, the buyer will suffer severe losses.
	<b>LIBOR</b>	LIBOR is generally used as the benchmark for one half of the swap.

**Market Risks**

	<b>Upside</b>	<b>Downside</b>
<b>Buyer</b>	<p><b>Limited.</b></p> <p>Receives a fixed above market return.</p>	<p><b>Unlimited.</b></p> <p>If the bond defaults, could lose as much as the entire amount delivered on the trade date.</p>
<b>Seller</b>	<p><b>Unlimited.</b></p> <p>The optionality kept by the seller could lead to unlimited returns.</p>	<p><b>Limited.</b></p> <p>At worst, pays out the agreed upon fixed rate with no additional upside.</p>

**Sensitivities**

	<u>Delta<sup>a</sup></u>	<u>Vega<sup>b</sup></u>	<b>Complexity</b>
<b>Buyer</b>	○	○	
<b>Seller</b>	?	?	
<b>Importance</b>	◆		

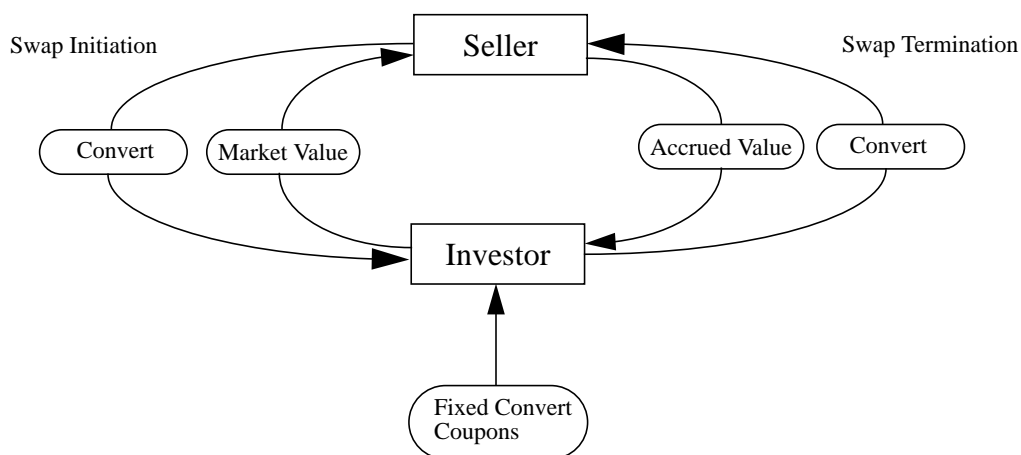
a. The optionality embedded in the convert may make the seller long or short the underlying stock.

b. If the convert has an embedded option, the seller is likely to be long volatility.

*See the discussion of Risk Factors on page 5 of this manual.*

**Example:** An investor buys a discount asset swap on the XYZ convertible bond on a total par value of \$10,000,000. The bond pays a 6% coupon quarterly and has six months of call protection remaining. The investor is to receive a yield to maturity of 7.50% (continuous compounding), with maturity to occur in one year.

### Overall Picture of Discount Asset Swap



### Payment Flows over Life of Swap

**Trade Initiation** • Buyer receives bonds with total par value of \$10,000,000 from the seller. In return, he pays \$8,704,785.06, which is given according to the formula below.

$$10,000,000e^{-0.075} - 150,000 \left( e^{-0.075 \times 3/4} + e^{-0.075/2} + e^{-0.075/4} + e^{-0.075} \right)$$

The value of 150,000 appears because that is the amount of each coupon and there are four coupons, the first coupon occurring in a quarter of a year and the last a year in the future.

**First Reset** • The buyer receives \$150,000 (6% x \$10,000,000 / 4) in quarterly coupons.

**Termination** • The buyer receives another \$150,000 in quarterly coupons.  
• The company called the convert, so the swap terminates. As a result, the buyer returns the bonds to the seller and the seller returns the accrued value of the bond. This is \$9,340,251.31 as given below.

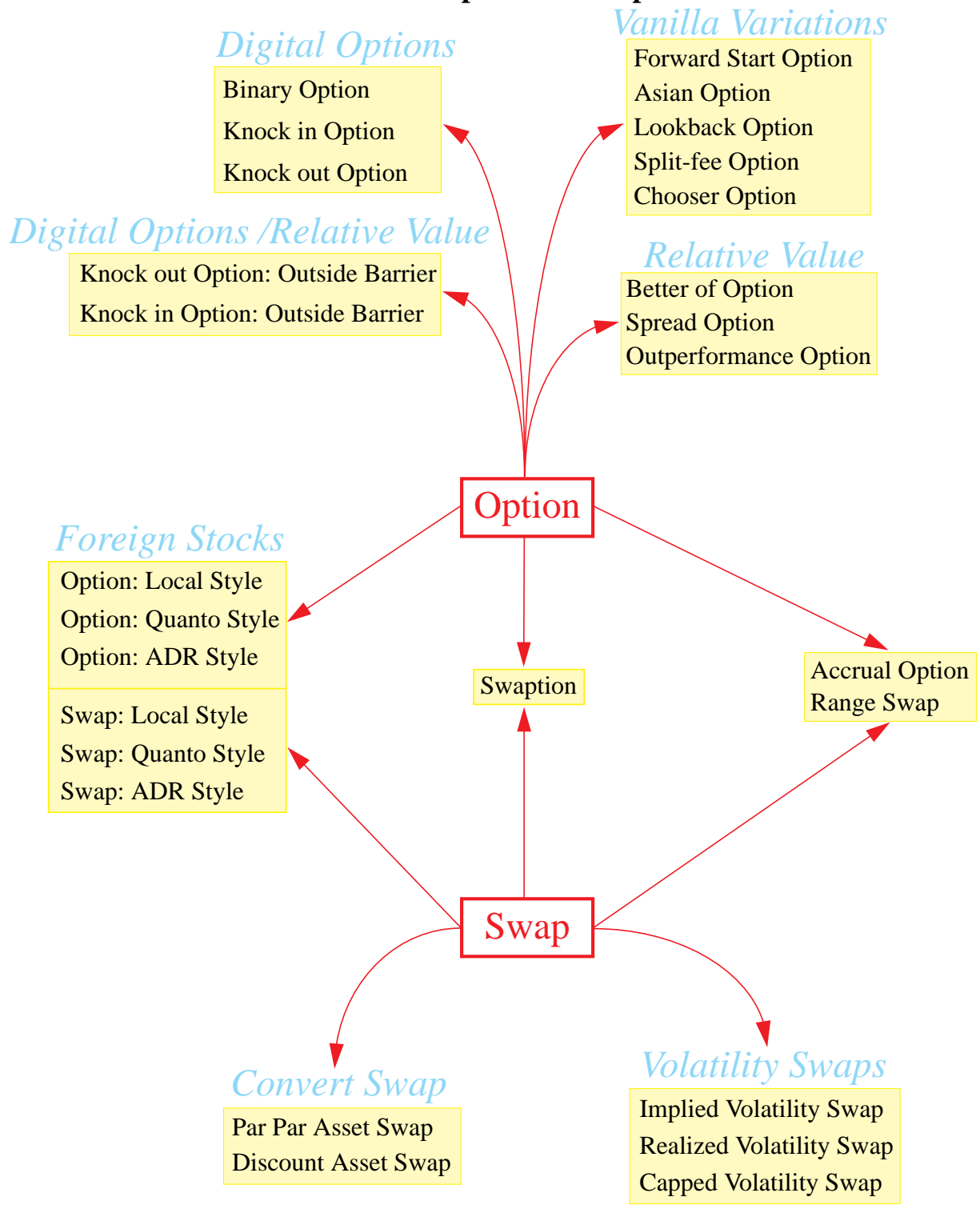
$$10,000,000e^{-0.075/2} - 150,000 \left( e^{-0.075/2} + e^{-0.075/4} \right)$$

The company called early, so there are two coupons remaining in the calculation.

*See the discussion of Risk Factors on page 5 of this manual.*



### From Options to Swaps



## Options by Strategy

	Directional	Max Leverage	Foreign Stocks	Lower Vol	Relative Value	Lower Cost	Finance	Amer or Euro	Path Dependent
Foreign Option: Local Style	✓		✓					✓	
Foreign Option: Quanto Style	✓		✓					✓	
Foreign Option: ADR Style	✓		✓					✓	
Swap	✓	✓			✓	✓			
Foreign Swap: Local Style	✓	✓	✓		✓	✓			
Foreign Swap: Quanto Style	✓	✓	✓		✓	✓			
Foreign Swap: ADR Style	✓	✓	✓		✓	✓			
Asian Option	✓			✓		✓			✓
Outperformance Option	✓				✓			✓	
Spread Option	✓				✓			✓	
Knock in/out Option	✓					✓			✓
Knock in/out Option: Outside Barrier	✓				✓	✓			✓
Lookback Option	✓			✓				✓	✓
Split-fee Option	✓					✓			
Binary Option	✓								✓
Accrual Option	✓								✓
Range Swap	✓								✓
Realized Volatility Swap		✓							✓
Capped Volatility Swap		✓							✓
Implied Volatility Swap		✓							
Forward Start Option	✓							✓	
Better of Option	✓				✓			✓	
Chooser Option		✓						✓	
Swaption	✓	✓							
Par Par Asset Swap				✓			✓		
Discount Asset Swap				✓			✓		

## Glossary

<b>American:</b>	Options with American style exercise may be exercised prior to expiration. If an option is exercised early, the holder receives the option's intrinsic value. However, for very complex options, intrinsic value may be difficult or impossible to define. See European.
<b>Barrier:</b>	When the value of an asset crosses a barrier, some aspect of an option becomes active or inactive. For example, a knock out call option with a barrier at \$30 becomes worthless if the stock price ever trades up or down to \$30. Knock in and knock out options are called barrier options.
<b>Breakeven:</b>	A breakeven scenario is one where the holder of an option receives as much or more on the option payout as was originally paid for the option.
<b>Correlation:</b>	A statistical measure of the extent to which two or more assets are expected to have similar returns. High correlation (near 1.0) means that returns of the two assets should be similar. Correlation near -1.0 means that returns should be opposite in sign. When assets have high positive correlation, the volatility of the basket is higher.
<b>Close-to-close:</b>	Barriers and high/lows can be measured on a close-to-close basis or throughout the day. When measurements are made close-to-close, only the closing price is needed to value the option; asset prices during the day are irrelevant. See intra-day.
<b>European:</b>	Options with European style exercise can only be exercised at expiration. See American.
<b>Hedge:</b>	Hedging changes the risk profile of a portfolio. Strategies may be done at a credit, no cost or at a premium. Some valid hedging strategies may actually increase risk under some circumstances.
<b>Implied Volatility:</b>	By holding all other determinants of an options value constant, the price of an option can be made to correspond to a single volatility, referred to as the implied volatility.
<b>Intra-day:</b>	Barriers and high/lows can be measured on a close-to-close basis or intra-day. When measurements are made close-to-close, only the closing price is needed to value the option; asset prices during the day are irrelevant. With an intra-day option, the high would be taken as the highest level seen at any time during the day. See close-to-close.
<b>Intrinsic Value:</b>	For in the money vanilla options, this is the difference between the strike and underlying asset level. For more complex options, the intrinsic value may be difficult or impossible to define.
<b>Moneyness:</b>	The degree to which an option is in or out of the money.
<b>Notional:</b>	The total value of the assets underlying an option or swap.
<b>Overwrite:</b>	Selling calls on a portfolio held by the investor. If the asset rises at a modest rate or falls, the strategy improves on a simple buy and hold strategy. Overwriters underperform in a strong bull market. See targeted buy/sell.
<b>Path Dependent:</b>	Options whose value depends on asset prices prior to the option's expiration are path dependent. Examples include barrier options, accrual options, range swap.
<b>Premium:</b>	Amount paid for an option.
<b>Realized Volatility:</b>	The actual historical volatility of an asset, as measured by taking the annualized standard deviation of the natural logarithm of returns.
<b>Rebate:</b>	If an option expires worthless (or knocks out), its terms may include a provision for the investor to receive a cash rebate.

**Targeted Buy/Sell:** Selling options is a way for investors to be paid for taking views on where a stock will be an attractive buy or sell. An investor who sells calls is willing to sell stock at the strike; if he sells puts, then he is willing to buy stock at the strike. In both cases the investor is paid for this willingness. See [overwrite](#).