

FINANCIAL RISK MANAGEMENT

Learning Objectives

After studying this chapter, readers should be able to

- discuss the fundamentals of risk management, including some types of risk and the general approach that businesses take to manage risk,
- explain how reserves and reinsurance can be used to manage the risk inherent in capitation contracts,
- describe the features of options and the factors that influence a call option's value,
- describe futures contracts and explain how they can be used in health services organizations to reduce the riskiness of financial transactions, and
- explain how interest rate swaps can be used to decrease risk and, in some situations, lower interest costs.

Introduction

In this chapter, we discuss financial risk management—a topic of increasing importance to healthcare managers. The term *risk management* can mean many things, but in a financial context it means identifying events that can have adverse financial consequences and then taking actions to prevent and/or minimize the damage these events could cause. Years ago, financial risk management dealt primarily with insurance: Managers made sure a provider was adequately insured against fire, theft, and other casualty losses and that it had adequate medical liability coverage. Since then, the scope of financial risk management has been broadened to include such actions as protecting against adverse changes in interest rates or ensuring that greater-than-expected utilization or illness severity will not have a catastrophic impact on a business's financial condition.

As the healthcare environment increases in complexity, it is becoming more difficult for managers to know what financial pitfalls might lie in wait. Therefore, providers need to have someone systematically look for potential problems and design safeguards to minimize potential damage. Most large

businesses have designated *risk managers* who report to the CFO, while the CFOs of medium-sized firms or the owners of small businesses personally assume risk management responsibilities. In this chapter, we present a diverse collection of financial risk management topics of relevance to healthcare providers.

Risk Management Basics

Risks can be categorized along several dimensions. In addition, there are multiple approaches to financial risk management in businesses. In this section, we introduce some fundamental concepts that apply to the overall field of risk management.

Risk Terminology

We begin by defining some commonly used risk management terms.

- **Pure risks** pose only the prospect of a loss. Examples include the risk that a facility will be damaged by fire or that a medical liability suit will bring a judgment against the business.
- **Speculative risks** might generate gains but might also cause a loss. Thus, investments in new service lines and securities involve speculative risks.
- **Utilization (volume) risks** are associated with the demand for a provider's services. Because the provision of services at appropriate volumes is essential to survival, utilization risk is one of the most significant risks that providers face.
- **Severity risks** are present when costs may be higher than expected because the realized severity of patients' illnesses is greater than that expected. For example, if a provider accepts a capitated or prospective payment contract with the expectation of a given average level of severity and it turns out to be much higher, costs will be higher than expected with no matching revenue increase.
- **Input risks** are associated with input costs, including labor, facilities, and supplies. For example, a provider faces the risk that its nursing costs will increase and that it will not be able to pass this increase on to its payers.
- **Financial risks** are present in financial transactions. For example, if a hospital expects to issue new bonds to finance a planned expansion, it faces the risk that interest rates will rise before the bonds can be brought to market and hence that financing costs will be higher than

projected. As we will explain in a later section, this type of risk can be mitigated by taking a position in the futures market.

- **Property risks** are associated with destruction of productive assets. Threats of fire, floods, and riots impose property risk on businesses.
- **Personnel risks** concern employees' actions. Examples include the risks associated with employee fraud or embezzlement as well as suits against a business that are based on age or sex discrimination.
- **Environmental risks** are associated with pollution of the environment. Public awareness in recent years, coupled with the huge costs of environmental cleanup, has increased the importance of this risk.
- **Liability risks** are associated with products, services, or employee performance. For providers, the risk of large judgments for medical mistakes is especially severe.
- **Insurable risks** can be covered by insurance. In general, property, personnel, environmental, liability, and even severity risks can be transferred to insurance companies. Note, though, that the ability to insure a risk does not necessarily mean that the risk should be insured. Indeed, a major function of risk management involves evaluating all alternatives for managing a particular risk, including self-insurance, and then choosing the optimal alternative.

Note that the risk classifications in the preceding list are somewhat arbitrary and overlap, and different classifications are commonly used in specific situations—for example, when defining the risks associated with capitation contracts. Still, the list does provide an idea of the wide variety of risks to which a provider can be exposed.

An Approach to Risk Management

Although several alternative approaches to risk management exist, most businesses use the following process:

- **Identify the risks faced by the business.** Here, the risk manager identifies the potential risks faced by his firm. This step is neither glamorous nor exciting, but it is critical to the risk management function. Generally, the risk management literature and data from previous incidents, surveys, and annual reviews are used for this purpose.
- **Estimate the potential impact of each risk.** Some risks are so small that they are immaterial, whereas others are so severe that they have the potential to doom the business. Furthermore, some risks are extremely remote, while others may occur with relatively high

frequency. It is useful to segregate risks by potential frequency and severity and then focus on those that have both high frequency and high severity. A *frequency/severity matrix* may be used for this purpose.

- **Decide how each relevant risk should be handled.** In most situations, risk exposure can be reduced through one of the following techniques:
 1. **Transfer the risk.** It is often advantageous to use insurance to transfer the risk to another party. However, the fact that a risk is insurable does not necessarily mean that it should be covered. In some instances, it might be better for the company to *self-insure*, which means bearing the risk directly rather than paying another party to bear it.
 2. **Transfer the function.** Sometimes it is best to transfer the entire risk-producing function to another party and hence eliminate the risk. For example, suppose a hospital is concerned about potential liabilities arising from its in-house disposal of medical wastes. One way to eliminate this risk would be to contract with another company to do the disposal, thereby passing the risk to another party.
 3. **Purchase derivative contracts.** As we will discuss in more detail in later sections, businesses can use derivatives to hedge some types of risk. For companies using commodities as inputs, commodity derivatives can be used to reduce input risks. For example, a surgical equipment manufacturer may use metal futures to hedge against increases in raw material prices. Similarly, financial derivatives can be used to reduce risks that arise from changes in interest rates.
 4. **Reduce the probability of occurrence.** The total losses expected to arise from any risk are a function of both the expected frequency of occurrence and each expected dollar loss. In some instances, it is possible to reduce the probability that an adverse event will occur. For example, the probability that a fire will occur can be reduced by instituting a fire prevention program, replacing old electrical wiring, and using fire-resistant materials in areas where the chance of fire is greatest.
 5. **Reduce the magnitude of the loss.** Continuing with the fire risk example, the dollar cost associated with a fire can be reduced by such actions as installing sprinkler systems, designing facilities with self-contained fire zones, and locating facilities close to a fire station.
 6. **Avoid the activity.** A business might discontinue a product or service line because the risks outweigh the rewards. For example, a hospital might decline an offer to participate in a clinical trial for a new medical device because the liability risk is too great.

Risk management decisions, like all business decisions, should be supported by a cost–benefit analysis of each feasible management alternative. For example, suppose it would cost a clinic \$50,000 per year to purchase a first-dollar-coverage medical liability policy. An alternative might be to purchase a lower-cost policy without first-dollar coverage and then use the money saved to establish a liability reserve. Both alternatives involve expected cash flows, and from a financial standpoint the choice should be made on the basis of the lowest present value of future costs. Thus, the same financial analysis techniques applied to other business decisions can be applied to many risk management decisions.

SELF-TEST QUESTIONS

1. Define the following terms:
 - a. Pure risks
 - b. Speculative risks
 - c. Utilization (volume) risks
 - d. Severity risks
 - e. Input risks
 - f. Financial risks
 - g. Property risks
 - h. Personnel risks
 - i. Environmental risks
 - j. Liability risks
 - k. Insurable risks
 - l. Self-insurance
2. Briefly describe one common approach to risk management.
3. Should a business insure itself against all of the insurable risks it faces? Explain your answer.

Risk Management of Capitated Contracts

As discussed in previous chapters, capitated (global) payments expose providers to financial risks that differ from those associated with conventional (fee-for-service) reimbursement. As with all financial risks, actions can be taken to reduce the impact of capitation-induced risks. We discuss two in this section: reserves and stop-loss provisions (reinsurance).

Reserves

An organization's first line of defense against financial risk is the maintenance of adequate *reserves*. Any provider, including medical practices and hospitals,

that assumes the financial (utilization) risk for a covered population without having adequate reserves can easily end up, so to speak, as “roadkill along the capitation highway.” When healthcare providers accept capitated rates, they agree to provide whatever services are required for a fixed monthly fee. If all goes well—that is, if the contract is fair and if utilization and costs are controlled—the provider will end the year with a profit. If realized utilization, and hence costs, exceeds estimates, or if average costs per patient encounter are higher than expected, any losses have to be covered. In such situations, the need for reserves becomes apparent. There are several classifications of reserves. We will cover the three most important types: (1) required reserves, (2) prudent (business) reserves, and (3) reserves for incurred but not reported costs.

Required Reserves

Required reserves are reserves specifically required by state authorities to ensure that insurance businesses have funds on hand to cover random periods when costs exceed revenues. Typically, regulations specify a minimum fixed dollar amount of reserves, some percentage of premium income, or some dollar amount per covered life. It is interesting to note that some state insurance regulators have examined the risk positions of providers that accept capitation contracts (and hence are self-insuring by assuming responsibility for costs that exceed their capitation payments) to ascertain whether requiring licensure and mandatory reserves for these businesses is appropriate.

Prudent (Business) Reserves

At the provider level, where reserves are not required by law, it makes good business sense to have sufficient cash and marketable securities on hand (in reserve) to cover losses that are reasonably likely to occur. One approach to setting reserve requirements in businesses is to use *Monte Carlo simulation* (which is discussed in Chapter 12 with regard to project risk assessment) to estimate the extent of the risk. Think in terms of a business's cash budget, which is discussed in Chapter 15. In that discussion, we note that a business's cash inflows and outflows are not known with certainty, so in any period (for example, a month), cash outflows can exceed inflows. Most firms set their target cash balances high enough to cover routine shortfalls, and hence the cash balance acts as a type of reserve. The concept is the same for capitation reserves, but in this case it is applied to a particular contract. By applying Monte Carlo simulation to utilization and costs, it is possible to estimate the sizes and probabilities of occurrence of potential contract losses. A reserve based on the risk aversion of the organization's managers (the more conservative the managers, the larger the reserve) can then be established to cover all but the most unlikely loss scenarios.

For an illustration of this concept, consider a capitation contract that Westside Memorial Hospital has with a local HMO (health maintenance organization) to serve 50,000 enrollees. The capitation rate is \$27.50 per member per month (PMPM), which means \$16.50 million in total revenue. Exhibit 17.1 contains Westside’s best estimate for the cost distribution of enrollees, along with the resulting profit distribution. These distributions were developed on the basis of estimates of enrollees’ admission rates, average length of stay, and average per diem cost. The expected total contract cost is \$15.775 million, so the expected profit of \$725,000 gives Westside a projected profit margin on the contract of 4.6 percent.

Clearly, this contract does not guarantee Westside a profit. According to the probabilities in Exhibit 17.1, there is a $10 + 20 + 30 = 60\%$ chance that the realized profit will be greater than the \$725,000 estimate. That’s the good news! The bad news is that there is a 40 percent chance that the profit will be less than expected, and a $5 + 3 + 2 = 10\%$ chance that Westside will lose money on the contract. How can Westside protect itself against the possibility that losses on this contract will push the hospital into financial distress? Of course, one answer is to have sufficient reserves. On the basis of the distributions in Exhibit 17.1, Westside can fund (establish) a \$5 million reserve that would totally protect it against losses on this contract, assuming that the probability distribution itself is correct. However, assuming a borrowing rate of 7 percent and a short-term investment rate of 4 percent, this conservative approach to reserves would cost Westside $0.03 \times \$5 \text{ million} = \$150,000$ annually, which would take a large chunk out of the expected profit on the contract.

As an alternative to establishing a \$5 million reserve, Westside might conclude that a 2 percent probability of such a loss means the event is unlikely to occur and hence does not warrant reserve protection. In this case,

EXHIBIT 17.1
Westside Memorial Hospital: Contract Cost and Profit Distribution

<i>Probability</i>	<i>Contract Cost</i>	<i>Contract Profit (Loss)</i>
0.10	\$14,000,000	\$2,500,000
0.20	15,000,000	1,500,000
0.30	15,500,000	1,000,000
0.20	16,000,000	500,000
0.10	16,500,000	0
0.05	17,500,000	(1,000,000)
0.03	19,000,000	(2,500,000)
<u>0.02</u>	<u>21,500,000</u>	<u>(5,000,000)</u>
<u>1.00</u>		
Expected value =	<u>\$15,775,000</u>	<u>\$ 725,000</u>

Note: Contract revenues are expected to total \$16.5 million.

Westside might set a reserve for the contract of less than \$5 million—say, \$1 million or \$2.5 million. The choice is a risk/return trade-off; more risk protection requires a larger reserve, which means higher protection costs and lower contract profits.

Unfortunately, in most situations the reserve requirement is not as clear-cut as discussed here. First, it is not easy to estimate utilization and cost distributions, so it is difficult to have much confidence in the values in Exhibit 17.1. Second, most providers have a large number of contracts with numerous payers, and what is most relevant is the chance of an overall loss rather than the probability of a loss on a particular contract. If the loss distributions on the individual contracts are not perfectly positively correlated, portfolio effects will somewhat mitigate the risks inherent in each contract. Also, under capitation, the greater the number of patients, the lower the probability of realizing profits far less than those expected.

As discussed in Chapter 2, financial withholds (risk pools) are a type of reserve. If certain financial goals are met, the withhold is distributed to providers. However, if goals are not met, the withhold is used to cover the excess costs incurred. Also, note that, of all the providers, physicians are particularly vulnerable when entering capitation contracts because historically they have not used reserves. In most cases, medical practices distribute most, if not all, of their profits each year, reinvesting only amounts absolutely necessary to fund new equipment. With this type of behavior as the historical standard, it is especially difficult for physicians to think in terms of establishing reserves.

Reserves for Incurred but Not Reported Claims

Incurred but not reported (IBNR) reserves is a financial accounting concept that recognizes that, as a result of a short period of time or “lag,” some services that have been provided have not been recorded or billed. To illustrate, consider the situation facing HealthyHMO at the end of 2019, at which time the HMO must close its books and reconcile its established risk pools. HealthyHMO uses capitation to pay for primary care services, but it uses fee-for-service reimbursement to pay for specialist services. When it closes its books, the HMO might not realize that specialist referrals made by its primary care physicians in late 2019 have not yet been billed. Indeed, some required specialist services may not have even been performed. The claims associated with referrals made in 2019 that have not yet been entered in the HMO's financial accounting system are called *IBNR claims*. Such claims (costs) must be estimated and reported as a liability in 2019 because they result from services provided (or obligated) in 2019. To make sure that IBNR claims can be met, insurers are required to set up reserves to cover them.

IBNR costs are also relevant for some providers. If a provider is capitated, yet has cost responsibility for referral services that it does not provide,

there is a strong likelihood that at the end of the year there will be payment (cost) obligations that have been incurred but not reported. Such costs must be planned for and covered, and the impact of such costs on risk pool distributions must be taken into account. There are relatively sophisticated methods of establishing IBNR reserves as well as some rather ad hoc methods, such as setting two or three months' worth of historical IBNR dollar claims aside. It is not important for you to know the details involved in setting up IBNR reserves—we will leave that task to the accountants—but it is important for you to recognize that providers bear extra risk when they are responsible for payments for services that they do not provide.

Stop-Loss Provisions (Reinsurance)

Rather than establish reserves to cover every conceivable cost situation, many providers elect to “reinsure” the risk. Such insurance is called *reinsurance* or medical *stop-loss insurance*. Note that the term *reinsurance* has traditionally been used to mean insurance bought by insurance companies from other insurance companies to limit the risk assumed by the first insurer in covering a potential loss. However, the term is also used in the health services industry when a provider seeks insurance to limit reimbursement risk.

There are two general types of stop-loss coverage: specific and aggregate. *Specific stop-loss coverage*, which is by far the most common, provides protection against losses arising from individual patients. For example, suppose a patient suffers a stroke that requires long-term hospitalization that far exceeds the average length of stay for the covered group. Specific coverage would protect the hospital against some of the losses incurred on this patient. Thus, such coverage is triggered on a case-by-case basis and can be used with any type of fixed payment contract, including capitation.

Aggregate stop-loss coverage protects against losses on the aggregate covered population—that is, losses on the entire contract. The availability of stop-loss coverage makes full-risk (capitation) contracts much more attractive to providers. In the absence of such coverage, the provider might be placed in a situation where it must assume so much risk that its own financial well-being is endangered.

An important feature of both types of reinsurance is the *threshold*, or *attachment point*, which is the loss amount the provider must realize before the stop-loss contract kicks in. For example, the attachment point for specific stop-loss coverage on a hospital's capitation contract might be \$100,000 in patient costs. However, most coverage does not require the insurer to pay all costs above the attachment point. Rather, the provider must pay a portion of the excess costs, which is called the *participation rate*. For example, the insurer may pay only 60 percent of costs above the threshold, meaning the provider must pay the remaining 40 percent. Of course, the lower the

threshold and the lower the participation rate, the higher the stop-loss coverage premium.

Sometimes stop-loss coverage specifies a *corridor* of cost amounts. For example, the insurer may pay 60 percent of costs between \$100,000 and \$500,000, after which the insurer pays full costs. There are two important features of this coverage. First, as under all stop-loss contracts, the insurer does not pay the full amount immediately after the threshold is met, so the provider still has an incentive to control costs. If the insurer were responsible for the full amount, it would have to monitor the provider to ensure that cost control did not fall by the wayside once the threshold was met. Second, the corridor creates certainty for the provider regarding the maximum per patient loss. In this example, the loss is limited to 40 percent of \$400,000, or \$160,000.

Providers typically have several means of obtaining stop-loss insurance. One way is to have the HMO withhold a portion of the capitation rate for the sole purpose of buying insurance. However, if the HMO elects to self-insure and then fails to establish adequate reserves, the provider remains at risk. An alternative is for the provider to receive the full capitation payment and then purchase stop-loss insurance directly from a company that specializes in such insurance. As another alternative, the provider can self-insure.

For a more extensive illustration of stop-loss insurance, assume that a hospital, in addition to its fee-for-service patients, has a capitated contract covering 60,000 lives that results in 2,016 admissions. The hospital can purchase stop-loss insurance with a \$30,000 attachment point and a 10 percent participation rate. Thus, the insurer pays 0 percent of costs up to \$30,000 and 90 percent of costs over \$30,000.

Exhibit 17.2 contains data relevant to the stop-loss insurance analysis. The first column contains historical per patient cost data arranged by range of costs, while the second column contains the average per patient cost within each range. The third column of historical data reports the number of admissions in each cost range. The fourth and fifth columns project the costs associated with each patient cost range for the following year. The column titled "Without SL" contains the total hospital cost projection for each range if no stop-loss insurance is purchased. The column titled "With SL" contains total projected costs if stop-loss insurance is purchased.

The only difference between the two projected cost-column amounts occurs at (and beyond) the attachment point (\$30,000). In the \$0 to \$4,999 cost range (which is below the attachment point), total costs are $535 \times \$3,288 = \$1,759,000$ with and without stop-loss protection. In the \$30,000 to \$39,999 cost range (which is above the attachment point), the hospital would incur $57 \times \$35,429 = \$2,019,000$ in costs with no stop-loss

EXHIBIT 17.2
 Stop-Loss (SL)
 Illustration

<i>Cost Range</i>	<i>Historical Data</i>		<i>Projected Costs (in thousands)</i>	
	<i>Average Cost</i>	<i>Admissions</i>	<i>Without SL</i>	<i>With SL</i>
\$0–\$4,999	\$ 3,288	535	\$ 1,759	\$ 1,759
5,000–9,999	7,255	825	5,985	5,985
10,000–14,999	12,207	273	3,333	3,333
15,000–19,999	17,283	136	2,350	2,350
20,000–24,999	22,510	101	2,274	2,274
25,000–29,999	27,300	77	2,102	2,102
30,000–39,999	35,429	57	2,019	1,740
40,000–50,000	<u>44,967</u>	<u>12</u>	<u>540</u>	<u>378</u>
Total		<u>2,016</u>	<u>\$20,362</u>	<u>\$19,921</u>
Expected savings	\$441,000			
Stop-loss premium	\$551,250			
Expected true cost	\$110,250			

protection. However, with the stop-loss insurance, the insurer would pay 90 percent of the cost above \$30,000, or $0.9 \times (\$35,429 - \$30,000) = \$4,886$ per patient, for a total cost savings of $57 \times \$4,886 = \$279,000$. Thus, the total cost for that range with insurance would be $\$2,019,000 - \$279,000 = \$1,740,000$. The result is that expected costs for the capitated population total $\$20,362,000$ without stop-loss insurance and $\$19,921,000$ with insurance, for a savings of $\$441,000$.

The insurer conducts a similar analysis to determine its expected cost and then adds a percentage markup to cover administrative fees and the appropriate profit amount for the risk assumed in writing the insurance. If we assume that the insurer's analysis is identical to the hospital's and its markup is 25 percent, the insurance premium would be $1.25 \times \$441,000 = \$551,250$.

Thus, the hospital would bear an expected **true** cost of $\$110,250$ for the stop-loss coverage, which is the $\$551,250$ premium cost less the expected cost savings of $\$441,000$. Of course, buying any type of insurance involves paying a premium to reduce the costs associated with an uncertain adverse event. Here, the adverse event is having more patients than expected with costs that exceed the $\$30,000$ threshold, or higher costs than expected for the expected number of patients. To protect itself from this risk, the hospital must pay an expected true premium of $\$110,250$. The final decision regarding the purchase of stop-loss coverage would be based on this cost plus a number of other factors, including the hospital's ability to bear the risk and the expected profitability of the capitated contract.

**SELF-TEST
QUESTIONS**

1. Why is it important for providers to establish reserves?
2. What are the three primary types of reserves?
3. What is stop-loss insurance?
4. Describe how a stop-loss insurance analysis is conducted.

Debt Portfolio Immunization

Healthcare providers, especially not-for-profit hospitals, often maintain large portfolios of securities to either fund future capital investments or maintain endowments. For most providers, a significant portion of these portfolios consists of debt securities. As we discussed in Chapter 6, debt securities carry interest rate risk, which is composed of price risk and reinvestment rate risk. *Price risk* is present because rising interest rates decrease the values of existing securities, and *reinvestment rate risk* is present because reinvested principal and interest will earn less in the future if rates are falling.

For an illustration of these risks, imagine that a hospital is planning to add a new tower in ten years and is creating a portfolio of Treasury securities to pay for the required construction and equipment. Assume that the yield curve is flat and so the interest rate on the securities, regardless of maturity, is 6 percent. Also assume that the hospital will buy securities in \$10,000 increments and that the bonds have annual coupons. If we assume that the bonds have a **ten-year maturity**, here are some possible interest rate scenarios and final values:

- **Interest rates remain at 6 percent.** If interest rates remain at 6 percent, the value of one increment would be the initial \$10,000 plus \$7,908 future value of interest payments at the end of ten years, for a total amount of \$17,908. This constant interest rate scenario is the base case, so the hospital is expecting each increment of bonds to be worth \$17,908 in ten years when it needs to pay for the new wing.
- **Interest rates drop to 4 percent immediately after purchase.** If interest rates fall and remain at the new level, the value of one increment will be only $\$10,000 + \$7,204 = \$17,204$. The reinvested coupon payments will earn less than in the base case because of the lower interest rate.
- **Interest rates rise to 8 percent immediately after purchase.** If interest rates rise and remain at the new level, the value of one increment will be $\$10,000 + \$8,692 = \$18,692$. As opposed to the previous scenario, the reinvested coupon payments will now earn more than in the base case.

Because of interest rate risk, the hospital might find after ten years that it has less savings than it expected. The shortfall would be realized if interest rates fall because the bonds have reinvestment rate risk. However, because the bonds have a ten-year maturity, the hospital will not bear price risk at maturity; the bonds will be worth \$10,000 per increment at the end of ten years, regardless of the level of interest rates.

Now, assume that the hospital invests in 30-year, rather than 10-year, Treasury securities. If we assume that they have a **30-year maturity**, here are the possible scenarios:

- **Interest rates remain at 6 percent.** If interest rates remain at 6 percent, the value of one increment would be the initial \$10,000 plus \$7,908 future value of interest payments at the end of ten years, for a total amount of \$17,908. These results are the same as with ten-year bonds because the constant interest rate holds the value of the 30-year bonds at \$10,000 per increment over their entire maturity.
- **Interest rates drop to 4 percent immediately after purchase.** If interest rates fall and remain at the new level, the value of one increment will be $\$12,718 + \$7,204 = \$19,922$. Note that the \$12,718 value per \$10,000 increment is the value of the bonds with 20 years remaining to maturity, which is the time remaining at the end of the ten-year holding period. In this scenario, the future value of the interest payments declines, but the bond will be worth more when it is sold. The net effect is an amount that is higher than the expected \$17,908.
- **Interest rates rise to 8 percent immediately after purchase.** If interest rates rise and remain at the new level, the value of one increment will be $\$8,036 + \$8,692 = \$16,728$. Although the interest payments are worth more, the value of the bonds has dropped by an even greater amount, so the total value of one increment is now less than the amount expected.

With 30-year bonds, the hospital is bearing both price risk and reinvestment rate risk. Thus, the possible shortfall is greater than it was in the case of ten-year bonds. Because the price risk is much greater than the reinvestment rate risk, the shortfall occurs when interest rates rise.

There are two ways for the hospital to create a portfolio that is riskless, or close to it—that is, a portfolio whose ending amount is known with relative certainty today. The first way is to buy *zero-coupon bonds* with a ten-year maturity. In this case, there is no reinvestment rate risk because there are no coupon payments, and there is no price risk at maturity because the maturity of the bond matches the hospital's ten-year holding period.

The second way is to **immunize** the portfolio. The term *immunize* is used because portfolio immunization frees the portfolio of interest rate risk just as a vaccination frees an individual of the risk of contracting some disease. The key to immunizing a portfolio is to buy bonds whose **duration** equals the holding period. The term *duration* cannot be defined as easily as *maturity*, but it can be thought of as the weighted average maturity of a bond when all of its cash flows are considered, including interest payments and return of principal. For zero-coupon bonds, the duration is the same as the bond's maturity. Thus, when we said that interest rate risk could be eliminated by investing in ten-year zero-coupon bonds, we were actually choosing bonds with a duration that matched the hospital's ten-year holding period. However, when bonds have coupon payments, duration is shorter than maturity, and the higher the coupon payment, the shorter the duration. (Higher coupon payments mean that, on average, the cash flows from the bond occur earlier in the bond's life.)

Duration is calculated in the following way:

1. Lay out the cash flows expected from the bond in each Year t .
2. Find the present value of each cash flow when discounted at the required rate of return on the bond.
3. Divide each present value by the bond's current value.
4. Multiply each amount from the previous step by the year in which it occurs.
5. Sum the resulting products. This sum is the bond's duration.

For an example calculation of duration, consider the ten-year, 6 percent annual coupon bonds described previously. Assume that the par value is \$10,000 and that the current required rate of return on the bond is 6 percent. Because the required rate of return equals the coupon rate, the bond's par value is also its current value. Exhibit 17.3 contains the duration calculation. As we stated previously, when a bond has coupon payments, its duration is shorter than its maturity. In this case, the duration is 7.8 years versus a maturity of 10 years.

In addition to being used for immunization, duration can be used to estimate the sensitivity of a bond to changes in interest rates. For each 1 percent change in interest rates, the value of a bond will roughly change by a percentage amount equal to its duration. Thus, if interest rates rose by 1 percentage point, the bond in Exhibit 17.3 would lose about 7.8 percent of its value, or fall to about \$9,220. The precise value is \$9,298, so the use of duration to determine the impact of interest rate changes gives us only an approximation but demonstrates that price risk is more closely related to duration than it is to maturity.

EXHIBIT 17.3**Duration
Calculation**

<i>Year (t)</i>	<i>Cash Flow</i>	<i>Present Value</i>	<i>Present Value/ Current Value</i>	<i>t × (Present Value/ Current Value)</i>
1	\$ 600	\$ 566.04	0.0566	0.0566
2	600	534.00	0.0534	0.1068
3	600	503.77	0.0504	0.1511
4	600	475.26	0.0475	0.1901
5	600	448.35	0.0448	0.2242
6	600	422.89	0.0423	0.2538
7	600	399.03	0.0399	0.2793
8	600	376.45	0.0376	0.3102
9	600	355.14	0.0355	0.3196
10	10,600	5,918.98	0.5919	5.9190
				<u>7.8017</u>

- Notes:*
1. The present value is found by discounting each cash flow back to Year 0 at the 6 percent required rate of return.
 2. The fourth column contains the present values divided by the \$10,000 current value.
 3. Values in the final column are found by multiplying each value in the fourth column by the corresponding value of t in the first column.

Healthcare managers can immunize a bond portfolio—protect it against interest rate risk—by creating a portfolio with a duration that equals the holding period. Thus, in our example, the hospital saving for a new tower would want to create a bond portfolio with a ten-year duration. For an illustration of the effects of immunization, consider a 14-year bond with a 6 percent coupon when the required rate of return is 6 percent. Its duration is 9.85 years, so it closely matches the ten-year holding period. When we change the interest rate environment as we did before, here are the results:

- **Interest rates remain at 6 percent.** If interest rates remain at 6 percent, we again have the base case situation of \$10,000 in principal amount plus \$7,908 future value of interest payments, for a total amount of \$17,908.
- **Interest rates drop to 4 percent immediately after purchase.** If interest rates fall and remain at the new level, the value of one increment will be $\$10,726 + \$7,204 = \$17,930$. Here, the future value of the interest payments declines, but the bond will be worth more when it is sold, and the two value changes just about cancel each other out.
- **Interest rates rise to 8 percent immediately after purchase.** If interest rates rise and remain at the new level, the value of one increment will be $\$9,338 + \$8,692 = \$18,030$. Although the interest payments are worth more, the value of the bond has dropped, and again the two value changes come close to offsetting one another.

With a duration roughly equal to the holding period, any gains from coupon reinvestment at a higher rate are offset by a loss of principal value, and vice versa. In effect, price risk and reinvestment rate risk are played against one another, and the resulting value at the end of ten years will be close to \$18,000, regardless of interest rate changes.

Unfortunately, life is not as easy as textbook examples. Although our example illustrates the basic concept of using duration to immunize bond portfolios, it oversimplifies the situation by involving only one interest rate change during the hospital's ten-year holding period. In reality, interest rates change on a daily basis, which causes bonds' durations to change. Because of these duration changes, real-world portfolios must be periodically *rebalanced* to remain immunized. Still, with the right software, rebalancing is not an overwhelming task; thousands of businesses rebalance their portfolios as part of their financial risk management programs.

SELF-TEST QUESTIONS

1. What are the two components of interest rate risk?
2. Why do zero-coupon bonds that match the holding period eliminate interest rate risk?
3. What is duration?
4. How is duration used to immunize debt portfolios?

An Overview of Derivatives

Derivatives are a type of security whose value is based on the value of a commodity item or other security, so its value is “derived” from the value of some other “instrument.” Because their values are derived from other instruments that have claims on real assets, derivatives are also called *indirect claims*. In contrast, stocks and bonds are *direct claims* because they have claims tied directly to the cash flows of a business. Because derivatives play an important role in financial risk management, an overview of these securities will help you understand the material to follow.

One of the first formal markets for derivatives was the *futures market* for wheat. Farmers were concerned when they planted in the spring about the price they would receive for their wheat when they sold it in the fall, and millers were concerned about the price they would have to pay. The risks faced by both parties could be reduced, or hedged, if they could establish a price earlier in the year. Accordingly, mill agents would go out to the wheat belt and contract with farmers to have grain delivered to them at a predetermined price. Both parties benefited from the transaction in the sense that their risks were reduced. The farmers could concentrate on growing their

crops without worrying about the price of grain, and the millers could concentrate on their milling operations without worrying about their input costs. In this case, hedging in the futures market reduced the price uncertainty to both parties and hence lowered aggregate risk in the economy.

These early futures dealings took place between two parties who arranged the transactions themselves. Furthermore, the *underlying asset*—which is wheat in this illustration—was delivered when the contract expired. Such a contract is called a *forward contract*, and the two parties that establish the contract are called *counterparties*. Because forward contracts require delivery, they are most useful when one of the counterparties owns the underlying asset and the other needs that asset to produce some product. A *futures contract* is similar to a forward contract, except for three key differences:

1. Futures contracts are generally standardized instruments traded on exchanges, whereas forward contracts are generally tailor made, negotiated between two counterparties, and not traded after they have been signed.
2. Futures contracts are *marked to market* on a daily basis, which means that gains and losses are noted by the exchange, and when losses exceed a preset limit, buyers must put up money to cover those losses. This process greatly reduces the risk of default that exists with forward contracts.
3. With futures, the underlying assets are virtually never physically delivered—the two counterparties simply settle up with cash for the difference between the contracted price and the actual price on the expiration date.

The formation of futures markets facilitated contract trading. The Chicago Board of Trade was an early marketplace for these dealings, and *futures dealers* helped make a market in futures contracts. Farmers could sell futures on the exchange, and millers could buy them there rather than contract directly with farmers. Thus, millers could buy wheat from any supplier at the prevailing harvest price yet lock in an effective price much earlier through futures contracts. Similarly, farmers could sell their crops to anyone at harvest and use the futures market to offset any adverse price trends that occurred during the growing season. The advent of a dealer system improved the efficiency and lowered the cost of hedging operations.

A third group of players—*speculators*—entered the scene immediately after the futures markets were established. Most derivatives, including futures, are highly leveraged, which means that a small change in the value of the underlying asset will produce a large change in the price of the derivative. This leverage appealed to speculators. At first blush, one might think that the

appearance of speculators would increase risk, but they do not. Speculators add capital and players (counterparties) to the market, which tends to create more liquidity and stabilize the market. Of course, derivatives markets are inherently volatile because of the amount of leverage involved, and hence risk to speculators is high. Still, their willingness to bear that risk makes the derivatives markets more efficient for hedging.

Natural hedges—defined as situations in which aggregate risk can be reduced by derivatives transactions between the counterparties—exist for many commodities, for foreign currencies, for interest rates on securities with different maturities, and even for common stocks on which portfolio managers want to “hedge their bets.” Natural hedges exist when futures are traded between cotton farmers and cotton mills, copper mines and copper fabricators, importers and foreign manufacturers (which hedge currency exchange rates), electric utilities and coal companies, and oil producers and oil users. In all such situations, hedging reduces aggregate risk and thus benefits the economy.

Hedging is also a possibility in situations where no natural hedge exists. One party wants to reduce some type of risk, so another party agrees to sell a contract that protects the first party from that specific event or situation. Health insurance is an obvious example of this type of hedge. Unlike natural hedges, in such asymmetrical hedges risks are generally **transferred** rather than **eliminated**. Even in this situation, however, insurance companies can reduce certain types of risk they face through diversification.

The derivatives market has grown more rapidly than has any other major market in recent years for a number of reasons. First, analytical techniques have been developed to help establish “fair” prices, and having a better basis for pricing contracts makes the counterparties more comfortable with deals. Second, computers and electronic communications greatly facilitate dealings between counterparties. Third, globalization has greatly increased the importance of currency markets and the need to reduce the exchange rate risks brought on by global trade. Recent trends and developments are sure to continue, if not accelerate, so the use of derivatives for risk management is bound to grow.

Note, though, that the use of derivatives does have a potential downside. Because these instruments are highly leveraged, small miscalculations can lead to huge losses. Also, they are complicated and hence not well understood by most people. This complexity makes mistakes more likely than with less complex instruments, and it makes it harder for a firm’s top management to exercise proper control over derivative transactions. In addition, because of the complexity and lack of reporting requirements, derivative markets and business holdings of derivatives are difficult to regulate and control by external agencies. For a historical example of the issues involved, one 28-year-old, relatively low-level employee operating in the Far East entered into derivative

transactions that led to the bankruptcy of Britain's oldest bank—Barings—which held the accounts of the Queen of England. Hundreds of other horror stories can be told, including the collapse of the credit markets in late 2008 caused by subprime mortgage derivatives.

Still, derivatives are used far more often to hedge risks than for harmful speculations, but these beneficial transactions never make the headlines. Therefore, while the horror stories point out the need for more regulation and managerial control over the personnel who deal with derivatives, they certainly do not justify the elimination of derivatives. In the balance of this chapter, we discuss some specific types of derivative securities and explain how healthcare businesses can use them for risk management.

1. What is the difference between direct and indirect claims?
2. How did derivatives come into existence?
3. What is a natural hedge? Give some examples of natural hedges.
4. What is the difference between using derivatives for hedging and using them for speculation?
5. Why are derivatives better than direct claims for speculation?
6. Is there a downside to the use of derivatives? Explain.

SELF-TEST QUESTIONS

Options

An *option* is a type of derivative that gives its holder the right to buy, or sell, an *underlying asset* at some predetermined price within a specified time frame. Healthcare managers should have some understanding of options for risk management purposes and also because of the impact of real options on the value of capital projects under consideration. (Real options are discussed in some detail in Chapter 12.)

Option Types and Markets

There are many types of options and option markets.¹ For an illustration of how options work, suppose you owned 100 shares of Midwest Healthcare, a for-profit hospital management company, which sold for \$28.50 per share on Monday, July 14, 2019. You might sell to someone else the right to buy your 100 shares at any time during the next four months at a price of, say, \$30 per share. The \$30 is called the *strike*, or *exercise price*. Such options are traded on a number of exchanges; the Chicago Board Options Exchange is the oldest and the largest. This type of option is a *call option* because the purchaser has a “call” on 100 shares of stock. The seller of an option is called the option *writer*. An investor who “writes” call options against stock held in

her portfolio is said to be selling *covered options*. Options sold without stock to back them up are called *naked options*. When the exercise price exceeds the current stock price, a call option is said to be *out of the money*. When the exercise price is below the current price of the stock, the option is *in the money*.

Suppose that the call options just described are selling for \$2.70. Thus, for \$270 an individual or business can buy the right to purchase 100 shares of Midwest stock at a price of \$30 per share at any time over the next four months.² If the stock price stays below \$30 during that period, the buyer will lose \$270, but if it rises to \$40, the \$270 investment will increase in value to $(\$40 - \$30) \times 100 = \$1,000$ in less than 120 days, which translates into a healthy annual rate of return. Incidentally, if the stock price does go up, the holder will not actually exercise the options, buy the stock, and then resell it at a higher price. Rather, the holder will merely sell the options, which will then have a value of somewhat more than \$1,000 versus the \$270 purchase price, to another options buyer or back to the original seller.

An individual or business can also buy an option that gives the holder the right to sell a stock at a specified price within some future period—this option is called a *put option*. For example, suppose someone believes Midwest's stock price is likely to decline from its current level of \$28.50 sometime during the next four months. This individual might buy a four-month put option for, say, \$150 that gives the buyer the right to sell 100 shares (which the option buyer would not necessarily own) at a price of \$25 per share (\$25 is the strike price). If the individual buys this 100-share contract and then Midwest's stock price falls to \$20, the holder can, in theory, buy a share of stock for \$20 and exercise the put option by selling it for \$25. The profit realized from exercising the option would be $(\$25 - \$20) \times 100 = \$500$. After subtracting the \$150 the buyer paid for the option, the profit (before taxes and commissions) would be \$350. As with call options, the holder would not actually exercise the put option. Rather, he would sell the put option, which would have a value of more than \$500.

In addition to options on individual stocks, options are also available on several stock indexes such as the NYSE Index and the S&P 500 Index. Index options permit someone to hedge, or bet, on a rise or fall of the general market as opposed to individual stocks. Option trading is one of the hottest financial activities in the United States. The leverage involved enables speculators with just a few dollars to make a fortune almost overnight. Also, investors with sizable portfolios can sell options against their stocks and earn the value of the options (less brokerage commissions), even if the stocks' prices remain constant. Most important, though, is that options can be used to create hedges that protect the value of an individual stock or portfolio.

Corporations on whose stocks options are written have nothing to do with the option markets. Corporations do not raise money in the option markets, nor do they have direct transactions in them. Moreover, option

holders do not vote for corporate directors or receive dividends. Numerous studies have been conducted to ascertain whether option trading stabilizes or destabilizes the stock market and whether this activity helps or hinders corporations that are trying to raise new capital. The studies have not been conclusive, but option trading is here to stay; many regard it as the most exciting game in town.

Factors That Affect the Value of a Call Option

Perhaps the best way to examine the factors that affect the value of a call option is to consider the concept of *exercise value*, which is defined as follows:

$$\text{Exercise value} = \text{Current price of the stock} - \text{Exercise (strike) price.}$$

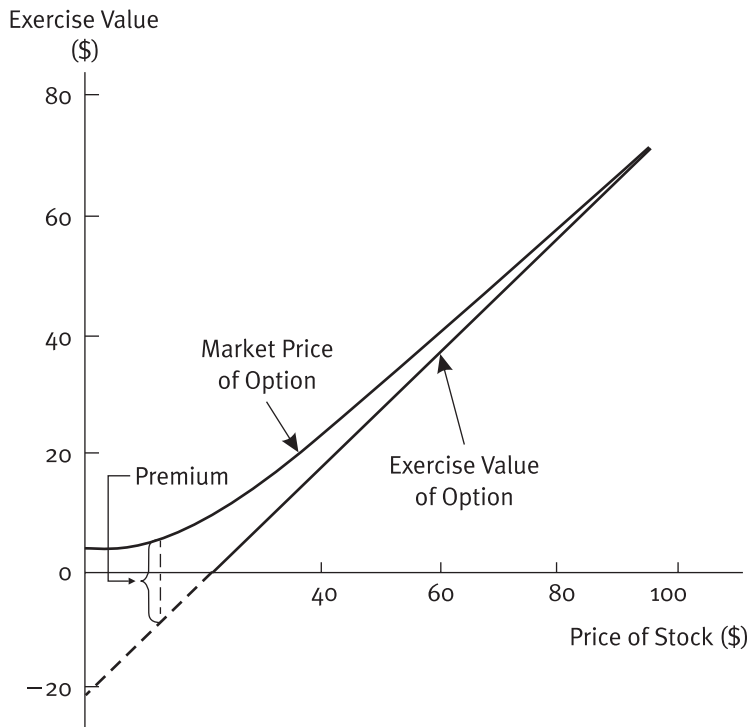
In other words, the exercise value is what the option would be worth if it were exercised immediately. For example, if a stock sells for \$50 and its option has an exercise price of \$20, you can buy the stock for \$20 by exercising the option. You would own a stock worth \$50, but you would have to pay only \$20 for it. Therefore, the option would be worth \$30 if you exercised it immediately.

Note that the calculated exercise value of a call option can be negative, but realistically the minimum true value of an option is zero because no one would exercise an out-of-the-money option. Note also that an option's exercise value is only an approximation—it merely provides a starting point for finding the actual value of the option.

Now, consider Exhibit 17.4, which contains some call option data on West Coast Genetics, Inc. (WCG), a company that recently went public and whose stock price has fluctuated widely during its short history. Column 1 in the table section contains a list of selected recent stock prices, while column 2 shows the constant \$20 strike price. Column 3 shows the exercise values for WCG's call option when the stock was selling at the listed prices, column 4 lists the actual market prices for the option, and column 5 shows the premium of the actual call option price over its exercise value. At any stock price below \$20, the exercise value is set at zero, but above \$20, each \$1 increase in the price of the stock prompts a \$1 increase in the option's exercise value. Note, however, that the actual market price of the option lies above the exercise value at each stock price, although the premium decreases as the price of the stock increases. For example, when the stock sold for \$20 and the option had a zero exercise value, its actual price, and the premium, was \$9. Then, as the price of the stock increased, the exercise value's increase matched the stock's increase dollar for dollar, but the market price of the option climbed less rapidly, causing the premium to decline. The premium was \$9 when the stock sold for \$20 a share, but it had declined to \$1 by the time the stock price had increased to \$73 a share. Beyond that point, the premium virtually disappeared.

EXHIBIT 17.4

West Coast
Genetics, Inc.:
Call Option
Data



<i>Price of Stock (1)</i>	<i>Strike Price (2)</i>	<i>Exercise Value of Option (1) - (2) = (3)</i>	<i>Market Price of Option (4)</i>	<i>Premium (4) - (3) = (5)</i>
\$20.00	\$20.00	\$ 0.00	\$ 9.00	\$9.00
21.00	20.00	1.00	9.75	8.75
22.00	20.00	2.00	10.50	8.50
35.00	20.00	15.00	21.00	6.00
42.00	20.00	22.00	26.00	4.00
50.00	20.00	30.00	32.00	2.00
73.00	20.00	53.00	54.00	1.00
98.00	20.00	78.00	78.50	0.50

Why does this pattern exist? Why should a call option ever sell for more than its exercise value, and why does the premium decline as the price of the stock increases? The answer lies in part in the speculative appeal of options—they enable buyers to gain a high degree of personal leverage when buying securities. For example, suppose WCG's option **sold for exactly its exercise value** and that you were thinking of investing in the company's common stock when it was selling for \$21 a share. If you bought a share and

the price rose to \$42, you would have made a 100 percent capital gain. However, had you bought the option at its exercise value—\$1 when the stock was selling for \$21—your capital gain would have been $\$22 - \$1 = \$21$ on a \$1 investment, or 2,100 percent! At the same time, your total loss potential on the option would be only \$1 versus a potential loss of \$21 if you purchased the stock. The huge capital gains potential, combined with the loss limitation, is clearly worth something: The exact amount it is worth to investors is the amount of the premium. Note, however, that buying the option is riskier than buying WCG's stock because there is a higher probability of losing money on the option. If WCG's stock price fell to \$20, you would realize a 4.76 percent loss if you bought the stock (ignoring transaction costs), but you would realize a 100 percent loss on the option investment.

Why does the premium fall as the price of the stock rises? Part of the answer is that both the leverage effect and the loss protection feature decline as the stock price rises. For example, if you were thinking of buying WCG's stock when its price was \$73 a share, the exercise value of the option would be \$53. If the stock price doubled to \$146, you would have a 100 percent gain on the stock, but the exercise value of the option would go from \$53 to \$126, for a percentage gain of only 138 percent versus 2,100 percent in the earlier case. Note also that the potential loss per dollar of potential gain on the option is much greater when the option is selling at high prices.

Option pricing models can be used to precisely identify the factors that affect the value of a call option, but these factors can also be discussed in a more intuitive way:³

- The higher the stock's market price in relation to the exercise price, the higher the exercise value and hence the option's value.
- The lower the exercise price, the higher the call option's value. Again, the value of a call option is based on the spread between the stock price and the exercise price (the exercise value), so a higher strike price reduces a call option's value.
- The longer the option period, the higher the option value. The longer the time before expiration, the greater the chance that the stock price will climb to a point that substantially exceeds the exercise price. Thus, option premiums, and hence values, increase as the expiration date is pushed farther into the future.
- An option on an extremely volatile stock is worth more than one on a very stable stock. If the stock price rarely moves, the chance of realizing a large gain is small. However, if the stock price is highly volatile, the option can easily become very valuable. At the same time, losses on options are limited—you can make an unlimited amount, but you can lose only what you paid for the option. Therefore, a large

decline in a stock's price does not have a corresponding bad effect on option holders. As a result of the unlimited upside but limited downside, the more volatile the stock price, the higher the premium, and hence value, of the call option.

SELF-TEST QUESTIONS

1. What is an option? A call option? A put option?
2. Define a call option's exercise value. Why is the actual market price of a call option usually greater than its exercise value?
3. What are some factors that affect a call option's value?

Futures

One of the most useful tools for reducing interest rate, exchange rate, and input risk is to hedge in the futures markets. Most financial and real-asset transactions occur in what is known as the *spot*, or *cash*, *market*, where the asset is delivered immediately or within a few days. *Futures markets* involve the purchase or sale of an asset at some future date, but at a price that is fixed today.

Futures contracts and options are similar to one another—so similar that people often confuse the two. A *futures contract* is a definite agreement on the part of one party to buy the underlying asset on a specific date and at a specific price, and the other party agrees to sell on the same terms. No matter how low or how high the price goes, the two parties must settle the contract at the agreed-on price. An option, on the other hand, gives someone the **right** to buy (call) or sell (put) an asset, but the holder of the option does not have to complete the transaction. The two types of instruments can be used for the same purposes. One is not necessarily better or worse than the other; they are simply different.

Types of Contracts

Futures contracts are available on hundreds of real and financial assets traded on numerous exchanges worldwide, the largest of which is the CME Group, which combined the Chicago Board of Trade (CBOT), the Chicago Mercantile Exchange (CME), and the New York Mercantile Exchange (NYMEX). Futures contracts are divided into two classes: (1) commodity futures and (2) financial futures.

Commodity futures—which cover oil, various grains, oilseeds, livestock, meats, fibers, metals, and wood—were first traded in the United States in the mid-1800s. *Financial futures*—which include Treasury bills, notes, bonds, certificates of deposit, Eurodollar deposits, foreign currencies, and

stock indexes—were first traded in 1975. Although commodity contracts are still important, today more trading is done in foreign exchange and interest rate futures.

When futures contracts are purchased, the buyer does not have to put up the full amount of the purchase price; rather, the purchaser is required to post an *initial margin*, which for CBOT Treasury bond contracts is \$3,000 per \$100,000 contract. The fact that the full value of the contract is not required from the counterparties to initiate the contract creates significant leverage. However, investors are required to maintain a certain value in the margin account, called a *maintenance margin*. If the value of the contract decreases, the owner may be required to add funds to the margin account, and the more the contract value falls, the more money must be added. The value of the contract is checked at the end of every working day, and margin account adjustments are made at that time. This process is called *marking to market*.

Using Futures to Hedge Interest Rate Risk

For an illustration of the use of interest rate futures to hedge (manage) risk, assume that Hospital Corporation of America (HCA) decides to build a new hospital at a cost of \$250 million. It plans to finance the project with 20-year bonds that would carry a 10 percent interest rate if they were issued today. However, the company will not need the money for about six months. HCA can go ahead and sell the 20-year bonds now, locking in the 10 percent rate, but it would have the money before it is needed, so it would have to invest the \$250 million in short-term securities that would yield significantly less than 10 percent interest that would have to be paid on the bonds. However, if HCA waits six months to sell the bond issue, interest rates might be higher than they are today, in which case the cost of financing would increase, perhaps even to the point of making the project unprofitable. One solution to HCA's dilemma is to hedge the bond issue transaction with *interest rate futures*, which are based on a hypothetical 20-year T-bond with a 6 percent semiannual coupon. If interest rates in the economy go up, the value of the hypothetical T-bond will go down, and vice versa.

Hedging involves protecting some underlying asset against adverse price trends. Because prices can go up or down, there are two basic types of futures hedges: (1) *long hedges*, in which a contract is purchased to guard against price increases, and (2) *short hedges*, in which a contract is sold to guard against price declines. In our example, HCA is worried about an increase in interest rates, which is actually a decrease in bond prices. Thus, HCA should use a short hedge; that is, it should sell T-bond futures for delivery in six months. Then, if interest rates rise, HCA will have to pay more when it issues its own bonds. However, it will make a profit on its futures position because it will have presold the hypothetical bonds at a higher price

than it will have to pay to cover (repurchase) them. Of course, if interest rates decline, HCA will lose on its futures position, but this loss will be offset by the lower interest rate HCA will pay when it issues its bonds.

If futures contracts existed on HCA's own debt, and interest rates moved identically in the spot (current) and futures markets, HCA could construct a *perfect hedge*, in which gains on the futures contract would exactly offset losses on the bonds. In reality, it is virtually impossible to construct perfect hedges because in most cases the underlying asset is not identical to the futures asset used in the hedge, and even when they are, prices and interest rates may not move exactly together in the spot and futures markets.

If HCA were publicly owned and had been planning an equity offering, and if its stock tended to move fairly closely with one of the stock indexes, the company could have hedged against falling stock prices by selling short the index future. Even better, because options on HCA's stock are traded in the option markets, it could use options—rather than futures—to hedge against falling stock prices. The general approach would be the same as that just described using the futures market.

The futures and option markets permit flexibility in the timing of financial transactions because the firm can be protected, at least partially, from changes that occur between the time a decision is reached and the time the transaction is completed. However, this protection has a cost: The firm must pay commissions. Whether the protection is worth the cost is a matter of judgment. The decision to hedge also depends on management's risk aversion as well as the company's strength and ability to assume the risk in question. In theory, the reduction in risk that results from a hedge transaction should have a value exactly equal to the cost of the hedge. Thus, a firm should be indifferent to hedging. However, many firms believe that the peace of mind is worth the cost.

Using Futures to Hedge Input Price Risk

As we noted earlier, futures markets were established for many commodities long before they began to be used for financial instruments. We can use American Dental Products (ADP), which uses large quantities of palladium for dental alloys, to illustrate input risk hedging. Suppose that, in July 2019, ADP becomes especially worried about the market price of palladium. Russia supplies about 60 percent of the world's supply, and increasing worker unrest has created concern among ADP's managers. Because ADP has many long-term fixed price contracts with buyers of dental alloys, a spike in palladium costs could easily cause significant damage to its bottom line.

ADP can go ahead and buy palladium today to meet its needs over, say, the next year, but if it does, it will incur substantial carrying costs. As an alternative, the company can hedge against increasing palladium prices in the futures market. The NYMEX trades standard palladium futures contracts of

100 troy ounces each. (A *troy ounce* is a unit of weight commonly used in metals. It is equal to 1.0977 avoirdupois [regular] ounces.) Thus, ADP can buy 100 contracts (go long) for delivery in, say, December 2019, which would lock in a price of \$637 per ounce. If palladium prices do rise appreciably over the next five months, the value of ADP's long position in palladium futures would increase, thus offsetting some of the price increase in the commodity itself. If palladium prices fall, ADP will lose money on its futures contract, but the company will be buying the metal on the spot market at a cheaper price, so it will make a higher-than-anticipated profit on its dental alloy sales. Thus, hedging in the futures market locks in the cost of ADP's raw materials and removes some of the risk to which the firm would otherwise be exposed.

1. Briefly describe the features of a futures contract.
2. How do options and futures differ?
3. How can futures contracts be used to hedge interest rate risk?
4. How can futures contracts be used to hedge input price risk?

SELF-TEST QUESTIONS

Swaps

A *swap* is just what the name implies. Two parties agree to swap something—generally obligations to make specified payment streams. Most swaps today involve either interest payments or currencies. Whereas swaps were at one time considered to be “too exotic” for healthcare providers, today swap contracts cover a significant proportion of both for-profit and not-for-profit hospitals' debt obligations. As hospitals have increased their use of short-term debt to decrease interest expense over recent years, their use of swaps to protect against rising rates has also increased.

For an example of an interest rate swap, suppose Hospital V has a 20-year, \$100 million floating (variable) rate bond outstanding, while Hospital F has a \$100 million, 20-year, fixed-rate issue outstanding. Thus, each hospital has an obligation to make a stream of interest payments, but one payment stream is fixed while the other will vary as interest rates change in the future.

Now, suppose Hospital V has stable cash flows and wants to lock in its cost of debt. On the other hand, Hospital F's cash flows fluctuate with the economy, rising when the economy is strong and falling when it is weak. Recognizing that interest rates also move up and down with the economy, Hospital F concludes that it would be better off with variable rate debt. If the companies swap their payment obligations, an *interest rate swap* occurs. Hospital V has to make fixed payments, thereby synchronizing its payments

with its stable cash inflows, and Hospital F has a floating stream, thereby reducing its risk.

Our example illustrates how swaps can reduce risk by enabling each company to match the variability of its interest payments with that of its cash flows. However, there are also situations in which swaps can reduce both the riskiness of the debt and its cost. For example, Antron Pharmaceuticals, which has a high credit rating, can issue either floating-rate debt at LIBOR + 1 percent or fixed-rate debt at 10 percent. (LIBOR stands for London Interbank Offer Rate, which is the rate charged on dollar loans between banks in the Eurodollar market—the market for US dollars traded overseas.) Bosworth Medical Instruments is less creditworthy, so its cost for floating-rate debt is LIBOR + 1.5 percent and its fixed-rate cost is 10.4 percent. Because of the nature of its operations, Antron's managers decide that the company is better off with fixed-rate debt, while Bosworth's managers prefer floating-rate debt. Paradoxically, both firms can benefit by issuing the type of debt they do not want but then swapping their payment obligations.

First, each company issues an identical amount of debt, which is called the *notional principal*. Even though Antron wants fixed-rate debt, it issues floating rate debt at LIBOR + 1 percent, and Bosworth issues fixed-rate debt at 10.4 percent. Next, the two companies swap their interest payments: Antron will make 10.4 percent fixed-rate payments to Bosworth, and Bosworth will make LIBOR + 1 percent payments to Antron.⁴

In addition, Bosworth must make an additional fixed payment—called a *side payment*—of 0.45 percent to Antron. Antron ends up making fixed payments, which it desires, but because of the swap, it pays a 9.95 percent rate versus the 10 percent rate it would have paid had it issued fixed-rate debt directly. At the same time, the swap leaves Bosworth with floating-rate debt, which it wanted, but at a rate of LIBOR + 1.45 percent versus the LIBOR + 1.50 percent it would have paid on directly issued floating-rate debt. As this example illustrates, swaps can sometimes lower the interest rate paid by each party.

As in the last illustration, swap arrangements often involve side payments. For example, if interest rates had fallen sharply since one company issued its bonds, its old interest payment obligations would be relatively high and it would have to make a side payment to induce another company to agree to a swap. Similarly, if the credit risk of one company were higher than that of the other, the stronger company would be concerned about the ability of the weaker counterparty to make the required payments. This high credit risk would also prompt the need for a side payment.

Major changes have occurred over time in the swaps market. First, standardized contracts have been developed for the most common types of swaps. These contracts have had two effects: (1) they have reduced the time and effort involved in arranging swaps and thus have reduced transaction

costs, and (2) they have created a secondary market for swaps, which has increased the liquidity and efficiency of the swaps market. A number of international banks now make markets in swaps and offer quotes on several standard types. Also, banks now take counterparty positions in swaps, so it is not necessary to find another firm with mirror-image needs before a swap transaction can be completed. The bank generally finds a final counterparty for the swap at a later date, so its positioning makes the swap market more operationally efficient.

Currency swaps, which are similar to interest rate swaps, are of significant value to businesses with overseas operations. They are structured in a manner similar to that of interest rate swaps, except that the counterparties exchange currency types rather than interest rate types. Because few health-care providers operate in foreign countries, we will not provide an illustration of a currency swap here.

1. What are swaps?
2. How can swaps be used to reduce risk? To lower borrowing costs?

SELF-TEST QUESTIONS

The Use and Misuse of Derivatives

Most of the news stories about derivatives are related to financial disasters. Much less is heard about the benefits of derivatives. However, because of these benefits, more than 90 percent of large US companies use derivatives on a regular basis. These data lead to one conclusion: If a company can safely and inexpensively hedge its financial risks, it should do so.

However, as discussed earlier, there can be a downside to the use of derivatives. Hedging is invariably cited by authorities as a “good” use of derivatives, whereas speculating with derivatives is often cited as a “bad” use. Some people and organizations can afford to bear the risks involved in speculating with derivatives, but others either are insufficiently knowledgeable about the risks they are taking or should not be taking those risks in the first place.

Kashima Oil Company and Accounting Rules

One interesting example of a derivatives debacle involves Kashima Oil Company, a business started in 1968 that imports oil for the Japanese market. The company buys oil priced in US dollars but then sells it in Japan priced in yen. Kashima began using the currency futures market to hedge its price risk, but later started to speculate on dollar–yen exchange rate movements in the hopes of increasing profits. When the currency markets moved against Kashima’s speculative position, it was able to avoid making the losses public because accounting rules at the time permitted the company to bypass reporting if the contract was rolled over (reestablished) as the expiration date approached. By the time Kashima bit the bullet and closed its position in 1994, it had lost more than \$1.5 billion. The

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company survived, but its reputation was badly tarnished. Unfortunately, this tale of woe was far too common.

Not surprisingly, in 1998 the Financial Accounting Standards Board issued new guidelines regarding the disclosure of derivative transactions and the valuation of derivative contracts. The rules require that the value of nearly all derivative contracts be reported and marked to market every quarter. In other words, a derivative position that has lost value has to be reported on the balance sheet at the new, lower value and charged against earnings on the business's income statement. Businesses must do this reporting even though the contract has not expired and may well increase in price later. Critics of the guidelines contend that they cause reported earnings to fluctuate unnecessarily and hence force managers to rethink their use of hedging strategies. Proponents contend that the new guidelines allow investors to see what derivative strategies are being used and how well they are working.

Most would agree that the typical corporation should use derivatives only to hedge risks, not to speculate in an effort to increase profits. Hedging enables managers to concentrate on running their core businesses without having to worry about interest rate, currency, and commodity price variability. However, problems can arise quickly when hedges are improperly constructed or when managers who are eager to report high returns use derivatives for speculative purposes.

Our position is that derivatives can and should be used to hedge against certain risks but that the leverage inherent in derivative contracts makes them potentially dangerous instruments. Also, health-care managers should be reasonably knowledgeable about the derivatives their firms use, should establish policies regarding when they can and cannot be used, and should establish audit procedures to ensure that the policies are actually carried

out. Moreover, a firm's derivative position should be known by the board and reported to stockholders because stockholders have a right to know the extent to which companies are using derivatives.

SELF-TEST QUESTIONS

1. How should derivatives be used in financial risk management? What problems can occur?
2. How are derivatives reported on a business's financial statements?

Key Concepts

This chapter introduces you to financial risk management. Here are its key concepts:

- In general, *financial risk management* involves the management of unpredictable events that could have adverse financial consequences for the business.

- The three steps in risk management are to (1) *identify* the risks faced by the company, (2) *estimate* the potential impacts of these risks, and (3) *decide* how each relevant risk should be handled.
- In most situations, risk exposure can be mitigated by one or more of the following techniques: (1) by *transferring the risk* to an insurance company, (2) by *transferring the function* that produces the risk to a third party, (3) by *purchasing derivative contracts*, (4) by *reducing the probability* that an adverse event will occur, (5) by *reducing the magnitude* of the loss associated with an adverse event, and (6) by totally *avoiding* the risky activity.
- *Derivatives* are securities whose values are determined by the market price of a commodity item or another security.
- A *hedge* is a transaction that lowers risk. A *natural hedge* is a transaction between two *counterparties* that reduces both parties' risks.
- *Options* are financial instruments that are (1) created by exchanges rather than by individuals or firms, (2) bought and sold primarily by investors, and (3) important to both investors and managers.
- The two primary types of options are (1) *call options*, which give the holder the right to purchase a specified asset at a given price (the *exercise*, or *strike*, *price*) for a given period, and (2) *put options*, which give the holder the right to sell an asset at a given price for a given period.
- A call option's *exercise value* is defined as the current price of the stock less the strike price.
- Under a *forward contract*, one party agrees to buy a commodity at a specific price on a specific future date and the other party agrees to make the sale, and the commodity is physically delivered.
- A *futures contract* is a standardized contract that is traded on an exchange and is *marked to market* daily, but the underlying asset is usually not delivered.
- *Financial futures* permit businesses to create hedge positions to protect themselves against fluctuating interest rates, stock prices, and exchange rates.
- *Commodity futures* can be used to hedge against input price increases.
- *Long hedges* involve buying futures contracts to guard against price increases.

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- *Short hedges* involve selling futures contracts to guard against price declines.
- A *perfect hedge* exists when the gain or loss on the hedged transaction exactly offsets the loss or gain on the underlying asset. Unfortunately, perfect hedges are difficult to create in the real world because of inherent differences in spot and future markets.
- A *swap* is an exchange of cash payment obligations. Swaps occur because the counterparties involved prefer the other party's payment stream because of risk and/or cost differentials.
- Derivatives can and should be used to hedge against certain risks, but the leverage inherent in derivative contracts makes them potentially dangerous instruments.

This chapter ends our discussion of financial risk management and concludes the text. We sincerely hope that you have found this text useful as you develop your healthcare financial management skills.

Selected Bibliography

- Freel, R., and E. A. Jordahl. 2016. "Implications of the Federal Reserve's Actions for Healthcare Borrowers." *Healthcare Financial Management* 70 (4): 104–6.
- Jordahl, E. A. 2017. "Contemplating the Case for Terminating Swaps." *Healthcare Financial Management* 71 (12): 84–85.
- Turner, R., and E. A. Jordahl. 2019. "Market Downturn Highlights Need for Integrated Approach to Risk and Resource Allocation." *Healthcare Financial Management* 73 (4): 54–56.

Selected Websites

- To learn more about the risk management function in the health services industry, see the website of the American Society for Healthcare Risk Management at www.ashrm.org.
- For more information on options and futures markets, see the following:
 - CME/CBOT/NYMEX: www.cmegroup.com

Notes

1. For an in-depth treatment of options, see Chance, D. M., R. Brooks, and S. Dhamija. 2019. *Introduction to Derivatives and Risk Management*, 10th edition. Cincinnati, Cengage.
2. The *expiration date*—the last date that the option can be exercised—is the Friday before the third Saturday of the exercise month. Also note that option contracts are generally written in 100-share multiples.
3. In addition to the four factors listed, the current level of interest rates also affects a call option's value. However, the effect is small compared to that of the factors listed. Also, for purposes of our discussion of healthcare finance, it is not necessary to discuss option pricing models, which identify the factors. For a discussion of such models, see the text referenced in note 1.
4. Such transactions generally are arranged by large money-center banks, and payments are made to the bank, which in turn pays the interest on the original loans. The bank would assume the credit risk and guarantee the payments if one of the parties were to default. For its services, the bank would receive a percentage of the payments.

Integrative Application

The Problem

(Note: This integrative application is meant to be a tutorial extension of concepts contained in the chapter rather than a problem that most students would be able to solve.)

It is now March, and the current cost of debt for Waterford Memorial Hospital (WMH) is 6 percent. WH plans to issue \$100 million in bonds (with coupons paid semiannually) in September, but there is concern that interest rates will rise over the summer. The following data pertain to futures prices on a \$100,000 T-bond having a maturity of 20 years and an interest rate of 4 percent (paid semiannually). Contracts are quoted in 32nds of 100%:

<i>Delivery Month</i>	<i>Open</i>	<i>High</i>	<i>Low</i>	<i>Settle</i>	<i>Change</i>
March	96–28	97–13	97–22	98–05	+7
June	98–03	98–03	97–13	97–25	+8
September	97–03	97–17	97–03	97–13	+8

WMH's CFO is considering using futures contracts to hedge against increasing interest rates. Specially, he wants to consider the value of a futures contract if interest rates increase by 1 percentage point between now and September.

The Analysis

The hypothetical bond in the futures contract has a semiannual coupon of 2 percent and a maturity of 20 years. At a current (closing) price of 97–13 for the September contract, a \$1,000 par value bond would have a price of 97 13/32 of par, or $97.40625 \times \$1,000 = \974.0625 . Using a financial calculator, the nominal yield on the hypothetical bond is 2.0964 percent per semiannual period or 4.1928 percent annually. (Use $N = 40$, $PMT = 20$, $FV = 1000$, $PV = -974.0625$, and solve for I .)

In this analysis, WMH would be hurt if interest rates were to rise by September, so it would use a short hedge (sell futures contracts). Because futures contracts are for \$100,000 of T-bonds, the value of one contract in 97.40625

$\times \$100,000 = \$97,406.25$ and the hospital must sell $\$50,000,000/\$97,406.25 = 513.314$, or about 513 contracts to cover the planned September bond issue. Because futures maturing in September are selling for $\$97,406.25$ per contract, the value of the hedge would be about $513 \times \$97,406.25 = \$49,969,406$. If interest rates rise by September, WMH would be able to repurchase the futures contract at a lower cost, which would help the hospital offset their loss from financing at a higher interest rate.

If interest rates increase by 1 percentage point, the required interest rate on the planned bond issue would be 7 percent. With a 6 percent coupon rate (3 percent semiannual) but a 7 percent (3.5 percent semiannual) required rate, the value of the new issue is only $\$44,661,232$. (Use $N = 40$, $PMT = 1500000$, $FV = 50000000$, $I = 3.5$, and solve for PV.) Therefore, the new bond issue would bring $\$50,000,000 - \$44,661,232 = \$5,338,768$ less than expected, which represents the cost of the increase in interest rates to the hospital.

However, the value of the futures contracts began at $\$49,969,406$. Now, if interest rates increased by 1 percentage point, the yield on the futures contract would increase to $6.2286 + 1.0000 = 7.2286$ percent, or 3.6143 percent per semiannual period. Thus, the value of each contract would fall to $\$87,111.04$ per contract. (Use $N = 40$, $PMT = 3000$, $FV = 100000$, $I = 3.6143$, and solve for PV.) With 513 contracts, the value of the futures position is $513 \times \$87,111.04 = \$44,687,962$. Because WMH sold the futures contracts for $\$49,969,406$ and would buy them back for $\$44,687,962$, the hospital would make a profit on the futures position of $\$49,969,406 - \$44,687,962 = \$5,281,444$, ignoring transaction costs. Thus, WMH gained $\$5,281,444$ on its futures position but lost $\$5,338,768$ on the bond sale, so, on net, it lost only $\$5,281,444 - \$5,338,768 = \$57,324$ rather than the full $\$5,338,768$.

Note that if futures contracts existed on WMH's own debt, and interest rates moved identically in the spot and futures markets, the hospital could construct a perfect hedge in which the gains on the futures contract would exactly offset the losses on the bonds. In this situation, because the bonds being issued had a higher interest rate than assumed in the T-bond futures contracts, the hedge was imperfect.

The Decision

After reviewing the relevant calculations, WMH decided to use the futures market to hedge against an increase in rates. Of course, if interest rates actually fell between March and September, the hospital would have lost money on the hedge, but the loss would have been offset by the fact that a lower interest rate could be set on the new bond issue. Even if rates stayed constant, the hospital

would be out the transactions costs of the futures position as well as the opportunity cost of the margin money. In essence, WH was willing to bear this cost to ensure against the probability of higher future interest rates. ■
