CHAPTER 3

Interest Rate Risk

After reading this chapter you will be able to

- Identify opportunities to reduce interest rate exposure
- Evaluate ways to manage interest rate risk with forward rate agreements, futures, and swaps
- Assess the use of interest rate options, including swaptions

Although the business of hedging usually involves derivatives, it is possible to rearrange activities to minimize interest rate exposure. Depending on its approach, an organization can supplement internal hedging strategies with interest rate derivatives such as forward rate agreements, futures, swaps, and options.

Interest rate derivatives may replace interest rate exposure with exposure to the performance of counterparties and raise other issues. Therefore, it is important to understand credit risk, which is discussed in more detail in Chapter 5.

Global Cash Netting

When an organization has cash flows in multiple currencies, some parts of the organization may have excess cash while others may need to draw down on available lines of credit. A cash forecast for specific currencies will enable surpluses and shortages to be forecast and managed

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Exposure Reduction

Although it might be possible to manage interest rate exposure without derivatives, legal, tax, and regulatory ramifications must be taken into consideration, particularly in foreign countries or for cross-border transactions. These may prohibit such transactions or reduce or eliminate the benefit. The following techniques have been used to reduce interest rate exposure and the resulting need for derivatives:

- Global cash netting/inhouse bank
- Intercompany lending
- Embedded options in debt
- Changes to payment schedules
- Asset–liability management

more accurately. On a centralized basis, it may be possible to pool funds from divisions or subsidiaries and make them available to other parts of the organization.

Expert assistance is necessary in this area, since some countries prohibit or restrict intercompany transactions, including cash pooling. Tax and legal issues should be determined prior to engaging in such transactions.

Intercompany Lending

A longer-term approach to managing funding shortages and surpluses across an organization is intercompany lending. When one part of an organization requires long-term funding, and another part has excess cash available for investment purposes, the combination of the two may

reduce interest costs and permit more control over the borrowing process. As with cash netting and pooling, expert assistance is necessary to ensure that legal, tax, and regulatory restrictions or prohibitions do not exist.

Embedded Options

The use of debt securities with features such as a call provision provides debt issuers with an alternative method for managing exposure to interest rates. Callable debt combines the debt component, which would typically otherwise not be callable, with the call provision, which provides an option to the issuer. If interest rates decline, the issuer can retire the higher-interest debt through the call provision and subsequently reissue lower-interest debt. The issuer will incur a cost for the call option through the call price premium or the coupon.

Changes to Payment Schedules

Changes to payment schedules may permit an organization to maintain cash balances for longer periods, reducing the need for funding and therefore exposure to interest rates:

- Changes to supplier/vendor payment schedules may permit a longer payment cycle, reducing the need for borrowing. Alternatively, payments may be made on behalf of other parts of the organization, which may permit netting to be used.
- Changes to customer payment schedules may increase the speed with which funds are collected, reducing the need for borrowing. Changing the methods used by customers to pay, such as encouraging electronic alternatives to paper checks, may also speed collections.
- Changes to contractual long-term payments, such as royalties and license agreements, to quarterly from annually, for example. A smaller, more regular payment may smooth the cash flow

impact and make it easier to forecast, particularly in smaller organizations. Alternatively, an organization may find that changes to a less frequent basis may provide additional operating funds throughout the fiscal cycle.

Asset–Liability Management

In financial institutions, the management of assets and liabilities is a key requirement for managing interest rate risk. In some ways, it is also more predictable in financial institutions than in other organizations.

Asset–liability management involves the pairing or matching of assets (customer loans and mortgages in the case of a financial institution) and liabilities (customer deposits) so that changes in interest rates do not adversely impact the organization. This practice is commonly known as *gap management* and often involves duration matching.

Some nonfinancial companies have exposure to interest rate gaps through their own internal financing or programs. For example, companies may offer financing programs for their customers, while others provide financing internally on a project basis. Nonfinancial institutions may be able to reduce interest rate exposure by building an awareness of asset–liability management within parts of the organization involved in such activities and using it to reduce exposure where possible.

Forward Rate Agreements

A forward rate agreement (FRA) is an over-the-counter agreement between two parties, similar to a futures contract, to lock in an interest rate for a short period of time. The period is typically one month or three months, beginning at a future date.

A borrower buys an FRA to protect against rising interest rates, while a lender sells an FRA to protect against declining interest rates. Counterparties to an FRA continue to borrow or invest through normal channels.

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Interest Rate Basis

When managing interest rate risk, the interest rate, or rate basis, is an important attribute of the risk. Interest rates do not change simultaneously. For example, bank prime rate is an administered rate and can remain unchanged for months while market rates fluctuate significantly.

If hedging products do not match exposure, an organization may not have adequate protection against interest rate risk. Using one interest rate product to hedge another type of exposure may provide an effective hedge at reasonable cost despite there not being a complete match between the hedge and exposure. It is important to understand the implications of matching exposure to a hedging strategy.

In the absence of using derivatives such as basis swaps to restructure exposure, it may be possible to change the basis of an organization's interest rate exposure through its business decisions and activities. For example, a company with prime-based borrowing might negotiate with its lender to use another basis for its interest calculations. An investor may select portfolio assets with returns based on actively traded interest rates.

Rates being hedged should be same or similar to the FRA reference rate to avoid basis risk.

At the beginning of the period covered by the FRA, the reference rate is compared to the FRA rate. If the reference rate is higher, the FRA seller pays a compensating payment (the settlement amount) to the FRA buyer. If the reference rate is lower, the FRA buyer pays the FRA seller. The notional contract amount is used for calculating the settlement amount but is not exchanged.

Although it can occur at the end of the contract term, payment of the settlement amount usually occurs at the beginning of the contract term. In that case, the settlement amount is discounted and the present value of the interest rate differential is paid.

FRAs allow the yield curve to be split into small segments that can be hedged (or traded) independently of one another. A strip of consecutive FRAs can be used to construct a longer-term hedge. For example, a one-year hedge could be constructed using consecutive three-month FRAs.

FRA rates are forward interest rates and are determined by the yield curve. Growth and liquidity in FRAs have been helped tremendously by futures contracts that permit arbitrage and therefore enhance liquidity.

The following information applies to FRAs:

- The forward term of an FRA is the time prior to the beginning of the FRA.
- The contract term is the time covered by the FRA.
- FRA reference rates are posted on major market information services and commonly are LIBOR (London interbank offered rate).
- The settlement amount is the payment to the FRA seller or buyer, based on the differential between the reference rate and the FRA rate at the beginning of the contract period, prorated over the term of the FRA, and usually discounted.
- The maturity of the FRA is the end of the contract term.

Closing Out a Forward Rate Agreement

FRAs can be closed out at current market value. Since both parties have an obligation under an FRA, closing out the contract involves unwinding it through an offsetting transaction. The buyer of an FRA will sell an

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Calculating an FRA Settlement Amount

A company needs to borrow $10 million in three months' time. Management is concerned that rates may rise, so the company buys a 3 x 6 FRA at 4.00 percent. The term 3 x 6 indicates that the FRA term begins three months from the trade date and ends six months from the trade date (a term of three months).

If interest rates have risen (as measured by the reference rate compared with the FRA rate), the bank will compensate the company. If the reference rate has fallen, the company will compensate the bank.

FRA rate	4.00%
Reference (actual) rate	5.00%
Difference	1.00%

1.00% x 90 days/360 days[a] x $10 million = $25,000

Since the settlement amount is usually paid at the beginning of the period covered by the FRA, the amount is discounted and its present value paid ($24,691.36) to the company.

[a] The daycount basis in many countries, including the United States, is 360 days. Canada and a few other countries use 365 days.

offsetting FRA, while the seller of an FRA will buy an offsetting FRA, with a resultant gain or loss.

Interest Rate Futures

Interest rate futures are exchange-traded forwards. They permit an organization to manage exposure to interest rates or fixed income prices by locking in a price or rate for a future date. Transacted through a broker, there are commissions to buy or sell and margin requirements.

Unlike FRAs, there is no need to establish a line of credit with a bank. The risk of dealing with other counterparties is replaced with exposure to the exchange clearinghouse.

Interest rate futures may be based on a benchmark interest rate, index, or fixed income instrument. In the case of a bond futures contract, for example, the futures price locks in the price for the bond and thus the resultant yield, since prices and yields move inversely. As with other forwards, locking in a price for the underlying asset, or an

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Short-Term Interest Rate Futures

Short-term interest rate (STIR) futures trade on several exchanges, including the Chicago Board of Trade, the Chicago Mercantile Exchange, and the Montreal Exchange. These contracts permit hedgers to fix a price for the underlying instrument and therefore the corresponding interest rate, or alternatively the interest rate directly.

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Eurodollar Rates

Some sample three-month eurodollar rates, as traded on the Chicago Mercantile Exchange, appear below. The quotes are price indices, from which rates are determined (100 minus price):

December	97.66
March	97.42
June	97.23
September	97.04

interest rate, also means forfeiting the possibility of subsequent favorable market moves.

Eurodollar futures are similar to FRAs for managing interest rate risk and are used in arbitrage with FRAs. These futures contracts are also used for arbitrage in the forward foreign exchange market, enhancing liquidity all around. A Eurodollar futures contract locks in a price for a future delivery and the corresponding interest rate.

Basis risk is a consideration with hedging with futures contracts and other derivatives. Basis risk arises when contracts are used to hedge interest rates other than the contract's underlying rate—for example, exposure to an administered borrowing rate hedged with a Eurodollar contract.

Bond Futures

Bond futures allow investors to hedge existing bond positions, or to replicate bond positions, without buying or selling the underlying bonds. They are useful for tactical asset allocation strategies employed by professional money and portfolio managers. In addition, they can assist in the management of exposure to long-term interest rates.

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Futures Margin

The futures user must post margin (cash or similar securities) in an account maintained by the broker who facilitated the transaction. Margin is designed to absorb potential subsequent losses on the open futures position. The amount of margin required depends on exchange rules and the nature of the position (e.g., hedging or speculative). Exchange margin requirements are subject to change from time to time, and brokers may require additional margin.

Margin is a performance bond to ensure that the buyer or seller of a futures contract fulfills the obligations associated with the contract. Normally, a futures contract will require initial margin, plus maintenance margin if the futures position suffers loss. Outstanding futures positions are marked-to-market daily, and the margin account of the futures buyer or seller is debited or credited accordingly. By preventing unrealized losses from accumulating, margin helps to safeguard the clearinghouse and the financial system.

Failure to respond to a margin call may lead the broker to close out the futures position by offsetting the contracts outstanding. Costs are the responsibility of the account holder.

Bond futures can be used to hedge bond and interest rate risk, change portfolio asset allocation, or alter portfolio duration.

A borrower can protect against rising rates by selling a bond futures contract provided that the contract underlying interest is similar to the exposure. If interest rates rise (underlying bond price falls), the gain on the futures contract should offset higher market interest rates. If interest rates

fall (underlying bond price rises), the loss on the futures contracts should be offset by lower market interest rates. This presumes that there has been no change in the willingness of the organization's lenders to extend credit.

Basis risk can impact the ultimate effectiveness of the hedge. Assuming the futures contract provides a hedge against market interest rates, it will not address other issues such as the deterioration of the hedger's credit quality, which in most cases will differ from the contract's underlying issue.

Bond futures are useful in portfolio management for facilitating tactical and strategic asset allocation. A portfolio manager can alter asset weightings by buying or selling futures contracts without changing actual holdings of securities. The advantages of using bond futures as a proxy to actual purchases of bonds include ease of execution and delivery and potential for reduced transaction costs.

Closing Out a Futures Contract

At expiry, a futures contract can be settled by offsetting it with another futures contract, or by delivering or accepting delivery of the underlying, as permitted. For delivery against bond futures contracts, since deliverable

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Futures Strips

A strip of futures contracts can also be used to construct a hedge for a longer period of time. The result is similar to an interest rate swap, where consecutive contracts together cover a longer period of time, such as one year. The strategy is limited by the maximum expiry dates of the contracts available.

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Hedge Ratios

Futures contracts trade in standardized contract amounts and for standardized assets, so a hedge ratio helps to determine the number of contracts needed to ensure an effective hedge. An incorrect number of contracts can mean under- or overhedging. Adjustments are estimates and they are therefore inexact.

Hedge ratios reflect price sensitivities. The goal of hedging is to match a change in the exposure (e.g., bond portfolio) with an offsetting change in the value of a hedge (e.g., futures contract). To determine a hedge ratio, the rate of change of the futures contract is compared with the rate of change of the underlying exposure (although they will be in different directions).

A basic ratio is calculated by dividing nominal exposure by nominal futures contract size. This ratio can be used if the underlying exposure is the same as the futures contract. Otherwise, if the exposure to be hedged differs from the futures contract, the basic ratio can be adjusted. Adjustments may be based on the ratio of basis point values, the correlation between the two interest rates or assets, or another calculation.

For bond futures, the exchange provides a list of bonds that meet delivery requirements. The cheapest-to-deliver bond is the most favorable for the bond seller to deliver, producing the greatest profit or the smallest loss, within delivery requirements. Bond futures prices track the cheapest-to-deliver bond, which itself can change during the futures contract's lifetime. The conversion factor of the cheapest-to-deliver bond, or alternatively duration, may be used to develop a hedge ratio.

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The hedge ratio may need further adjusting if the exposure differs from the cheapest-to-deliver bond. Historical price data or regression analysis can also be used to develop a hedge ratio. However, relationships between instruments can change and may differ from the historical period tracked. It is for this reason that hedge ratios are an estimate of the number of contracts required.

bonds have different coupons and maturities, a conversion factor is used. Exchanges list deliverable bonds and their conversion factors.

Prior to delivery, a purchased futures contract can be closed out by selling a futures contract with the same delivery date. Similarly, a sold futures contract can be offset by buying a futures contract with the same delivery date.

Commonly, futures contracts are rolled forward to maintain the position. This is accomplished by closing out the near-term delivery contract (buying or selling) and entering into a new contract with farther delivery date (selling or buying).

Interest Rate Swaps

Transacted in the over-the-counter market, interest rate swaps are related to forwards and futures but facilitate interest rate hedging over a longer time interval. Common swaps include asset swaps, basis swaps, zero-coupon swaps, and forward interest rate swaps.

The swap is an agreement between two parties to exchange their respective cash flows. Most commonly, this involves a fixed rate payment exchanged for a floating rate payment. Both parties are obligated by the

swap's conditions, and thus there may be a cost to exit from an existing swap, depending on how rates have changed since it was transacted.

Swaps permit a change to the effective nature of an asset or liability without changing the underlying exposure. For example, payment structures can be changed in anticipation of rising interest rates. Alternatively, organizations may be able to take advantage of benefits, such as government or tax incentives, that are available for certain types of financing.

Borrowers with weaker credit ratings may face a credit premium for fixed rate borrowing. Such an organization may borrow at relatively more attractive floating rates and swap for the desired fixed rate payments without any change to the underlying debt. The benefit that accrues can improve the bottom line for both swap parties.

The terms *receiver* and *payer* refer to the fixed rate payment stream in a swap. The benchmark floating rate is, by convention, an average from several market-making financial institutions. Rates are posted on major financial information services. This convention helps avoid con-

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Swap Counterparties

The principal notional (contractual) amount of an interest rate swap is not exchanged between counterparties but is used to calculate payments. Since only net cash flows are exchanged between counterparties, credit exposure is reduced. However, swaps often have large notional contract amounts and significant terms to maturity, which means the credit quality of counterparties should be monitored. High-quality counterparties should be chosen.

tention over the correct benchmark or opportunities for manipulation. Three-month or six-month LIBOR are common benchmark floating rates. Master agreements are provided by the International Swaps and Derivatives Association (ISDA).

When interest rates are expected to fall, market participants move to floating interest rates, and there is downward pressure on swap spreads. When interest rates are expected to rise, market participants will move to borrow at fixed interest rates, putting upward pressure on swap spreads.

Asset Swaps

A swap to transform an asset's income stream is known as an *asset swap.* Asset swaps allow investors to change the interest rate structure of their revenue streams without changing the structure of the underlying asset. Both interest rate swaps and currency swaps (discussed in Chapter 4) can be asset swaps.

The most popular asset swaps are those that change payments from a fixed interest rate to a floating interest rate, and those that exchange a cash inflow in one currency to another currency.

Asset swaps can also be used to synthetically create a return that would not otherwise be available. For example, consider an investment that offers a floating rate return at a relatively attractive price. An investor that prefers fixed rate assets can buy the floating rate asset and swap the revenue stream for a fixed rate revenue stream without changing the structure of the asset.

Similarly, an investor with foreign currency assets may prefer U.S. dollar revenues that offset a need for U.S. dollars elsewhere in the business. The investor could swap the foreign currency revenues for U.S. dollar revenues without affecting the foreign assets.

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Swap Rates

Swap spreads, and therefore all-in swap rates, fluctuate in response to supply and demand. The spread is added to the benchmark (government) yield for the fixed rate, below. A financial institution will pay fixed at the bid rate or receive fixed at the offered rate.

Term of Swap	Governments	Spreads	All-in Rate (bank bid-offer)
2 years	4.40–4.45	20–25	4.60–4.70
3 years	4.60–4.65	25–30	4.85–4.95
4 years	4.70–4.75	25–30	4.95–5.05
5 years	4.95–5.00	25–30	5.20–5.30

A corporate borrower wanting to exchange floating rate payments for fixed rate payments (pay fixed and receive floating) for five years will pay an all-in swap rate of 5.30 (5.00 + .30) percent from the sample swap rates and spreads above.

Basis Swaps

Basis swaps enable counterparties to change exposure from one benchmark floating rate to another. This might permit a better match between an organization's asset and liability cashflows. Basis swaps can also be used to exploit favorable interest rate differentials between indices, or in anticipation of interest rate movements, while maintaining exposure to floating interest rates.

Some rates, such as bank prime rate, are administered and therefore differ from floating or market-determined rates. Administered rates are generally not managed using basis swaps.

Zero-Coupon Swaps

Zero-coupon bonds consist of one payment at maturity comprising principal plus all interest. With no coupon payments, zero-coupon bonds eliminate reinvestment risk for coupon income.

Zero-coupon financing can be desirable but difficult to obtain from a lender, so an alternative is to borrow in another cost-effective way and use a zero-coupon swap to synthetically create the zero-coupon debt. This leaves the original coupon debt unchanged but overlays a zero-coupon structure.

Forward Interest Rate Swaps

Also known as forward-starting interest rate swaps, forward interest rate swaps allow hedgers to arrange a swap in advance of its requirement and commencement. Forward interest rate swaps also allow borrowers and investors to alter cash flows in anticipation of future changes in interest rates or the yield curve.

Additionally, forward interest rate swaps can be used to convert a fixed interest rate to a floating interest rate, or to protect against anticipated rate changes until a fixed rate liability or asset is arranged. At that time, the interest rate swap can be offset with another or can be terminated.

Closing Out an Interest Rate Swap

Interest rate swaps must be settled at market value to be terminated. The market value of a swap at any time after its commencement is the net present value of future cash flows between the counterparties. Swap termination involves the calculation of a settlement amount representing the net present value of all future obligations by each counterparty. This net payment is made to the counterparty with unrealized gains in the swap.

There are several ways to alter or eliminate an existing interest rate swap:

- Offset the swap with another that will produce the required payment streams.
- Cancel the existing swap by paying or receiving a lump sum representing the net present value of remaining payments. This may require a cash payment if the swap has a negative value.
- Extend the swap by blending it with a new one (*blend-and-extend*). This embeds the cost of closing out the swap in the new periodic swap payments.
- Assign the swap to another party that will continue to make and receive payments under the original swap agreement until maturity. The counterparty assigning the swap will either pay to, or receive from, the new counterparty a lump sum that reflects the net present value of all remaining payment streams.

Interest Rate Options

Interest rate options include caps, floors, and collars used to protect against different reference interest rates or prices of underlying assets. Although option strategies usually involve over-the-counter options, they can also be constructed from exchange-traded options.

The business of options is analogous to insurance. One party pays to reduce or eliminate risk, while the other party accepts the risk in exchange for option premium. Option premium paid increases the effective borrowing cost, or decreases the effective return on assets, for hedgers.

Pricing of interest rate options depends on several factors including term to expiry, strike rate, and volatility of the reference interest rate. Prices are normally quoted in basis points of the notional contract

amount. The option buyer's specification for contract size, strike rate, reset dates, term to expiry, and reference interest rate can be met with customized options in the over-the-counter market.

Purchased interest rate options can be costly if the underlying rate is volatile. If underlying rates move, but not enough to make the option worth exercising, the option will expire worthless, resulting in a potential loss through adverse market rates as well as the cost of the option premium.

Interest rate options may be cash-settled contracts on interest rates, fixed income instruments such as government bonds, or options on futures contracts. Although the mechanics are similar, the details are important. The hedger should clearly understand the option's underlying interest, permitted delivery opportunities, and the appropriateness of the option as a hedge given the organization's own exposure and objectives.

Basis risk is a consideration in hedging with interest rate options as it is with other interest rate hedges. With options on bond futures, price

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LIBOR

LIBOR (London Interbank Offered Rate) is the most widely used benchmark or reference rate for short-term interest rates. LIBOR is the interbank rate between major banks for transactions of market size and is calculated from at least eight regular contributor banks. LIBOR is used for settlement of interest rate and futures contracts and lending arrangements. LIBOR rates are posted daily for British pound, Japanese yen, Canadian dollar, Australian dollar, euro, Danish krone, New Zealand dollar, Swiss franc, and U.S. dollar by the British Bankers' Association (BBA) for a range of maturities up to 12 months.

changes may occur as a result of changes in the underlying bond's price, interest rates, or because of a change in the basis. The underlying (cheapest-to-deliver) bond can change during the term of a futures contract, so care should be taken when comparing an option on a futures contract with an option on the bond itself.

Since the buyer has control over its exercise, an option is useful for covering contingent risk, where the anticipated need for a hedge may or may not occur. By avoiding the necessity of locking in an interest rate, even for a short time period, options provide protection against worst-case interest rate scenarios and flexibility for best-case scenarios.

Caps and Floors

Caps and floors are interest rate options packaged to provide protection from changes in interest rates over a period of time. A cap is a series of interest rate options to protect against rising interest rates. A *cap* (sometimes called a *ceiling*) is typically made up of short European-style options, the expiry of each option corresponding to the hedger's anticipated borrowing schedule. In exchange for cap premium, the cap buyer is protected from higher rates (above the cap strike rate) for the period of time covered by the cap.

At the expiry date of each individual option (caplet), the cap seller reimburses the cap buyer if the reference rate is above the cap strike rate. If rates are below the cap rate, the caplet is left to expire, and funding can be obtained at lower market rates. Unexpired portions of the cap (caplets) remain for future borrowing dates.

Compensation to the cap buyer is based on the difference between the strike rate and the reference rate for the notional contract amount and the period of time covered by the option. Although the cost of the cap increases the effective cost of funds for a borrower, it also provides protection and flexibility without locking in a rate.

EXAMPLE

Interest Rate Cap

A U.S. manufacturer borrows by rolling over short-term debt every quarter. Concerned about rising rates, the company buys an interest rate cap to cover its $10 million floating rate debt. The cap strike rate is 5.00 percent, the reset period is quarterly, and the reference rate is the London Interbank Offered Rate (LIBOR).

- Rollover 1. At the first rollover and cap date, the average reference rate is 4.25 percent. The company will do nothing, since the reference rate is lower than the cap rate. The company will borrow at the lower market rates, and the cap will remain for subsequent rollover dates until its expiry.
- Rollover 2. At the second rollover and cap date, the rate has increased to 5.65 percent. The company will be reimbursed by its bank for the difference between the cap strike rate and the reference rate. Assuming 91 days in the period, this amount is calculated as $10,000,000 x (0.0565 – 0.0500) x 91/ 360 = $16,430.56.

A floor is similar to a cap except that it provides protection against falling rates below the floor strike rate. A floor provides the floor buyer with reimbursement if the reference rate falls below the floor strike rate.

As an alternative to buying a cap, a borrower may sell an interest rate floor, receiving the floor premium. The borrower will be required to pay the floor rate should the floor be exercised by the floor buyer. The floor will be exercised only if interest rates fall. The floor premium received will partially offset higher borrowing costs, but the floor seller

still incurs all the risk of rising interest rates and has not hedged against higher rates.

Interest Rate Collar

An interest rate collar comprises a cap and a floor, one purchased and one sold. Collars are often used when caps (or floors) are deemed too expensive. The purchased option provides protection against adverse interest rate movements. The sold option trades away some of the benefits of favorable rates in order to pay for the protective option. Like caps and floors, collars typically consist of a series of interest rate options with expiry dates customized to the hedger's schedule.

If at expiry of each option comprising the collar, the reference rate is between the cap and floor rates, neither the cap nor the floor will be exercised. However, if rates move above the cap rate or below the floor rate, the appropriate option (cap or floor) will be exercised. Effectively, rates will be capped at the cap rate or prevented from falling below the floor rate. If the reference interest rate moves beyond the strike rate, the option is exercised and the option seller pays the option buyer the difference between the reference rate and the strike rate on the notional amount, adjusted for the number of days in that option's term.

Collars may be transacted independently of the underlying exposure they are designed to hedge. In a *zero cost* collar, option premiums offset one another. Like other interest rate options, the collar protects against changing market interest rates but does not provide protection against rate changes as a result of the deterioration of an issuer's credit rating.

Intrinsic value, or the amount that an option is *in-the-money,* is the economic benefit, if any, of exercising the option, as compared with current market prices. Intrinsic value may be positive or zero. Time value is the value attributed to chance that the option may be worth-

while exercising before or at expiry. The greater the time to expiry of an option, the greater the time value and premium, all else being equal. Time value declines more rapidly as expiry approaches. At expiry, time value is zero.

Swaptions

Swaptions are options on interest rate swaps. They give the swaption buyer the right, but not the obligation, to enter into an interest rate swap with predetermined characteristics at or prior to the option's expiry. Swaption premium is paid by the swaption buyer to the swaption seller, typically as a percentage of the notional amount of the swap.

An interest rate swaption can be used to obtain a fixed interest rate (or, alternatively, a floating interest rate). For example, in anticipation of rising interest rates, a swaption buyer can exercise its option to enter into a pay-fixed (receive floating) swap, providing protection against higher rates. The cost of such a strategy is the swaption premium.

The terms *receiver* and *payer* refer to the fixed rate payment stream in a swap:

- The buyer of a payer swaption has the right to enter a pay-fixed (receive floating) swap at the strike rate.
- The buyer of a receiver swaption has the right to enter a receive-fixed (pay floating) swap at the strike rate.

A floating rate borrower can purchase a swaption giving it the right, but not the obligation, to enter into an interest rate swap at the expiry of the swaption. In exchange for this right, the buyer of the swaption pays a premium.

Swaptions may also be sold to earn premium income that can be used to reduce interest costs. The swaption seller takes on potentially unlimited risk because the swaption will only be exercised when the

current market is less favorable (to the swaption seller) than the swap strike rate. The swaption seller must be comfortable entering into a swap with the specified terms or, alternatively, not having the swaption exercised.

For the swaption seller, the swaption premium is the only offset for the risk undertaken. The swaption seller may be obligated to enter into the underlying swap, or pay to exit from the obligation, if the swaption is exercisable at expiry. The sale of a swaption alone also does nothing to hedge interest rate exposure.

Exchange-Traded Options

Exchange-traded options may have a futures contract as the underlying interest. Options on interest rates or options on interest rate futures can be used to construct an interest rate cap, floor, or collar. Options may be settled in cash or with the underlying asset or futures contract, depending on exchange rules. Basis risk may be a consideration if exchange-traded options are used for hedging purposes.

When the underlying interest is a futures contract, the purchase of a put option permits the option buyer to sell the futures contract at the strike price, which provides protection against falling (futures) prices. The purchase of a call option on a futures contract allows the option buyer to buy the futures contract at the strike price, providing protection against rising (futures) prices.

Closing Out an Interest Rate Option

In general, if an interest rate option is no longer required and there is time remaining to expiry, it can be sold at market value. For a strategy involving several purchased options, market value is the total of the options that comprise it, and the maximum loss is the cost of the options.

A sold option remains an obligation to the option seller unless it has been closed out by purchasing an offsetting one and the outstanding

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Interest Rate Futures

Several exchanges offer interest rate contracts:

- Chicago Board of Trade offers futures on 2-, 5-, and 10-year U.S. Treasury notes, Treasury bonds, and 30-day U.S. interest rates.
- Chicago Mercantile Exchange offers bond futures, swap futures, turn futures, and Consumer Price Index (CPI) futures, among other contracts.
- Montreal Exchange offers BA and bond futures and options on futures for Canadian interest rates.

Other international futures exchanges offering interest rate contracts include:

- Euronext-Liffe
- Sydney Futures Exchange

option is canceled. Interest rate collars and other strategies that comprise both purchased and sold options involve such potential obligations.

Sold options with time and/or intrinsic value may be expensive to repurchase. Therefore, the maximum loss may be greater than the original cost (for a package of bought and sold options) or premium received (for sold options).

If not exercised, an option will be worthless if there is no intrinsic value at expiry. Some exchange-traded contracts offer automatic exercise on options that are in-the-money by a certain minimum amount, while others require the option buyer to notify in case of exercise.

At a swaption's expiry, if it is not favorable to use it, the swaption buyer can allow it to expire and transact a swap at market rates. If the swaption is favorable, the swaption buyer can exercise it and enter into the predetermined swap. Alternatively, an in-the-money swaption may be sold, or alternatively closed out with a difference payment from the swaption seller to the swaption buyer.

Summary

- Basic changes to the way that business is conducted may help to minimize an organization's exposure to interest rates.
- Forward rate agreements (FRAs) and futures contracts permit a rate to be fixed for a specific period of time, while swaps permit a hedge to be constructed for a longer period of time.
- A hedge ratio helps to determine the number of exchange-traded contracts needed to ensure an effective hedge. An incorrect number of contracts can result in under- or over-hedging.
- Interest rate caps and floors provide hedgers with protection against rising (or falling) rates, without locking in an interest rate.