

Interest Rate Options

**A discussion of how
investors can help
control interest rate
exposure and make
the most of the
interest rate market.**

The Chicago Board Options Exchange (CBOE) is the world's largest options marketplace and one of the largest securities exchanges in the United States. CBOE was founded in 1973, creating the world's first standardized, listed equity options. Today, CBOE accounts for more than 48 percent of all U.S. options trading and 91 percent of all index options trading. This success has been accomplished by CBOE's leadership and innovation, and its commitment to individual and institutional investors worldwide. CBOE continues to push forward with new products and new technology that help meet the needs of the investing community.

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Making a move in today's financial markets.

Whether you invest in stocks, mutual funds, real estate or fixed-income instruments, there are few factors that affect your investments more than *interest rates*.

Two of the most closely watched interest rates are the benchmark rates on short-term and long-term U.S. Treasury securities. They reflect changes in general economic conditions, inflationary expectations, monetary and fiscal policies and the value of the U.S. dollar. Other interest rates, including bank prime lending rates, home mortgage rates and corporate and municipal bond rates, tend to respond to trends in the Treasury markets.

For investors, fluctuations in interest rates represent:

- **Opportunity.** Investors can capitalize on their outlook on these rates.
- **Risk.** interest rate moves can adversely affect the value of their investments.

Now, with CBOE Interest Rate Options, an investor has a tool to help control interest rate exposure and take advantage of new investment opportunities. These options give investors an opportunity to invest based upon their views on the direction of interest rates.

What are interest rate options?

Interest Rate Options are options on the **spot yield** of U.S. Treasury securities. Available to meet the investor's needs are options on short-, medium- and long-term rates. The following contracts are available for trading at the Chicago Board Options Exchange:

- **Options on the short-term rate (ticker symbol IRX) are based on the annualized discount rate on the most recently auctioned 13-week Treasury bill.** The 13-week T-bill yield is the recognized benchmark of short-term interest rates. These bills are issued by the U.S. Treasury in auctions conducted weekly by the Federal Reserve Bank.
- **Options on the 5-year rate (ticker symbol FVX) are based on the yield-to-maturity of the most recently auctioned 5-year Treasury note.** The notes are usually auctioned every month.
- **Options on the 10-year rate (ticker symbol TNX) are based on the yield-to-maturity of the most recently auctioned 10-year Treasury note.** The notes are usually auctioned

every three months following the refunding cycle: February, May, August and November.

- **Options on the 30-year rate (ticker symbol TYX) are based on the yield-to-maturity of the most recently auctioned 30-year Treasury bond.** Treasury bonds are auctioned every six months in a February and August refunding cycle.

IRX, FVX, TNX, and TYX values are reported throughout the trading day by *Telerate Systems Incorporated*, a leading international supplier of financial services. These values are based on current market data from the Treasury securities markets. Options prices, on the other hand, are disseminated by CBOE. Both these values and option prices are available through most on-line pricing services.

How do interest rate options work?

Options on interest rates and listed stock and stock index options have similar benefits and risks. They are standardized contracts traded on an exchange regulated by the Securities and Exchange Commission. There are two types of contracts --- puts and calls.

In general, when yield-based option positions are purchased, a call buyer and a put buyer have opposite expectations about interest rate movements. A **call buyer** anticipates interest rates will go up, increasing the value of the call position. A **put buyer** anticipates that rates will go down, increasing the value of the put position.

A yield-based call option holder will profit if, by expiration, the underlying interest rate rises above the strike price plus the premium paid for the call.

Conversely, **a yield-based put** option holder will profit if, by expiration, the interest rate has declined below the strike price less the premium. Option writers (sellers) receive a premium for selling options to buyers. Sellers tend to view premiums received for selling options as a source of additional income or as a hedge against a possible decline in the value of treasuries they hold or intend to purchase.

Yield-based options can be used alone or in conjunction with the underlying securities. The economics of the two approaches may be quite different. Prospective investors should consult their financial advisor about the logistics and suitability of their approach.

The Options' Underlying Values

Underlying values for the option contracts are **10 times** the underlying Treasury yields (rates)—13-week T-bill yield (for IRX), 5-year T-note yield (for FVX), 10-year T-note yield (for TNX) and 30-year T-bond yield (for TYX). An annualized discount rate of 5.5% on the newly auctioned 13-week Treasury bills would place the underlying value for the option on short-term rates (IRX) at 55.00. A yield-to-maturity of 6%

on the 30-year T-bond would place the underlying value of the yield-based option on the 30-year T-bond (TYX) at 60.00.

When Treasury rates change, corresponding underlying values for the options on interest rates also change. For example, if the yield-to-maturity on the 30-year T-bond increases from 6.25% to 6.36%, TYX would move from 62.50 to 63.60. For every one percentage point rise or fall in interest rates, underlying values would rise or fall 10 points.

Interest Rate Options features:

Cash settled. Interest Rate Options are settled in cash. There is no need to own or deliver any Treasury securities upon exercise.

Contract size. Interest Rate Options use the same \$100 multiplier as options on equities and stock indexes.

European-style exercise. The holder of the option can exercise the right to buy or sell only at expiration. This eliminates the risk of early exercise and simplifies investment decisions.

Comparing Interest Rate Options to other options.

A main difference between Interest Rate Options and listed equity options is that the underlying values of Interest Rate Options are based on interest rates and not on units of specific Treasury bills, notes or bonds. Individual equity options' underlying securities are shares of a specific stock.

Prices on Treasury obligations, like prices on all fixed-income securities, are inversely related to interest rates. An investor must be able to understand this inverse relationship between bond prices and yields. That is, whenever interest rates rise, prices on outstanding Treasury securities fall. Whenever interest rates decline, prices on outstanding Treasury securities rise.

To see why prices must fall when interest rates rise, consider a Treasury bond held by an investor with a principal or par amount of \$1,000, payable at maturity, and a coupon interest rate of 7%. This means that the bond pays \$70 a year in interest until maturity, when the principal amount of \$1,000 is paid to the holder. These terms will not change over the life of the bond. Like a stock, this bond has a value for which it can be sold in the market. That value reflects the rate at which the marketplace discounts this bond's payment stream.

If interest rates rise, the amount that would be necessary to invest to receive \$70 per year would drop. (If, for example, rates rise to 10%, the necessary investment would be only \$700.) The fact that a smaller investment is required to receive the same payment stream explains why bond values fall as long-term rates rise. But the converse is also true. As long-term rates fall a larger investment is required to receive the same payment.

There are formulas or algorithms that allow investors to find bond prices given knowledge of their yields or their yields given knowledge of their prices. The actual calculations, however, are complex. Desired numbers can be found using specialized calculators and bond tables. They may also be available from your financial advisor.

Cash Settlement.

Since Interest Rate Options are cash-settled, exercise of a put or call gives the holder the cash difference between the exercise price and the exercise-settlement value, times the \$100 multiplier. The exercise-settlement value is based on the spot-yield, as reported by Gov Px.

For example, an investor holding an expiring TYX “**in-the-money**” (ITM) July 75 call option with an exercise-settlement value of 78 would

exercise the option and receive the cash difference of \$300 $[(78 - 75) \times \$100]$. An option is ITM if the underlying security is higher (lower) than the strike price of the call (put).

$$\begin{aligned} &78 \text{ (exercise-settlement value)} \\ &\underline{-75 \text{ (strike price)}} \\ &3 \times \$100 \text{ multiplier} = \$300 \end{aligned}$$

For example, if the exercise-settlement value is below the strike price of an expiring call, or above the strike price of an expiring put, the option simply expires “**out-of-the-money**” (OTM) and will be worthless. If the exercise-settlement value turned out to be at or below the 75 strike price at the July expiration, the TYX July 75 call option would be worthless.

Of course, an investor does not have to wait until expiration to close an option position. A **closing** transaction could be executed at anytime prior to expiration. For instance, an opening purchase of the TYX July 75 call option could be closed out by selling the same TYX July 75 call option at anytime prior to the July expiration. The profit (or loss) in the position would be the difference between the premium originally paid when the option was purchased and the premium received upon the sale of the option.

Interest Rate Movement and Option Premium

Interest Rate Options in many ways are like all other traded options. They are affected by similar factors: e.g., volatility, time to expiration, and the price level of the under-lying instrument. Nonetheless, there are certain considerations regarding the structure of interest rates and the very nature of the underlying instrument itself that investors must take into account to fully understand the behavior of interest rate options and their differences from other traded options.

Since these options will settle at a future expiration date, investors must form expectations about the yield on the underlying instrument. The yield that the market expects to prevail at expiration is called the **forward yield** or **forward rate**.

These yield-based options are European and, therefore, cannot be exercised until expiration. For this reason, the options will be priced off the market's best estimate of the yield of the underlying instruments at expiration of the options; or, in other words, the market's best estimate of the exercise-settlement value at expiration, that is, off the **forward rates**. If the market is currently projecting a forward rate that is below the current spot rate, call options will fall in value and put options will rise in value.

The forward pricing phenomenon may be apparent only at the short-end of the yield curve. In order to assist investors, CBOE is currently calculating **implied forward rates** for IRX options based on the put-call parity relation. These rates are disseminated to the investing public under the ticker symbols IZ_. The last letter of this symbol is the letter used in the call option symbol to denote expiration month (used for both puts and calls).

The difference between the current spot yield and the forward yield can be significant, even for short-dated options. In general, it will depend on the segment of the U.S. Treasury **yield curve** considered. In the U.S., the yield curve has been upward-sloping (normal) during most of modern U.S. financial history, meaning that long-term Treasuries have a higher yield than short-term. A downward-sloping (inverted) or flat yield curve illustrates short-term Treasuries with a higher yield than long-term. The curve has also been steeper at the short end with a tendency to flatten out at longer maturities. A consequence of this type of yield curve is that the shorter the maturity of the Treasury securities, the greater the divergence between current spot and forward yields. There is likely to be less difference between the yield of a Treasury bond with 30 years to maturity and the yield of a Treasury bond with 29-3/4 years to maturity than there is between the yield of a 13-week T-

bill with 3 months to maturity and the yield of a 13-week T-bill with one month to maturity.

Tracking Forward Rates.

Again, call options have **intrinsic value** when the current underlying value is greater than the exercise price. Put options have **intrinsic value** when the current underlying value is lower than the exercise price. A result of options tracking forward rates rather than current spot rates is that when rates are projected to fall, call options can trade below intrinsic value relative to the current spot yield. In other words, trading at a discount from parity can occur.

The time value of an option is that part of the premium that reflects the remaining life of the option. The more time that remains before the expiration date, the higher the premium, because there is more time available for the underlying value to move up or down. Another result of forward pricing is that premiums may be lower in the later months than in nearby months when the market is forecasting a lower forward rate in the far month than in the nearby month. If the difference in forward rates is large enough to offset the **time value** associated with the longer expiration, then the premium on the longer expiration could be below the premium on the nearby month with the same strike price.

The same but reverse phenomenon appears in puts when the market is projecting higher

forward rates relative to current interest rates. The time premium in the far out months may be less than the near-term months due to the market projecting a higher forward rate in the far month than in the nearby month. Also, if the market revises its estimate of forward rates, option prices may move sharply when current spot rates are unchanged.

Basic Strategies with Interest Rate Options

Using options to implement interest rate strategies offers several advantages to transactions in Treasury securities:

Option **buying** involves **a known and limited risk**. Like any option, the most an option buyer can lose if interest rates move against him is the premium paid for the option. Unlike a Treasury security, however, an option can expire worthless. Option selling involves limited profit and unlimited risk. Like any option, the most a seller can make is the premium received and the risk theoretically is unlimited if interest rates move against him.

Options provide **leverage**. An option buyer pays a relatively small premium in relation to the value of the underlying security. If interest rates move as anticipated, substantial profits relative to the capital invested may be realized. If the interest rates do not move as anticipated, the buyer's risk is limited to the premium paid. Also, small moves in interest rates can have a large impact on the value of the options position.

Options involve a specific **time period**. An option buyer can choose an expiration month which meets his time expectations for interest rates moves. Treasury securities do not have to move immediately for a buyer to profit on his option position. **However, a move in the anticipated direction must occur by option expiration in order for the option position to become profitable.**

In the following examples, we present a variety of possible option strategies for different interest rate forecasts. These are only a few of the strategies that might be employed. There are numerous other strategies, some more sophisticated than others, that may be used by investors who are experienced and understand how they work and when to use them. The examples discussed below are based on hypothetical situations, should only be considered samples of potential investment alternatives, and are presented for educational purposes only.

The positions are shown being held to expiration. It should also be noted that taxes, commissions and margin requirements have not been included in the following examples to simplify the explanations. They are important and must be taken into account when considering an actual trade, and when calculating actual net returns on any option transaction. These charges and requirements may vary, and should be discussed with your investment advisor.

Scenario 1:

Investor expects rising long-term interest rates

1

Buy TYX calls.

Forecast: Rising 30-year Treasury bond yields.

Objective: To profit from rising 30-year interest rates.

If an investor anticipates a rise in the 30-year Treasury bond yield, he might choose to buy TYX call options. If the anticipated rate increase occurs, TYX, the 30-year underlying value for the options (10 x 30-year yield), also will increase.

This strategy gives the buyer the right to a payoff equal to the difference between the strike price and exercise-settlement value of TYX upon option expiration if the underlying value rises above the strike price. The profit is unlimited, while the risk is limited to the premium paid for the calls.

Example:

TYX is at 70.00 (the 30-year interest rate at 7.00%) and a three-month TYX 70 at-the-money call is trading at 1-1/2. For this example, the investor who expects 30-year Treasury yields to rise will buy 5 calls at a cost of \$750 (1-1/2 premium x \$100 multiplier x 5 contracts). A profit will be realized if the underlying rises above the breakeven of 71-1/2 (70 strike price + 1-1/2 premium) which translates into a current yield of 7.15% (1/10th of the underlying value) on the 30-year Treasury.

Possible Outcomes

Outcome 1:

Exercise-settlement Value Above Breakeven (71.5):

If the 30-year Treasury bond yield rises and the exercise-settlement value for TYX is at 75.00 at expiration (interest rates at 7.5%), the TYX 70 call option would be exercised, the holder of the calls would receive the amount by which the closing yield exceeds the strike price.

Exercise-settlement Value:	75
Less Strike Price:	<u>70</u>
	5
Amount Paid to Holder:	\$2,500
(5 x \$100 x 5 contracts)	
Less Cost of Calls:	<u>-750</u>
Profit:	\$1,750

This investor profited because the yield did rise above the breakeven prior to expiration. Had the yield on the 30-year Treasury risen after expiration the options would have expired worthless. This timing consideration applies to all of the strategies discussed below.

Outcome 2:

Exercise-settlement Value Between Call Strike Price (70) and Breakeven Level (71-1/2):

If, by expiration, the 30-year Treasury yield slightly increases to 7.10% which equals an exercise-settlement value of 71.00, the holder would exercise his options. He would receive the amount by which the exercise-settlement value is above the strike price. The amount received would be less than what was originally paid, but it would offset some of the cost of the calls.

Exercise-settlement Value:	71
Less Strike Price:	<u>70</u>
	1
Cost of Calls:	\$750
Less Amount Paid to Holder:	<u>-500</u>
(1 x \$100 x 5 contracts)	
Loss:	\$250

Outcome 3:

Exercise-settlement Value At or Below Call Strike Price (70):

If the exercise-settlement value is at or below 70.00 (the yield on the 30-year Treasury at or below 7.00%), the holder would have lost the total premium of \$750, in this example. However, no matter how low interest rates decline the most that can be lost is the premium paid.

Importantly, if the yield on the Treasury rises substantially and/or the investor's opinion changes, the calls may be sold at any point in time through the last trading day of that particular series.

2

Sell TYX put spread

Forecast: Investor expects moderate rise in 30-year Treasury bond yields.

Objective: To profit from an increase in rates by bringing in income.

If a rise in the 30-year Treasury bond yield is expected, an investor may choose to sell a TYX put spread to increase income. Selling a put spread involves selling a put and buying a put with a lower strike price, both with the same expiration. The purpose in selling the put spread is to limit risk while receiving premium. The most that can be lost is the difference between the two strike prices less the premium received and the most that can be made is the premium received for selling the spread. If the investor simply sold puts outright he would have received more premium but with significant risk.

Example:

Assume, as before, that TYX is still at 70.00, and a rise in 30-year interest rates from 7.00% to 7.5% is anticipated in the next three months. For simplicity's sake the investor will sell 1 three-month TYX 75 put and purchase 1 three-month 70 put. The premium received for this spread position is:

Sell 1 Three-month 75 Put	
at $4\frac{7}{8} \times 100 =$	\$487.50*
Buy 1 Three-month 70 Put	
at $1\frac{1}{4} \times 100 =$	<u>-125.00</u>
Total Premium Received =	\$362.50

* These puts are trading at a discount to parity due to the European-style exercise (the options cannot be exercised until expiration).

The total premium received is the maximum profit that can be made. The maximum risk is the difference between the strikes less the premium received.

Short Strike:	75
Long Strike:	<u>-70</u>
	5
Premium Received:	<u>-3-5/8</u>
Maximum Risk:	1-3/8

The risk for this position is $1\frac{3}{8} \times 100$ or \$137.50. The breakeven on this position is $71\frac{3}{8}$. The breakeven is calculated by subtracting the premium received, $3\frac{5}{8}$ from the short 75 strike price.

Possible Outcomes

Outcome 1:

Exercise-settlement Value At or Above Short Put Strike Price (75):

If 30-year the Treasury bond yield rises and the exercise-settlement value for TYX is at 76.00 at expiration (interest rates at 7.60%), the TYX 70 put and the 75 put both expire worthless and the investor keeps the total premium received, \$362.50. This is the maximum profit that could be earned. This would be the result for any TYX exercise-settlement value at or above 75.

Outcome 1:

Exercise-settlement Value Between Short Put Strike Price (75) and Breakeven (71-3/8):

If, by expiration, the 30-year Treasury yields do increase to 7.45 which equals an exercise-settlement value of 74.5, the spread seller would be assigned on his short put position and his long position would expire worthless. He would deliver the amount by which the exercise-settlement value is below the strike price. The seller of the spread would give up some of the premium received but not all of it.

Short Strike Price:	75
Less Exercise-settlement Value:	<u>-74.5</u>
Amount to Deliver:	.5

Amount Rec'd for Selling Spread:	\$362.50
Less Amount to Deliver:	<u>-50.00</u>
(.5 x \$100 x 1 contract)	
Profit:	\$312.50

Outcome 2:

Exercise-settlement Value Between Long Put Strike Price (70) and Breakeven (71-3/8):

If, at expiration, the yield on the TYX is 7.05% (the exercise-settlement value is 70.5), the spread seller would be assigned on the short side. The seller would have to give back some of the premium received.

Short Strike Price:	75
Less Exercise-settlement Value:	<u>-70.5</u>
Amount to Deliver:	4.5

Amount to Deliver:	\$450.00
(4.5 x \$100 x 1 put)	
Less Original Premium Received:	<u>-362.50</u>
Loss:	\$ 87.50

Outcome 3:

Exercise-settlement Value At or Below Long Put Strike Price (70):

If the exercise-settlement value is at 67.5 (the yield on the 30-year Treasury is at 6.75%), the spread seller would have lost 1-3/8, the difference between the strikes (5) less the premium received for selling the spread (3-5/8). However, no matter how low interest rates decline, the most that can be lost is \$137.50, the difference between the strikes less the premium received.

Short Strike Price:	75
Less Exercise-settlement Value:	<u>-67.5</u>
Amount to Deliver:	7.5

Long Strike Price:	70
Less Exercise-settlement Value:	<u>-67.5</u>
Amount Received:	2.5

Amount Delivered:	7.5
Less Amount Received:	<u>-2.5</u>
Net Delivered:	5

The spread seller would pay out \$750 ($7.5 \times \100×1 put) for the assignment of his short put and would receive \$250 ($2.5 \times \100×1 put) for exercising his long put for a net cost of \$500.

Net Delivered (See Above):	\$500
Less Original Premium Received:	<u>-362.50</u>
Maximum Loss:	\$137.50

As the exercise-settlement value declines below 70 the amount to be delivered will increase but so will the amount paid to the investor. The net amount will always be \$500, the difference between the two strikes. Therefore, the risk is limited to \$137.50, the difference between the strikes less the premium received for selling the put spread.

Scenario 2:

Falling 5-Year Interest Rates

1

Buy FVX puts

Forecast: Falling 5-year Treasury note yields.

Objective: To profit from a decline in 5-year interest rates.

Assume that a decline in 5-year Treasury note rates is expected in the next few months. An investor would like to have the opportunity to profit if this forecast is correct. A purchase of FVX put options would allow the holder to profit if rates do decline because as 5-year interest rates fall, so does the level of FVX.

As interest rates decline and the level of the 5-year underlying declines, the value of the put options should increase. An investor might be able to sell the put options at a profit, thereby closing out the position. Or, he can hold the put options for the profit potential they have upon exercise at expiration.

Example:

If the underlying 5-year interest rate is 6.50%, the level of FVX would be 65. An investor anticipates a decline of roughly 30 basis points

in 5-year interest rates to somewhere close to 6.2% (FVX at 62). He decides to buy 10 two-month FVX 65 (at-the-money) put options at \$875.00 ($7/8$ premium x \$100 multiplier x 10 puts). This sum will be the maximum loss if the forecast is wrong, and 5-year Treasury rates increase. The breakeven for the put position is $64-1/8$, (65 strike price $-7/8$ put premium).

Possible Outcomes

Outcome 1:

Exercise-settlement Value Below Breakeven (63):

If 5-year Treasury note yields do decline and the exercise-settlement value for FVX is at 63.00 at expiration (interest rates at 6.3%), the FVX 65 put option would be exercised and the holder of the puts would receive the amount by which the closing yield has declined below the strike price.

Strike Price:	65
Less Exercise-settlement Value:	<u>-63</u>
	2
Amount Received:	\$2,000
(2 x \$100 x 10 contracts)	
Less Cost of Puts:	<u>-875</u>
Profit:	\$1,125

Outcome 2:

Exercise-settlement Value Between Breakeven Level (64-1/8) and Put Strike Price (65):

If, by expiration, the 5-year Treasury yields decrease slightly to 6.45% or an FVX exercise-settlement value of 64.5, the holder would exercise his puts. He would receive the amount by which the exercise-settlement value is below the strike price. The amount received would be less than what was originally paid, but it would offset some of the cost.

Strike Price:	65
Less Exercise-settlement Value:	<u>-64.5</u>
	.5

Cost of Puts:	\$875
Less Amount Received:	<u>-500</u>
(.5 x \$100 x 10 contracts)	
Loss:	\$375

Outcome 3:

Exercise-settlement Value At or Above Put Strike Price (65):

If the exercise-settlement value is at or above 65, the yield on the 5-year Treasury at or above 6.5%, the holder would have lost the total premium of \$875, in this example. However, no matter how high interest rates climb, the most that can be lost is the premium paid.

2

Sell FVX call spread

Forecast: Investor expects falling 5-year Treasury note yields.

Objective: To profit from a decline in 5-year interest rates.

Assume as before that FVX is still at 65.0, and a decline is projected in the 5-year interest rates over the next three months from 6.5% to 6.2%.

Instead of paying for puts, the investor would like to use a strategy with limited risk that brings in premium. A strategy to use could be to sell the call spread. Selling a call spread involves selling a call and buying a call against it with a higher strike but the same expiration. The most that can be made is the premium received for selling the spread. The maximum risk is the difference between the strike prices less premium received.

Example:

For simplicity's sake the investor will sell 1 three-month FVX 60 call and buy 1 three-month 65 call. The premium received for this spread position is:

Sell 1 Three-month 60 Call at

5-3/8 x 100 = \$537.50

Buy 1 Three-month 65 Call

at 1-3/8 x 100 = -137.50

Total Premium Received: \$400.00

The total premium received is the maximum profit that can be made. The maximum risk is the difference between the strikes less the premium received.

Long Strike:	65
Short Strike:	<u>-60</u>
	5
Premium Received:	<u>-4</u>
Maximum Risk:	1

The maximum risk is \$100 ($1 \times \100) for this position. The breakeven on this position is the 64 (60 short strike + 4 premium received).

Possible Outcomes

Outcome 1:

Exercise-settlement Value At or Below Short Call Strike (60):

If 5-year Treasury note yield declines and the exercise-settlement value for FVX is at 59.5 at expiration (interest rates at 5.95%), the FVX 60 and 65 call would both expire worthless and the investor keeps the total premium received, \$400. This is the maximum profit that could be earned.

Outcome 2:

Exercise-settlement Value Between Short Call Strike Price (60) and Breakeven (64):

If, by expiration, the 5-year Treasury yield decreases to 6.1% which equals an exercise-settlement value of 61.00, the spread seller would be assigned on the short call position. The long position would expire worthless. The investor would deliver the amount by which the exercise-settlement value is above the strike price. The seller of the spread would give up some of the premium received but not all of it.

Exercise-settlement Value:	61
Less Short Strike Price:	<u>-60</u>
	1
Original Premium Received:	\$400
Less Amount to Deliver:	<u>-100</u>
(1 x \$100 x 1 contract)	
Profit:	\$300

Outcome 3:

Exercise-settlement Value Between Breakeven (64) and Long Call Strike (65):

If, at expiration, the yield on the FVX is 6.45% or the exercise-settlement value is 64.5, the spread seller will be assigned on the short side. The seller would have to deliver more than the \$400 originally received but would not be paying the maximum risk of \$100.

Exercise-settlement Value:	64.5
Less Short Strike Price:	<u>-60</u>
Amount to Deliver:	4.5

Amount to Deliver:	\$450
(4.5 x \$100 x 1 call)	
Less Original Premium Received:	<u>-400</u>
Loss:	\$ 50

Outcome 4:

Exercise-settlement Value At or Above Long Call Strike Price (65):

If the exercise-settlement value is at 66.00, the yield on the 5-year Treasury is at 6.6%, the holder would have lost 1, the difference between the strikes (5) less the premium received for selling the spread (4). However, no matter how high interest rates rise the most that can be lost is \$100 (1 x \$100), the difference between the strikes less the premium received.

Exercise-settlement Value:	66
Less Long Strike Price:	<u>-65</u>
Amount Received:	1

Amount Received:	
Exercise-settlement Value:	66
Less Short Strike:	<u>-60</u>
Amount to Deliver:	6

The spread seller would pay out \$600 (6 x \$100 x 1 call) for the assignment of his short call and

would receive \$100 ($1 \times \100×1 call) for exercising his long call for a net cost of \$500.

Amount to Deliver (See Above): \$500

Less Original Premium Received: - 400

Maximum Loss: \$100

Scenario 3:

Trading Strategy for Investors with strong views on the yield curve

1

Sell Treasury bills. Deposit cash in Money Market and purchase puts on the 10-year Treasury yield (TNX).

Forecast: Investor owns Treasury bills and expects short-term rates will rise, long-term rates will decline.

Objective: To profit from a reshaping of the yield curve.

Having analyzed the latest market developments and the U.S. government's package of proposed fiscal and monetary measures, an investor has come to a conclusion that short-term rates may rise from 4% to 4.75% and intermediate-term rates will decline from 6.75% to 6.25%. Currently, the investor has \$20,000 in U.S. Treasury bills, and, if his projection is correct, his Treasury bills will go down in value.

Example:

An investor has \$20,000 in U.S. Treasury bills and is concerned that short-term rates will rise therefore causing a decline in the value of his bills. This investor also anticipates a drop in intermediate-term rates and would like to profit from his projection for the move in interest rates. The investor will sell his T-bills and will deposit \$18,000 in a money market account and \$2,000 will be used to buy puts. Suppose that a three-month, at-the-money TNX put cost 1 point or \$100 ($1 \times \$100 \text{ multiplier} \times 1 \text{ put}$). The investor would buy 20 puts at 1 costing \$2,000. The breakeven level for the put position is $66\frac{1}{2}$ ($67\frac{1}{2}$ strike price - 1 cost of put).

Possible Outcomes

Outcome 1:

TNX Exercise-settlement Value Below Breakeven ($66\frac{1}{2}$):

If the investor is right and 10-year Treasury yield declines to 6.25%, an exercise-settlement value for TNX at 62.5, the TNX $67\frac{1}{2}$ put option would be exercised. The holder of the puts would receive the amount by which the closing yield has declined below the strike price. The investor would also be earning interest on his \$18,000 in his money market.

If short-term interest rates did rise as anticipated, then he would be better off having sold the T-bills and having deposited the money in a money market. If short-term rates declined, the

T-bills that were sold would have risen in value and the investor would be earning less interest on his money market. In this case he would have been better off having held onto the T-bills.

Strike Price (67-1/2):	67.5
Less Exercise-settlement Value:	<u>-62.5</u>
Profit:	5

Amount Paid to Holder:	\$10,000
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(5 x \$100 x 20 puts)	
Less Cost of Puts:	<u>-2,000</u>
Profit:	\$ 8,000

Outcome 2:

Exercise-settlement Value Between Breakeven Level (66-1/2) and Put Strike Price (67-1/2):

If, by expiration, the TNX exercise-settlement decreases slightly to 67.00 or a yield of 6.7%, the holder would exercise his puts. He would receive the amount by which the exercise-settlement value is below the strike price. The amount received would be less than what was originally paid, but it would offset some of the cost. The investor would also be earning interest on his \$18,000 in his money market account.

Strike Price (67-1/2):	67.5
Less Exercise-settlement Value:	<u>-67</u>
	.5

Cost of Puts:	\$2,000
Less Amount Paid to Holder:	<u>-1,000</u>
(.5 x \$100 x 20 contracts)	
Loss:	\$1,000

Outcome 2:

Exercise-settlement Value At or Above Put Strike Price (67-1/2):

If the exercise-settlement value is at or above 67.5, the yield on the 30-year Treasury at or above 6.75%, the holder would have lost the total premium of \$2,000, in this example.

However, no matter how high interest rates climb the most that can be lost is the premium paid. The investor still has \$18,000 in a money market account earning interest.

Scenario 4:

Hedging Strategies Using Interest Rate Options

1

Buy TYX calls

Forecast: Investor expects rising long-term interest rates.

Objective: To offset a decline in the value of a long-term bond portfolio.

Recall that option prices move directly with interest rates. When 30-year rates rise, TYX increases and calls tend to increase in value while puts tend to decrease in value. Thus, yield-based calls can be used to protect or insure the value of a bond portfolio against rising interest rates (when the value of the bonds would decline).

By purchasing yield-based calls, investments can be protected against large losses without sacrificing participation in portfolio appreciation. However, remember that any portfolio appreciation may be diminished by the cost of the call options.

Example:

An investor holds a portfolio of Treasury securities with a current market value of

\$100,000. Its weighted average coupon is 7.0% and its weighted average maturity is 20 years. The yield-to-maturity on the portfolio is 6.60%.

Because of mounting inflationary pressure in the economy, the investor anticipates a 1% rise in interest rates over the next three months. The 30-year Treasury yield is at 6.75%, and the TYX exercise-settlement value is at 67.50. To protect the value of his investments while continuing to earn interest income on the bonds in his portfolio, the investor decides to buy at-the-money TYX 67-1/2 three-month call options at a price of 1-1/2.

To calculate how many options are needed to protect the bond portfolio, the following two-step procedure is needed:

(a) First, determine by how much your portfolio will decline in value if interest rates were to rise by 1%. A financial measure known as **modified duration** provides the answer. Modified duration is a measure of a bond or a portfolio's price sensitivity to changes in yield. It gives you an estimated percentage change in the value of your bond portfolio for a 1% change in interest rates. The calculation is complex, but can be performed using many analytical software packages, vendor systems and most modern financial calculators. If you are unable to calculate duration, consult your financial advisor.

Assume that modified duration given the current value of the yield, maturity and coupon of the bonds in your portfolio is 11 years. This means that a 1% increase in interest rates will lead to a 11% decline in the portfolio value. Given a current portfolio value of \$100,000, an 11% decline would mean a loss of \$11,000 resulting in a new portfolio market value of \$89,000.

(b) Determine by how much your long at-the-money TYX 67-1/2 calls will increase in value following a 1% rise in interest rates. A 1% percent rise in the 30-year yield from 6.75% to 7.75% results in a new value for TYX of 77.50, an increase of 10 points. Therefore, each call with a 67-1/2 strike will be worth 10 points if the interest rate rises to 7.75% at expiration, or \$1,000 (10 points x \$100 multiplier). The portfolio would decline \$11,000; therefore, 11 calls would have to be purchased. This would not be a total hedge because a premium would have been paid for the calls.

For this example, an investor will purchase 11, three-month 67-1/2 calls at 1-1/2. These calls will cost \$1,650 (1-1/2 premium x \$100 multiplier x 11 calls). The breakeven on this position is 69, the 67-1/2 strike price plus 1-1/2 call premium. At or above 6.9% interest rate (the breakeven level), the call holder should begin to make money to offset some of the loss in the bond portfolio.

Possible Outcomes

Outcome 1:

Exercise-settlement Value at Anticipated Level (77.5):

The holder would exercise his calls and receive the difference between the strike price and the exercise-settlement value. The profit would be the difference less the premium paid. This money would be used to offset some of the loss in the bond portfolio.

Exercise-settlement Value:	77.5
Less Strike Price (67-1/2):	<u>-67.5</u>
	10
Amount Paid to Holder:	\$11,000
(10 x \$100 x 11 contracts)	
Less Cost of Calls:	<u>- 1,650</u>
Profit:	\$ 9,350

The profit on the option trade is applied to the bond portfolio to offset some of the loss which would occur when interest rates rose.

Outcome 2:

Exercise-settlement Value Above Breakeven (69):

If the 30-year Treasury bond yield rises and the exercise-settlement value for TYX is at 73.00 at expiration (interest rates at 7.3%), the TYX 67-1/2 call option would be exercised, the holder of the calls would receive the amount by which the closing yield exceeds the strike price. This money

would partially offset the loss in the bond portfolio due to an increase in interest rates.

Exercise-settlement Value:	73
Less Strike Price (67-1/2):	<u>-67.5</u>
	5.5
Amount Paid to Holder:	\$6,050
(5.5 x \$100 x 11 contracts)	
Less Cost of Calls:	<u>-1,650</u>
Profit:	\$4,400

Outcome 3:

Exercise-settlement Value Between Call Strike Price (67-1/2) and Breakeven Level (69):

If, by expiration, the 30-year Treasury yield slightly increases to 6.85 which equals an exercise-settlement value of 68.5, the holder would exercise his options. He would receive the amount by which the exercise-settlement value is above the strike price. The amount received would be less than what was originally paid, but it would offset some of the cost. The value of the bond portfolio should have only dropped slightly.

Exercise-settlement Value:	68.5
Less Strike Price (67-1/2):	<u>-67.5</u>
	1
Cost of Calls:	\$1,650
Less Amount Paid to Holder:	<u>-1,100</u>
(1 x \$100 x 11 calls)	
Loss:	550

Possible Outcomes

Outcome 1:

Exercise-settlement Value At or Below Call Strike Price (67-1/2):

If the exercise-settlement value is at or below 67.5, the yield on the 30-year Treasury is at or below 6.75%, the holder would have lost the total premium of \$1,650, in this example. However, no matter how low interest rates decline, the most that the option can lose is the premium paid.

Risks in tracking.

This example assumes that the yield of your bond fund moves one-for-one with the 30-year Treasury bond yield. The risk in the combined position (bond portfolio and calls) is that an increase in the interest rate driving the bond portfolio is not offset by an equivalent increase in the 30-year Treasury bond yield.

Under these circumstances, the gains in the option position may not offset the losses in the bond position. The maximum loss in the combined position could equal the entire premium plus the loss in the bond investment.

Conversely, this “tracking error” can result in a profit if the underlying increases more than the yield driving your investment. The greater the similarity between the characteristics of your investment and long-term Treasuries, the more closely the two yields are likely to track one another.

Summary

A whole range of interest rate options is currently traded at the CBOE. The characteristics and structure of these options have been described in this booklet. You have a variety of strategies with which to take advantage of the direction of interest rates including the future shape of the yield curve and spreads between different parts of the curve.

Whether you choose to use these instruments to control your exposure to interest rate fluctuations or to take advantage of your views about interest rates, CBOE yield-based options are versatile tools now available to investors that cannot be ignored.

Contract Specifications

Yield description: The term “spot yield” refers to the annualized discount rate and the yield-to-maturity on the most recently issued Treasury bills, notes and bonds, respectively, with a designated maturity (rounded to the nearest basis point). For example, the 30-year spot yield means the yield-to-maturity of the most recently issued 30-year Treasury bond. In other words, on any given day, the 30-year spot yield will refer to the yield-to-maturity of the 30-year Treasury bond with the longest remaining time to maturity. On the other hand, the 13-week spot yield means the annualized discount rate on the most recently auctioned 13-week T-bill.

Expiration: Three near-term months plus three additional months from the March quarterly cycle. LEAPS® (Long-term Equity Anticipation Securities™) expire in December of the expiration year.

Underlying: 10 x the spot yield value.

Contract size: \$100 multiplied by the underlying value.

Premium quotations: Stated in points and fractions; one point equals \$100. Minimum price change for series trading below \$3 is 1/16 (\$6.25) and for all other series, 1/8 (\$12.50).

Strike (exercise) price: Strike prices are set at 2-1/2 point intervals. A 1-point interval represents 10 basis points.

Strike price symbols:

U=	7-1/2	37-1/2	67-1/2	97-1/2
V=	12-1/2	42-1/2	72-1/2	102-1/2
W=	17-1/2	47-1/2	77-1/2	107-1/2
X=	22-1/2	52-1/2	82-1/2	112-1/2
Y=	27-1/2	57-1/2	87-1/2	117-1/2
Z=	32-1/2	62-1/2	92-1/2	122-1/2

Retail Automatic Execution System (RAES): Available for short-term option orders of 20 (IRX, FVX, TNX) or 100 (TYX) contracts or less in all series which closed at \$10 or under the previous day.

Exercise style: European. Options may be exercised on the last business day before the expiration date.

Exercise-settlement: All options are cash-settled. Exercise-settlement values are based on the spot yield on the last trading day as reported by Gov Px. (The last trading day will generally be the third Friday of the expiration month.)

Position and exercise limits: IRX, IRX LEAPS--

The aggregate position and exercise limit is
5,000 contracts on either side of the market.

FVX, TNX, TYX, and their respective LEAPS--

The aggregate position and exercise limit is
25,000 contracts on either side of the market. A
hedge exemption for public customers may be
available for certain diversified portfolios which
may expand the limit.

Trading system: Designated Primary Market
Maker.

Trading hours: 7:20 a.m. to 2.00 p.m. (Central
Time).



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