Representatives of the rating agencies have consistently stated that no precise formula is used to set a firm's rating—all the factors listed, plus others, are taken into account, but not in a mathematically precise manner. Statistical studies have borne out this contention, for researchers who have tried to predict bond ratings on the basis of quantitative data have had only limited success, indicating that the agencies do indeed use a good deal of subjective judgment when establishing a firm's rating.

EXHIBIT A1
Comparison of Bond Ratings

	Moody's	S&P	Yields[a]
High quality	Aaa	AAA	7.80%
	Aa	AA	8.07
Investment grade	A	A	8.26
	Baa	BBB	8.72
Junk bonds substandard	Ba	BB	9.04
	B	B	10.81
Speculative	Caa	CCC	—
	C	D	—

Note: Moody's and S&P use "modifiers" for bonds rated below AAA. S&P uses a plus and minus system; thus, A+ designates the strongest A-rated bonds, and A– the weakest. Moody's uses a 1, 2, or 3 designation, with 1 denoting the strongest and 3 the weakest; thus, within the AA category, Aa1 is the best, Aa2 is average, and Aa3 is the weakest.
[a]Yields of corporate bonds with 10-year maturities as at September 28, 1992.

EXHIBIT A2
Bond Ratings of Industrial Corporations (1987–1989 Medians)

	AAA	AA	A	BBB	BB	B	CCC
Times interest earned	12.0	9.1	5.5	3.6	2.3	1.0	.8
Long-term debt as percent of capital	12%	19%	30%	38%	51%	66%	62%

Derivative Instruments and Risk Management

Introduction to Derivative Instruments

A derivative is a financial instrument, or contract, between two parties that derives its value from some other underlying asset or underlying reference price, interest rate, or index. Common derivatives include options, forward contracts, futures contracts, and swaps. Common underlying assets include interest rates, exchange rates, commodities, stocks, stock indices, bonds, and bond indices. Derivatives are created and traded in two interlinked markets—organized exchanges at the national and regional level, and an international network of dealers and end-users in which transactions are executed privately, that is, "over the counter" (OTC).

Over recent decades, financial markets have been marked by increased volatility. As foreign exchange rates, interest rates, and commodity prices continue to experience sharp and unexpected movements, it has become increasingly important that corporations exposed to these risks be equipped to manage them effectively. Risk management, the managerial process that is used to control such price volatility, has consequently risen to the top of financial agendas. And in the hot spot are these so-called derivatives. Furthermore, as these instruments have become more readily available, their application has extended beyond traditional risk management to the more opportunistic realm of speculation. In both applications, derivatives represent powerful tools by which institutions and individuals alike can significantly affect their financial security and viability.

Derivatives are used by a variety of entities such as corporations, commercial banks, and individual and institutional investors to reduce or "lay off" various risks, including the aforementioned interest rate risk, foreign currency risk, commodity price risk, and investment risk. Exhibit 1 provides results of a survey on the uses of derivatives by chief financial officers. For example, a chief financial officer (CFO) of a company heavily exposed to foreign exchange fluctuations often exploits the foreign exchange forward market to shield the company's balance sheet from currency depreciation. Similarly, a grain producer might use a forward contract to hedge against price depreciation in, say, wheat or soybeans. Through the use of a put option, an investor can establish a limit on the potential loss on an investment. On the other end of the application spectrum, an entity can trade derivatives for purely speculative purposes. Broadly, holders of derivatives securities, as well as their counterparties, can achieve goals ranging from risk management to speculation. The derivatives themselves help allocate economic risks efficiently by transferring risks between parties such that each holds the risks it is better able or more willing to bear.

This case was prepared by Research Associate Kendall Backstrand under the supervision of Professor W. Carl Kester.

This note provides a conceptual basis for understanding the fundamental properties and applications of common derivative products that give rise to their use in financial management. Each of three major families of derivative instruments—options, forwards and futures, and swaps—is discussed in the separate sections that follow.

Options

Common Terminology

Options are derivative instruments that can be used as a means of speculation or investment as well as hedging or risk management. Options written on both financial and physical assets have been traded for many years in dealer markets. However, it was not until 1973, when the Chicago Board of Trade formed the Chicago Board Options Exchange (CBOE), that organized public markets for options began to appear. Exchanges were then established to trade options written on assets such as individual stocks, stock indices, commodities, foreign currencies, and Treasury bonds.

An option is a contract between the buyer (or holder) of the option and the seller (or writer) of the option. This contract gives the buyer of the option the *right* to buy (or sell) an asset from (to) the seller of the option. The seller, on the other hand, is *obligated* under the terms of the option contract to perform. Plainly stated, an option contract defines the rights of the buyer and the obligations of the seller. The option to buy an asset is known as a *call* option, and the option to sell an asset is known as a *put* option. An example of a call and put option written on a particular company's common stock, that of Microsoft Corporation, is provided in Table A.

The specified asset involved in the option contract is referred to as the *underlying asset* on which the option is written. The specified price at which the asset may be bought or sold in the future is known as the *exercise,* or *strike, price.* Purchasing or selling the asset in the future through the option contract is referred to as *exercising* the option, and the specified date on or before which the option may be exercised is called the *expiration date,* or *maturity date.* So-called *American*-style options are contracts that may be exercised at any time prior to maturity, whereas *European*-style options are contracts that may be exercised only at maturity.

The options on Microsoft's stock shown in Table A were American options. A holder of the call option could have purchased Microsoft's stock at $60 per share by exercising the call option on or before April 15, 1995. Likewise, a holder of the put option could have sold Microsoft's stock at $60 per share by exercising the put option on or before April 15, 1995.

Option contracts have a *market,* or *premium, value,* and an *intrinsic value.* The market value of the option is simply the price at which a buyer and seller are willing to enter into an option contract. More specifically, it is the up-front cash premiums that the buyer must pay the seller in order to claim the rights of that particular option contract. As shown in Table A, the market value of the call option on Microsoft's stock was $7.50 per option as of the end of trading on November 30, 1994. Likewise, the market value of the put option on Microsoft's stock was $2.125. Because standard option contracts are contracts to buy or sell 100 shares at a time, an investor would actually have had to pay $750.00 to buy a standard call option contract on Microsoft's stock, and $212.50 to buy a standard put contract.

TABLE A
Options Traded on Microsoft's Stock, November 30, 1994 (dollars per share)

Stock (asset) price	$64.125
Exercise price	$60
Maturity date	April 15, 1995
Call option price (premium)	$7.50
Put option price (premium)	$2.125

The intrinsic value of an option can be thought of as the price a rational investor would pay for an option if it were about to mature instantly. Because an option contract gives the holder the right to exercise but not the obligation, the intrinsic value of an option can never be less than zero. This is true because if the option is never exercised by the holder, it simply expires worthless.

If, for instance, the price of Microsoft's stock had fallen to $55 per share, the owner of the call option described in Table A would not have elected to exercise the option to buy at $60 per share. An investor wishing to own Microsoft's stock, in this case, would have been better off buying it directly on the stock exchange at $55 per share. Thus, at a stock price of $55 per share, the intrinsic value of a call option with an exercise price of $60 would have been zero, representing a worthless position for the holder of the call.

In general, the intrinsic value of a call option is always the greater of zero and the difference between the current market price of the underlying asset and the option's exercise price. In the case of a call option, this intrinsic value will be positive when the market price of the asset exceeds the exercise price of the option, and zero otherwise. At $64.125 per share, the call option on Microsoft's stock had a positive intrinsic value of $64.125 less $60, or $4.125. The call option holder could have bought Microsoft's stock for less than its actual market value. The opposite is true in the case of a put option: Sensible investors would not sell a put option's underlying asset at the put's exercise price unless that exercise price were above the asset's market value. Thus, the intrinsic value of a put option is always the greater of zero and the difference between the put's exercise price and the current market price of the underlying asset.

An option is said to be *in-the-money* when its intrinsic value is positive and *out-of-the-money* when it is zero. That is, a call option is in-the-money when its underlying asset's market price is above the exercise price; it is out-of-the-money when the opposite occurs. The converse is true for a put option: When the exercise price is above (below) the underlying asset's market price at maturity, the put is considered in-the-money (out-of-the-money). As the term suggests, an *at-the-money* option describes an option when its exercise price exactly equals the underlying asset's market price. Again using the Microsoft example, the terms described in Table A constitute an in-the-money call option and an out-of-the-money put option. If the exercise price were $64.125, or the stock price were $60, both options would be at-the-money. If the market price of an underlying asset is far above (below) the exercise price of a call (put) option, then the option is said to be *deep-in-the-money.* If the opposite is true, it is said to be *deep-out-of-the-money.* A deep-in-the-money position at maturity is the most desirable outcome for either a call or put option.

Graphical representation of an option's intrinsic value is useful to illustrate its total payoff. Payoff diagrams for both put and call options written on the same underlying asset with the same exercise price are provided in Figure I, where K = Exercise price, and P = Premium.

Determinants of Option Value

Notice in Table A that each option's market value is greater than its intrinsic value. This will always be true for options that have some time remaining before maturity. A graph of a call option's market, or premium, value relative to intrinsic value is shown in Figure II, where

K = Exercise price

FIGURE I
Payoff Diagrams

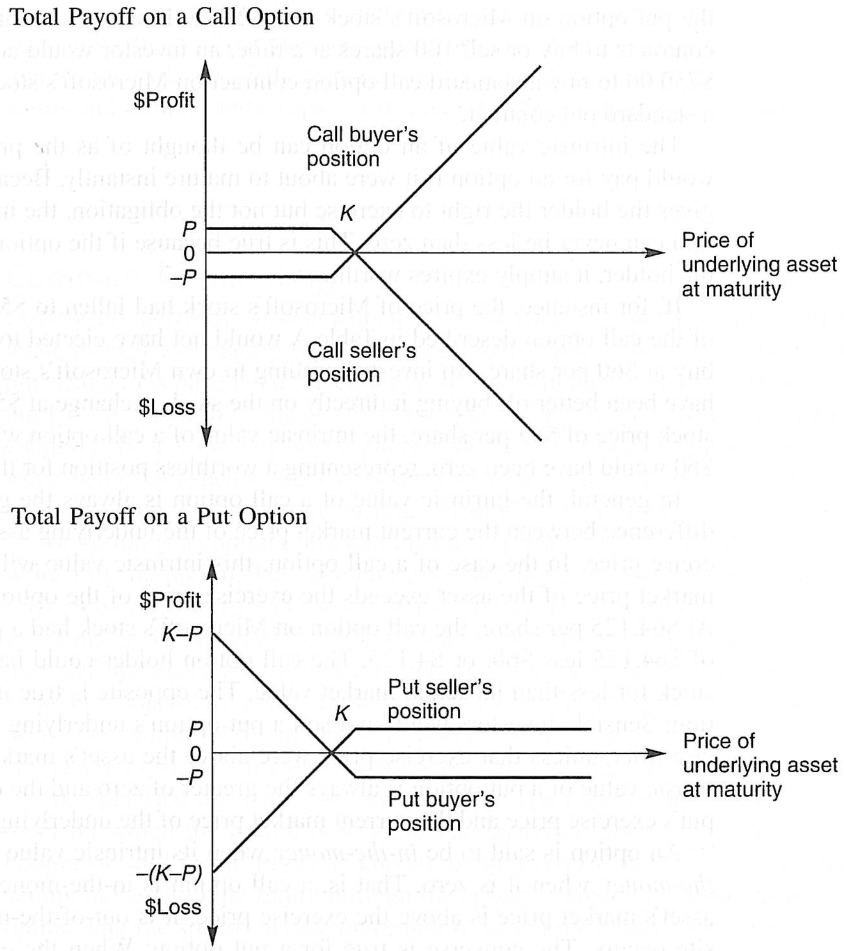
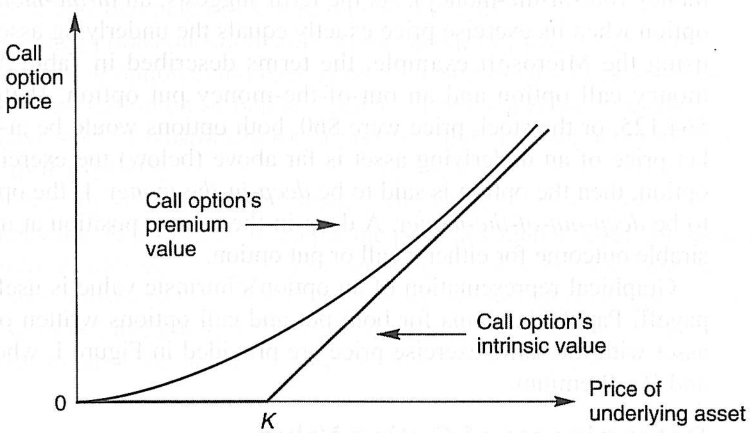


FIGURE II
Call Option Premium in Relation to Intrinsic Value



How much greater the premium value is over the intrinsic value depends on several factors. In general, for generic American-style call and put options, the premium value depends upon the following six determinants: underlying asset price, exercise price, the risk-free rate of return, volatility of the asset price, time to expiration, and expected cash distributions, if any. Their respective effects on option value are briefly described below.

Asset Price

For an American or European call option, the higher the price of the underlying asset, the greater the option's intrinsic value and the more likely it will remain above the option's exercise price at expiration. Hence, the higher the asset price, the greater will be the call option's premium, other things held constant. The opposite is true for American and European put options: the higher the value of the underlying asset, the lower the put option's intrinsic value and premium, other things held constant.

Exercise Price

An increase in a call option's exercise price *decreases* both the intrinsic value of the option and the likelihood that the option will be worth anything at maturity. Consequently, the higher an American or European call option's exercise price, the lower its premium value will be, other things held constant. Again, the opposite is true of a put option: A higher exercise price *increases* the put option's intrinsic value, other things held constant, and would be reflected in a higher premium.

Interest Rates

Because buyers of options do not pay or receive the option's exercise price until later, if ever, interest rates play a role in the determination of option premium value. Specifically, an increase in the interest rate lowers the present value of the cash exercise price expected to be paid or received in the future. For a call option, a rise in interest rates means the future cash payment of its exercise price is worth less in present value terms, implying greater option value for the holder. Hence, the value of an American or European call option increases as interest rates rise, holding other factors constant. In contrast, a rise in interest rates lowers the present value of the cash that a put option holder might receive in the future upon exercising the put. Consequently, American and European put option premiums decline as interest rates rise, other things being equal.

Volatility of the Asset Price

Other factors held constant, the more volatile the underlying asset price, the more valuable the option. Again, this is true because of the asymmetrical construct between an option's potential upside gains and downside losses (see Figure I). The holder of a call option experiences unlimited potential gains as the price of the asset increases. At the same time, however, the call option holder effectively limits loss by simply not exercising the option if the asset's price falls below the option's exercise price. The holder of a put, although only experiencing limited potential gains (the maximum gain being obtained when the asset price is zero upon maturity, implying an intrinsic value exactly equal to the option's exercise price), can also limit loss by simply not exercising the put if the asset's price rises above the put's exercise price. In short, the more volatile the asset price, the greater the chance the holder of either a put or call option has of realizing a gain without equally increasing the chance of incurring a large loss. Thus, higher expected volatility in the underlying asset's price enhances both American and European option values, other things being equal.

Time to Expiration

American and European call options increase in value when the time remaining to expiration is further away. This positive influence derives from two sources. First, in connection with the interest rate effect, the longer the time before expiration when the exercise payment will be made, the lower the discounted present value of that cash payment. Second, in connection with the volatility effect, the more time there is before expiration, the more likely it is that a large price change will occur and dramatically increase the value of the option. Consequently, so long as there is time remaining before expiration, an option's premium will exceed its intrinsic value. Provided there are no cash distributions to owners of a call option's underlying asset (see below), it follows that a call option should not be exercised before maturity, because doing so would sacrifice the value attributable to time.

American put option value is also positively affected by time to expiration. Because of the asymmetry between potential gains and losses from holding a put option, more time before expiration increases the chance that the put will mature in the money. Although the proceeds to be received from the future exercise of the put will have a lower present value as time to expiration increases, other things constant, this negative influence will not generally outweigh the positive influence associated with price volatility unless interest rates are high. When this is so, American put option holders might find it in their best interests to exercise their puts prematurely and reinvest the cash proceeds.

For European put options, the time to expiration can have either a positive or negative influence on prices depending on which of two effects dominate. When a European put is in the money, a longer time to expiration will tend to have a negative influence on premium value because the expected receipt of cash proceeds from exercising the put is farther in the future. However, if the European put is deep-out-of-the-money, a long time to expiration will tend to enhance option value. This is because more time provides a greater opportunity for the stock price to drop far enough to make the put valuable at expiration. Of course, the stock price could rise as well, but as in the case of call options, losses on the downside can be limited by simply not exercising the put.

Cash Distributions

Some assets, notably many common stocks, have cash distributions associated with them. A cash dividend paid on an underlying stock decreases the value of a call option, other things held constant. The reason is that cash dividends reduce the market price of the stock on the day the stock goes *ex dividend* (i.e., begins to trade without rights to any cash dividends previously declared on the stock; shareholders of record just prior to the ex dividend date are entitled to the cash dividends, but holders of call options on that stock are not). As the price of a stock declines when it goes ex dividend, so too will the value of a call option on the stock, other things remaining constant. The opposite is true for a put option: the holder of the put option, as well as the owner of the stock, benefit from cash dividends in that the stock owner receives a cash payout and the put holder obtains increased option value when the stock's price declines upon going ex dividend.

A summary of the effect each of the preceding factors has on American option value is illustrated in Table B.

TABLE B
Summary of Factors Determining American Option Value[a]

	Call Option	Put Option
Asset price	+	−
Exercise price	−	+
Interest rates	+	−
Volatility of the asset price	+	+
Time to maturity	+	+[b]
Cash distributions	−	+

[a]The + and − signs indicate the nature of the effect each factor has on the value of the option.
[b]As discussed above, time to maturity could have either a positive or negative influence on European put option value.

Put-Call Parity

Consider again the Microsoft put and call options described in Table A. Notice that, in addition to being written on the same stock, these options had identical exercise prices and maturity dates. Given their similar characteristics, it seems logical that the market values of the call and put would have been related to one another in a predictable way. That is, as the price of Microsoft's stock changed, the prices of the options should also have changed, but in such a way that an astute investor could not have bought one and sold another so as to lock in a visually riskless profit. Should such an *arbitrage* opportunity develop, the very act of exploiting it ought to set buy and sell transactions in motion that will ultimately ensure a kind of parity between put and call prices.

This is, in fact, the case. A condition known as *put-call parity* describes the relationship that a put and call option written on the same stock with the same exercise price and maturity date must sustain if there are to be no riskless arbitrage opportunities.[1] Specifically, put-call parity states that the difference in price between a call option and a put option with the same terms should equal the price of the underlying asset less the present discounted value of the exercise price. This relationship can be described as follows:

$$V_c - V_p = P_a - X$$

where

V_c = the price of a call option
V_p = the price of a put option
P_a = the price of the underlying asset
X = present discounted value of the underlying asset's exercise price

Another way to interpret this relationship is to say that someone owning a call option while having simultaneously written (sold) a comparable put option on the same asset should, at all times, be in a position equivalent to someone who purchased the underlying asset with a pure-discount (i.e., zero-coupon) loan having a face value equal to the option's exercise price and maturing at the option's expiration date. The value of these two options must be equal because each investor would realize identical payoffs at the time of maturity. You can demonstrate this to yourself by constructing payoff diagrams such as those shown in Figure I for each of these two positions. As you will observe, the payoff in both cases is equivalent to owning stock purchased on "margin" (that is, purchased partly with borrowed proceeds).

Consider what could be done if this relationship were not true. For illustrative purposes, assume that the options on Microsoft's stock shown in Table A were European options. Suppose further that the call option on Microsoft's stock shown in Table A actually sold for \$8.50 instead of \$7.50. At the time, short-term interest rates were about 6% annually (equivalent to a compound daily rate of 1.6 basis points, or 0.016%). Under these conditions, strict put-call parity would *not* have held:

$$(\$8.50 - \$2.125) > (\$64.125 - \$58.709)$$
$$\$6.375 > \$5.414$$

where

\$8.50 = assumed market value of the call option
\$2.125 = market value of the put option
\$64.125 = market value of Microsoft's stock
\$58.709 = current value of a pure-discount loan maturing on April 15 at a value of 60

[1]Strictly speaking, put-call parity as described above applies only to European options because, unlike American options, they cannot be exercised prior to the expiration date.

Upon observing such a discrepancy, an astute trader would have executed the following transactions:

November 30, 1994	Per Share Cash Proceeds
1. Write (sell) a call option on Microsoft's stock	$8.50
2. Buy a put option on Microsoft's stock	(2.125)
3. Borrow $58.709 at a daily compound rate of interest of 0.016%	58.709
4. Purchase Microsoft's stock at $64.125	(64.125)
Net proceeds	$0.959

April 15, 1995	
a. If Microsoft's stock was worth more than $60 per share, then:	
1. Deliver the stock to the call option owner	—
2. Receive $60 from the call option owner	$60.00
3. Use the proceeds from the exercise of the call option to repay the loan	(60.00)
Net proceeds	$0.00
b. If Microsoft's stock was worth less than $60 per share, then:	
1. Exercise the put by delivering the stock to the put writer	—
2. Receive $60 from the put writer	$60.00
3. Use the proceeds from exercising the put to repay the loan	(60.00)
Net proceeds	$0.00

Notice that regardless of what happened to the price of Microsoft's stock, the trader would have received $60 on April 15, 1995, which is exactly sufficient to repay the loan with interest. Thus, the residual net proceeds of $0.959 per share from the November 30, 1994, transactions represent an immediate, riskless profit involving no commitment of the trader's own capital. Notice too that such an arbitrage profit would have been virtually immaterial at the call option's actual price of $7.50. If call or put option prices deviated substantially from levels dictated by the put-call parity relationship, transactions similar to those described above would drive prices up or down until the arbitrage opportunity was eliminated.

Applications

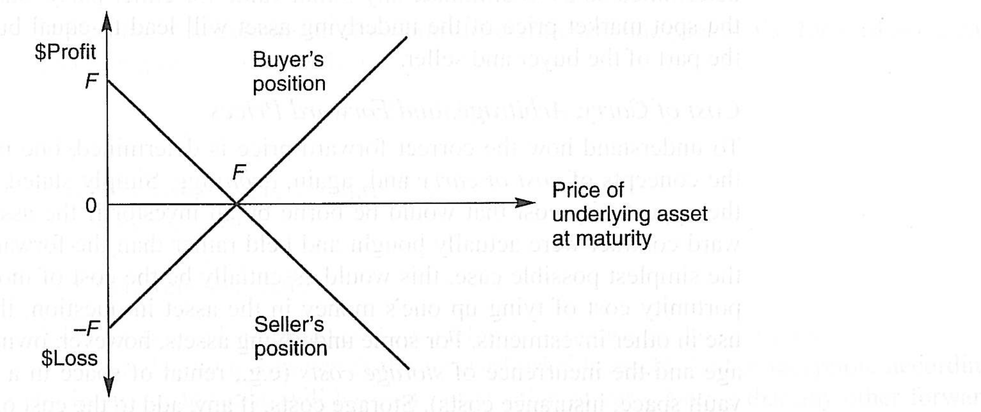
Options can be used to insure against various risks as well as to bet on various market movements. Risk management, or insurance, is often achieved through, for example, the purchase of put options. Assume a company expects to receive some foreign currency and is concerned that the currency will depreciate against its home currency. To limit its losses, the company might elect to purchase an at-the-money put option written on the exposed currency. Buying such a put option would, in effect, limit the company's loss associated with currency depreciation to the amount of the put premium. In effect, by buying a put option, the company buys insurance against currency depreciation. The cost of this insurance is the put premium. By insuring against loss in this way, however, the company also gives up some of the potential gains it might realize from currency appreciation in that it must pay a cash premium to buy the put.

Speculative positions can also be achieved by using options. A directional position is taken when a company or individual uses options to bet on a belief that the underlying asset price will move in one particular direction. If an entity believes that the British pound will appreciate, for example, then it could buy a call option written on the pound (i.e., go "long" British pounds). Because the currency could easily move in the "wrong" direction, (i.e., contrary to one's prior beliefs), buying currency call options does not secure a profit, nor does this transaction cover an already exposed position. But still, because of the inherent asymmetry of potential upside gains and downside losses, the holder stands to gain quite a bit, while potentially losing only the amount of the premium paid for the call option. This would be a more powerful way to speculate on the pound's movement than simply buying the currency in the spot market because, for a given amount of dollars, considerably more currency can be controlled through the purchase of relatively inexpensive option contracts than can be done by buying pounds outright on the spot foreign exchange market (a standard option contract on British pounds would provide an investor with a call option on £62,500 for a price in the vicinity of $1500; the same amount of currency might cost $95,000 to $100,000 on the spot market).

Forwards and Futures

Forwards and futures, like options, are derivative securities that can be used as a means of hedging or risk management, as well as to speculate. Predating any other derivative instrument, the privately traded forward contract serves as the foundation for its more standardized exchange-traded variant, the futures contract. While these two contracts are viewed and traded quite differently, they both operate under the same essential framework. Specifically, both the forward and the futures contract are defined by an obligation of the buyer and the seller both to perform under the specified terms of the contract. In this respect, forward and futures contracts differ fundamentally from option contracts. Because options give the owner the right but not the obligation to exercise the option, option contracts provide owners with asymmetric payoff patterns that are well suited to insuring against loss under certain circumstances. Because forwards and futures provide an obligation to transact at a prespecified future price, they are better suited for true "hedging" activities in which transacting parties wish to lock in future prices without risk. Figure III provides a payoff diagram of a generic forward contract to illustrate and distinguish these particular forms of derivative securities from options. (Note that F = Forward price.)

FIGURE III
Total Payoff on a Forward Contract



Forward Contracts

In contrast to exchange-traded derivatives, forward contracts are not standardized products. Instead, forward contracts are OTC derivatives that can be tailored to meet specific user needs. The underlying assets of these contracts include traditional agricultural or physical commodities, currencies (referred to as foreign exchange forwards), and interest rates (referred to as forward rate agreements or FRAs). A forward transaction typically involves a contract, most often with a bank, under which both the buyer (or holder) of the contract and the seller (or writer) of the contract are obligated to execute a transaction at a prespecified price on a prespecified date. That is, the seller is *obligated* to deliver a specified asset to the buyer on a specified date in the future. Likewise, the buyer is *obligated* to pay the seller a specified price (the forward price) upon delivery. If, at maturity, the actual spot market price is higher than the forward contract's exercise price, the contract holder makes a profit and the seller suffers a loss; if the spot price is lower, the contract seller makes a profit and the buyer suffers a loss. In any event, one party's gain is the other party's loss.

Normally, a forward contract's exercise price is fixed at inception at a level that makes the contract's value zero in the eyes of both the buyer and the seller. That is, ignoring risk aversion, both sides of the transaction would be roughly indifferent between entering into the contract at the specified exercise price or remaining unhedged. However, as the value of the underlying asset changes throughout the life of the contract, the value of the forward contract as seen by the buyer and the seller also changes. Specifically, the value changes for the benefit of one party and at the expense of the other. This property of the forward contract makes it a "zero-sum game" for the buyer and the seller.

To illustrate this zero-sum characteristic, consider a forward contract written on some specified asset with a forward exercise price for the asset of \$50. Now imagine how a sudden upswing in the asset's price to \$55 will affect both parties' views of the value of the contract. The party on the sell side of the forward contract views the contract to have lost value because the price at which he or she is obligated to sell the asset (\$50) is now below that which could be received in the spot market (\$55). In contrast, the party on the buy side of the contract sees this change as positive because, as the spot price of the asset increases, there is a better chance that the forward exercise price will be below the prevailing spot market price in the future when the forward contract matures and the asset is to be delivered. If this market condition persists until the specified delivery date, the seller's loss of \$5 (\$55–\$50) equals the buyer's gain.

To summarize, both the buyer and the seller of a forward contract view their positions as having zero initial value. The agreed-upon forward price for the underlying asset is the contract price that fulfills this initial condition: that is, the forward price is determined so as to eliminate any initial value for either party. Subsequent changes in the spot market price of the underlying asset will lead to equal but opposite gains on the part of the buyer and seller.

Cost of Carry, Arbitrage, and Forward Prices

To understand how the correct forward price is determined, one must first appreciate the concepts of *cost of carry* and, again, *arbitrage.* Simply stated, the cost of carry is the opportunity cost that would be borne by an investor if the asset underlying a forward contract were actually bought and held rather than the forward contract itself. In the simplest possible case, this would essentially be the cost of money; that is, the opportunity cost of tying up one's money in the asset in question, thereby foregoing its use in other investments. For some underlying assets, however, ownership requires storage and the incurrence of *storage costs* (e.g., rental of space in a grain silo, rental of vault space, insurance costs). Storage costs, if any, add to the cost of carry.

Offsetting some of the cost of carry are cash payouts on the underlying asset (e.g., cash interest payments on debt securities or cash dividend payments on shares of stock) and so-called *convenience yields.* A convenience yield is the value that might be associated with actually owning, and therefore being able to use, the asset in question rather than simply having a future claim on that asset. A manufacturer that uses a lot of copper, for example, might wish to own a fairly sizable inventory of copper to assure that shortages are not experienced as demand for output fluctuates. Likewise, heavy users of fuel oil will often prefer to own oil itself rather than oil futures to safeguard against unanticipated interruptions in supply.

Consider now an asset such as gold, which provides no cash payouts, and capital market conditions in which the 1-year yield on Treasury bills is 10%. For simplicity, assume further that under current market conditions, the convenience yield on gold equals storage costs. Under these simplified conditions, the cost of carry on gold is simply the cost of money. If someone were to purchase gold with cash in the spot market for \$375 per ounce and hold it for a year, money would be tied up for a year, thereby imposing an opportunity cost on the investors of 10%, or \$37.50—resulting in a total cost of \$412.50 per ounce of gold by the time it is used or sold 1 year later.

This opportunity cost could be avoided if the investor elected instead to enter into a forward contract that would oblige him or her to pay cash for gold a year later, but not before. What would be a fair price to agree to pay 1 year later? In principle, the investor should be happy to pay any price less than or equal to \$412.50, for at such prices, the investor should be no worse off, and possibly better off, than buying gold and holding it for a year. Similarly, the party writing the forward contract should be happy to sell the contract at any price equal to or greater than \$412.50, for such prices would permit the writer to buy and hold gold for a year, thus eliminating the risk of future price changes in the spot market, while also at least covering his or her cost of carry. The interests of both the buyer and the seller can be met at their mutual breakeven price of \$412.50 = \$375 × (1 + .10).

This pricing equilibrium implies the following simple formula for determining the forward price of an asset:

$$F_n = S(1 + c)^n$$

where

F_n = the forward price of an asset n years into the future
S = the current spot price for the asset
c = the annual cost of carry, expressed as a fraction of the asset's spot price (e.g., .01, .05, etc.)
n = years to maturity

Because c is composed of several different costs and yields, the forward price can also be expressed more fully as

$$F = S(1 + r_f + s - i - v)^n$$

where

r_f = the riskless rate of return
s = storage costs
i = cash yield
v = convenience yield

All are expressed as annual costs or yields as a fraction of the spot price.

Forward contracts in which the forward price is established at inception, according to the above formula, will have an initial value of zero. Notice that any other forward price would lead to a potential arbitrage opportunity. Suppose, for example, that a forward contract on gold such as that described above was struck at a below-market forward price of $400 per ounce. This being the case, and assuming ample supplies of gold in storage, arbitrageurs could lock in a riskless profit by simultaneously buying that which is relatively "cheap" (gold in the forward market) and selling that which is relatively "expensive" (gold in the spot market).

Specifically, an arbitrageur would:

	Per Ounce Cash Proceeds
1. Borrow some gold and sell it (i.e., "short" gold)	$375.00
2. Invest the proceeds of the sale for 1 year at 10%	(375.00)
3. Enter into a 1-year forward contract to purchase gold at $400.00/oz.	—
Net proceeds	$0.00

One year later, the same arbitrageur would:

	Per Ounce Cash Proceeds
1. Collect the proceeds from the 1-year investment	$412.50
2. Use the proceeds to execute the forward agreement to buy gold at $400/oz.	(400.00)
3. Deliver the gold to the party from whom it was originally borrowed	—
Net proceeds	$12.50

In effect, market arbitrageurs would make a riskless profit of $12.50 per ounce of gold on zero net investment. This arbitrage opportunity arises because the forward price is too low given the current spot price and the cost of carry. To eliminate this arbitrage opportunity, forward and/or spot prices for gold must adjust until the forward price formula shown above is satisfied.

Notice that if a forward contract's underlying asset does not have a significant cash payout relative to the cost of money, and/or if storage costs significantly exceed convenience yields, the cost of carry will be positive and the current forward price will be greater than the spot price. This premium of the forward price over the spot price is known as *contango.* Typical examples of assets with low or no cash payouts are stock indices and foreign exchange.[2] The opposite will be true if there are large cash payouts or when the convenience yield is especially high (a common occurrence for many commodities when supply conditions in the spot market become quite tight). Under these conditions, the forward price will be below the spot price, a condition known as *backwardation.* Notice too that, regardless of how high or low the forward price is relative to the spot price at the time the forward contract is established, the forward price eventually converges with the spot price as the time to delivery shortens to zero. This is because the cost of carry in an asset necessarily becomes less as the time to delivery approaches.

[2]In the particular case of foreign exchange, the forward price must take account of two interest rates because two currencies are involved. "Shorting" one currency implies borrowing it at prevailing interest rates in that currency, while investment in the other currency will take place at that other currency's prevailing interest rates. The formula for determining the forward exchange rate between a domestic currency *(d)* and a foreign currency *(f)* is as follows:

$$F = S \times (1 + R^d)/(1 + R^f)$$

where

F = forward rate of exchange, expressed as units of domestic currency per unit of foreign

S = spot market rate of exchange, expressed as units of domestic currency per units of foreign

R^d = domestic interest rate

R^f = foreign interest rate

Futures Contracts

Futures contracts, unlike forwards, trade on organized exchanges. They are traded in three primary areas: agricultural commodities, metals and petroleum, and financial assets. While commodity futures have been traded since the 1860s, financial futures were first traded in 1972 with the advent of the foreign currency future. Since then, financial futures have been established for various debt instruments, stock market indices, and foreign currencies.

The basic form of the futures contract mirrors that of the forward contract: Both parties are obligated under the terms of the contract to deliver a specified asset or pay the specified price of the asset on the contract maturity date. In addition, the futures contract entails the following two obligations, both of which help to minimize the default (or credit) risk inherent in forward contracts.

1. The value of the futures contract is "settled" (i.e., paid or received) at the end of each trading day. In the language of the futures markets, the futures contract is *cash settled,* or *marked-to-market,* daily. The marked-to-market provision effectively reduces the performance period of the contract to a day, thereby minimizing the risk of default.
2. Both buyers and sellers are required to post a performance bond called *margin.* At the end of each trading day, gains and losses are added to and taken away from the margin account, respectively. The margin account must remain above an agreed-upon minimum or the account will be closed. The margin provision prevents the depletion of accounts, which, in turn, largely eliminates the risk of default.

With these additional features in mind, a futures contract can be thought of as a connected series of 1-day forward contracts in which the forwards are settled and restruck daily until the specified maturity date. By definition, a futures contract is an agreement between the seller of the contract and the buyer of the contract in which the seller is obligated to deliver a specified asset to the buyer on a specified date in the future and the buyer is obligated to pay the seller the then prevailing futures price upon delivery. The nature of marked-to-market defines the "then prevailing futures price" simply as the then prevailing spot price. Therefore, upon final settlement of a futures contract that has reached maturity, the only profit and loss incurred is that associated with the last day's market movement.

Applications

The two generic uses for forwards and futures are speculation and hedging. As an example of forward market speculation assume an investor expects the dollar price of the Japanese yen to fall dramatically over the next 90 days. Foreign currency markets allow such an investor to bet on his or her expectations. First, the investor sells yen forward at the prevailing forward spot rate. After 90 days, assuming the yen depreciated as expected, the investor then purchases yen in the spot market for delivery on the forward contract. If all goes well, the forward price at which the investor sells yen will exceed the future spot price at which he or she buys, and a profit will result from the difference. Of course, if the opposite is true and the yen strengthens against the dollar, the investor will lose the difference between the future spot rate and the forward price.

Hedging, unlike speculation, is a tactic used to avoid or limit risk. Forward and futures contracts are commonly used for this purpose. For example, assume an investor will hold some specified asset for 1 year and is fearful of price depreciation over the holding period. To hedge against price depreciation by locking in a known value today, the investor could sell a forward contract written on the asset; that is, he could sell the asset forward, just as the investor in the previous speculation example sold the yen forward. In doing so, the investor covers his or her "long" position in the asset with a "short" position (the forward sale). Losses that might occur on the long position will be offset by gains on the short position, and vice versa. In this way, uncertainty about the future market value of the asset in question can be eliminated.

Swaps

A swap is any agreement to a future exchange of one asset for another, one liability for another, or more specifically, one stream of cash flows for another. The most common swaps include currency swaps, in which one currency is exchanged for another at prespecified terms on one or more prespecified future dates, and interest rate swaps, in which one type of interest payment (e.g., interest payments that float with LIBOR[3]) is exchanged for another (e.g., fixed interest payments) at one or more prespecified future dates. Like other derivative securities, these swaps (as well as more sophisticated swaps not addressed in this note) are used by various entities such as corporations, banks, and investors to hedge risk or to speculate, in the expectation of making a profit. As a tool of risk management, swaps offer considerable flexibility and cost savings to their users. The boom in swaps transactions since the early 1980s is testament to the growing demand for flexible and standardized risk management products.

Although its origins can be traced back to the 1970s, the swap market did not publicly exist until 1981 when currency swaps were first introduced. U.S. interest rate swaps followed in 1982 as rising interest rate volatility necessitated a flexible means by which companies with floating interest rate exposures could hedge such risk. As swap markets grew, swaps became common adjuncts to financings, particularly cross-border financings, as a way to help companies lower their funding costs. They did so by enabling companies to source capital in whatever market or currency it was found to be cheapest (e.g., floating-rate Swiss francs), and then to convert the resulting liability into whatever form made most sense (e.g., fixed-rate dollars). Today it is a common practice of major borrowers to analyze funding opportunities in light of relative pricings for new debt issues and swaps across global markets.

Like a forward or futures contract, a swap is a private agreement between two parties in which both parties are *obligated* to exchange some specified cash flows at periodic intervals for a fixed period of time. In contrast to a forward or futures contract, a swap agreement generally involves multiple future points of exchange. The cash flows of a swap may be fixed in advance, or adjusted for each settlement date by reference to some specified interest rate, such as LIBOR, or other market yield. Although it is convenient to describe swaps as involving an outright exchange of cash flows at the so-called *settlement dates,* in practice, it is generally the case that a *difference check* is simply paid by whichever party in the swap is obligated to pay more cash than is to be received at that settlement date. For example, consider a fixed-for-floating interest rate swap agreement that requires one party to pay a fixed rate of interest of 9% a year on $100 million of principal in exchange for receiving from a counterparty interest equal to LIBOR plus

[3]LIBOR stands for the London Interbank Offered Rate. It is the interest rate offered by banks for dollar deposits in the London market. It is frequently used as a base interest rate for dollar loans.

½% on $100 million. If, at the first settlement date, LIBOR is equal to 7.5%, the party paying a fixed rate would owe the floating-rate counterparty a net payment of $1 million: [.09 – (.075 + .005)] × $100 million. If, at the next settlement date, LIBOR had risen to 9%, the fixed-rate party would receive a net cash payment of $.5 million from the floating rate counterparty: [.09 – (.09 + .005)] × $100 million. All of these settlements would be carried out by a financial intermediary such as an investment or commercial bank.

Also, like forward or futures contracts, swaps are priced so as to have zero value at inception. As interest rates or exchange rates change, the swap agreement then takes on positive value for whichever party becomes a net recipient of cash, and negative value for the counterparty that is the net payer of cash. In a sense, a swap agreement can be thought of as a prepackaged bundle of forward contracts, and its cash flows can be decomposed into the equivalent cash flows of these individual forward contracts.

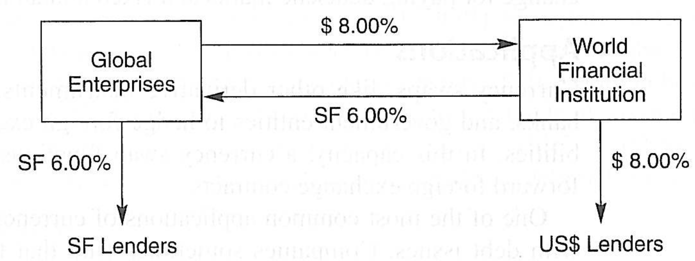
Currency Swaps

In its simplest form, a currency swap is an agreement between two parties to exchange a given amount of one currency for another and to repay these currencies with interest in the future. As an example, consider one party, Global Enterprises, Inc. (Global) that has borrowed 200 million Swiss francs (SF) at 6% and wishes to transform this liability into dollars. At the same time, the World Financial Institution (WFI), which actively manages the currency mix of its debt portfolio in light of changing economic conditions, wishes to convert a $100 million obligation bearing 8% interest into a Swiss franc liability. Both companies' obligations have a 4-year maturity and are rated AAA. The prevailing spot exchange rate between the Swiss franc and the U.S. dollar is SF 2.00/$1.

Given these "matching," or opposite, hedging needs, a mutually satisfactory swap could be arranged in which Global agrees to pay 8% dollar interest to WFI for 4 years plus $100 million at maturity, and WFI agrees to pay Global 6% Swiss franc interest for 4 years plus SF 200 million at maturity. In this way, each borrower would have its debt service to its respective lender exactly covered, and each would be left with a payment stream in the currency of its choice. Figure IV illustrates this arrangement and the cash flows entailed.

FIGURE IV
FX Swap Illustration

Swap Diagram



Swap Cash Flow Diagram (millions)

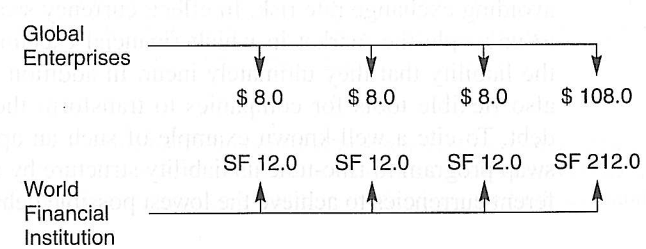


TABLE C
Selected Swap Rates, December 16, 1985[a]

	3 Years		5 Years	
	Pay	Receive	Pay	Receive
U.S. dollars	8.79%	8.97%	9.42%	9.58%
British sterling	11.49	11.70	11.45	11.66
Japanese yen	7.12	7.28	7.02	7.17
Swiss francs	5.10	5.35	5.35	5.60
Deutsche marks	5.80	6.10	6.45	6.75

[a]All quotes are fixed annual rates against six-month dollar LIBOR, and quoted from the swap dealer's perspective. That is, the bank is willing to pay British sterling at a fixed annual rate of 11.49% in exchange for receiving six-month dollar LIBOR, and to receive British sterling at a fixed annual rate of 11.70% in exchange for paying six-month dollar LIBOR.

In practice, one party in a swap agreement seldom makes payments directly to the counterparty. When parties to a swap are matched directly, a financial institution usually intermediates the agreement, guaranteeing each party that payments in the needed currency will continue uninterrupted even if the counterparty defaults. The intermediary is paid a fee for acting as guarantor.

The most common swap arrangement is one in which the intermediary itself acts as the swap counterparty to its corporate clients. Major international banks make a market in currency swaps by quoting bid and offer rates for payments in various currencies for various maturities. The bid rate and the offer rate are the fixed rates of return in a specified currency that a bank is willing to pay a corporate client in exchange for receiving six-month dollar LIBOR, or to receive from a corporate client in exchange for paying six-month dollar LIBOR. For example, foreign currency swap rates being quoted by Morgan Guaranty, Ltd. in London on December 16, 1985, are shown in Table C.

The bank earns a profit on swap transactions by realizing the spread between its bid and offer rates on six-month dollar LIBOR. Notice that by relating any two quotes to dollar LIBOR, fixed swap rates can be quoted between any two currencies. For instance, using the quotes in Table C, the bank would be willing to pay yen for 3 years at a fixed annual rate of 7.12% in exchange for receiving deutsche marks for 3 years at a fixed annual rate of 6.10%, and to receive yen at a fixed annual rate of 7.28% in exchange for paying deutsche marks at a fixed annual rate of 5.80%.

Applications

Currency swaps, like other derivative instruments, are often used by corporations, banks, and government entities to hedge foreign exchange risk on both assets and liabilities. In this capacity, a currency swap functions much like a series of long-dated forward foreign exchange contracts.

One of the most common applications of currency swaps is their use in conjunction with debt issues. Companies sometimes find that they can source capital especially cheaply by selling debt denominated in a foreign currency. At the same time, however, they may wish to avoid the exchange rate risk associated with such foreign currency debt. A currency swap allows such companies to capture the low-cost capital while avoiding exchange rate risk. In effect, currency swaps allow corporate financial officers to uncouple the market in which financial execution takes place from the currency of the liability that they ultimately incur. In addition to transforming new debt, swaps are also flexible tools for companies to transform the currency denomination of existing debt. To cite a well-known example of such an application, the World Bank pursues a swap program to fine-tune its liability structure by actively swapping into and out of different currencies to achieve the lowest possible debt costs.

TABLE D
Interest Rate Swap Quotes[a]

Years	Bid	Offer
3	8.79%	8.97%
5	9.21	9.36
7	9.48	9.63

[a]Rates are quoted from the bank's perspective. Thus, the bank is willing to pay a fixed rate of interest of 8.79% in exchange for receiving six-month LIBOR for 3 years, and to receive 8.97% in exchange for paying six-month LIBOR for 3 years.

Interest Rate Swaps

An interest rate swap is a derivative transaction in which an asset or liability with a floating rate of interest can be converted into a fixed-rate instrument, or vice versa. Like a currency swap, an interest rate swap is a counterparty transaction in which the respective positions of two counterparties with equal but opposite needs are exchanged.

Principal payments are not exchanged in interest rate swaps. This is because the dollar value of the principal remains the same throughout the contract for both the fixed-rate asset or liability and the floating-rate asset or liability. The agreed "notional" principal is only used as a basis for calculating the fixed- and floating-rate payment streams. These payments are made, or more commonly netted by the use of a difference check, on specified periodic settlement dates. While the fixed rate of interest is set for the life of the contract, the floating interest rate is set at the beginning of each interval and typically based on three- or six-month LIBOR.

An example of a typical U.S. dollar-denominated interest rate swap might involve a company that wants to convert a portion of its fixed-rate debt to floating rate, perhaps because it has acquired some assets generating cash flows that will vary directly with short-term interest rates. To achieve this conversion, the company's treasurer could call a swap dealer at a major bank to obtain quotes on interest rate swaps. As with currency swaps, dealers in interest rate swaps typically make a market in six-month LIBOR. That is, swap dealers quote a bid rate, which is the fixed rate of interest the bank will pay in exchange for receiving six-month LIBOR (i.e., the "price" at which the bank stands ready to "buy" six-month LIBOR), and an offer rate, which is the fixed rate of interest the bank is willing to accept as payment in exchange for paying six-month LIBOR (i.e., the "price" at which the bank stands ready to "sell" six-month LIBOR). Swap rate quotes made in London by Morgan Guaranty, Ltd. on December 16, 1985, are shown in Table D.

Given these quotes, a company wishing to get out of fixed-rate debt into floating-rate debt for, say, 5 years could do so by agreeing to pay the bank six-month LIBOR in exchange for receiving fixed-rate payments of 9.21%, which could then be used to cover a portion of the interest on its outstanding fixed-rate debt obligations.[4]

Applications

Interest rate risk is the leading reason that corporations use swaps. They are typically used to insure against loss in value of existing corporate liabilities and assets due to unexpected changes in interest rates. For example, a corporation that has recently taken on a substantial amount of debt might want to adjust the duration of its debt to match better the duration of its expected cash inflows, thereby reducing the exposure of the corporation's market value to interest rate risk.

[4]In practice, the bid rate by the bank may not cover precisely the fixed rate of interest that the company must pay to its debt holders. When this occurs, an adjustment is made by adding or subtracting an appropriate number of basis points to the fixed rate paid and six-month LIBOR received.

In addition to hedging, corporations often use interest rate swaps to reduce debt costs. There are three principal ways by which these swaps might provide cost savings: (1) speculating on market movements, (2) exploiting arbitrage opportunities, and (3) reducing transactions costs. A corporation can speculate on the direction of interest rates by swapping in and out of fixed- and floating-rate agreements in hopes of achieving lower borrowing rates. Of course, this sort of speculation can result in higher borrowing costs if interest rates move in an adverse direction.

A corporation might also reduce borrowing costs by exploiting arbitrage opportunities arising from an ability to source either fixed- or floating-rate debt at particularly attractive rates in one market compared to another. A company wishing to issue fixed-rate debt might, for example, discover that it can command unusually low rates in the Eurodollar floating-rate note market. The company can exploit this opportunity by issuing the floating-rate notes, thus securing the low-cost funds, and then entering into an interest rate swap that would convert the floating-rate debt to fixed rate. In this respect, like currency swaps, interest rate swaps enable corporate treasurers to uncouple the market in which they source funds from the desired interest rate structure of their debt obligations. In the early days of the swap market, funding could be obtained at savings of as much as 50 basis points given the significant arbitrage opportunities that were then available. Today, due to more integrated capital markets, arbitrage savings are rarer and more commonly below 20 basis points.

Finally, transaction costs of an interest rate swap are relatively lower than those of its predecessor, the interest rate forward contract (forward rate agreements), due to the standardized nature of the swap market. Thus, interest rate swaps represent an attractive risk management and cost-savings tool for an increasingly wide range of market participants.

Basis Rate Swaps

A basis rate swap is essentially an interest rate swap in which both interest rates are floating. In effect, a basis rate swap allows a borrower or investor to exchange cash flows determined by one floating interest rate for cash flows determined by another floating interest rate. For example, a corporation could transform a loan based on six-month LIBOR to the same loan based on one-month commercial paper rates.

A basis rate swap can be thought of as two interest rate swaps paired together. One of the pair would be a floating-for-fixed swap, and the other would be an exchange of the fixed rate with another floating rate. For example, a company could swap a six-month LIBOR obligation for a fixed rate, and then swap the fixed rate with another counterparty for another floating-rate obligation based upon commercial paper rates. The basis rate swap conveniently rolls into one transaction what would otherwise be two using conventional fixed-for-floating interest rate swaps.

EXHIBIT 1
Survey of the Use of Derivatives by CFOs

Source: *Institutional Investor*, CFO forum, February 1993.

A. Percent of affirmative answers to the question: What kind of derivatives, if any, does your company use?	
Foreign exchange forwards	64.2%
Interest rate swaps	78.9
Foreign exchange options	40.4
Oil and energy-linked swaps	11.9
Other commodity-linked swaps	14.7
Exchange-traded interest rate futures and options	29.4
Exchange-traded foreign exchange futures and options	11.0
Exchange-traded equity futures and options	10.1
OTC interest rate futures and options	13.8
Equity-linked swaps	4.6
Equity swaps	2.8
B. Percent of affirmative answers to the question: For what purpose does your company use derivatives?	
To hedge floating rate debt	52.7%
To hedge commercial paper issuance	23.2
To create synthetic floating-rate debt at a lower cost	35.7
To create synthetic fixed-rate debt at a lower cost	43.8
To access capital markets globally	15.2
To hedge investments overseas	36.6
To achieve strategic liability management	40.2

Glossary

American option See **Option.**

Arbitrage Profiting from price differences on the same security, currency, or commodity traded in two or more markets.

At-the-money Term used to describe an option contract that has an exercise price equal to the current market price of the underlying asset.

Backwardation Pricing situation in which forward and futures prices are higher for those contracts expiring in the near future than those expiring farther out.

Bid/ask spread Difference between the bid price (the highest price a prospective buyer is prepared to pay for a particular security) and the ask price (the lowest price a prospective seller is willing to accept for the same security).

Call option See **Option.**

Contango Pricing situation in which forward and futures prices get progressively higher as maturities get progressively longer.

Cost of carry Out-of-pocket costs incurred while an investor has an investment position.

Deep-in/out-of-the-money Call option whose exercise price is well below the current market price of the underlying asset **(deep-in-the-money)** or well above the current market price of the underlying asset **(deep-out-of-the-money).** The situation would be exactly opposite for a put option.

Default (credit) risk Financial risk that a debtor will fail to make timely payments of interest and principal as they come due, or to meet some other provision of a financial agreement.

Derivative instrument Financial instrument whose value is based on that of another underlying security.

Difference check Form of direct, one-way payment upon settlement of a financial contract.

European option See **Option.**

Ex-dividend The absence of the right to receive a cash dividend payment already declared on a stock.

Exercise price Price at which some security underlying a derivative instrument can be purchased or sold on or before the contract's maturity date.

Expiration date See **Maturity date.**

Forward contract Privately traded contract to buy or sell a specific amount of some underlying asset at a specified price on a specified future date.

Futures contract Standardized exchange-traded contract to buy or sell a specific amount of some underlying asset at a specified price on a specified future date.

Guarantor Entity that takes on a contingent liability by assuming the responsibility for payment of a debt or performance of some obligation if the party primarily liable fails to perform.

Hedging The reduction of risk by eliminating the possibility of future gains or losses (e.g., by buying or selling forward and futures contracts).

Insurance The reduction of risk by the purchase of contingent claims (e.g., put options, call options, guarantees, insurance policies) that offset future losses by paying off under those circumstances in which losses are expected to be incurred.

In-the-money Term used to describe an option contract that has an exercise price below the current market price of an underlying asset in the case of a call option, and above the current market price of the underlying asset in the case of a put option.

Intrinsic value For call options, the greater of zero and the difference between the market value of the call's underlying asset and its exercise price. For put options, the greater of zero and the difference between the put's exercise price and the market value of its underlying asset.

London Interbank Offered Rate (LIBOR) Rate that the most creditworthy international banks dealing in Eurodollars charge each other for large loans.

Margin Amount of cash an investor deposits with a broker when borrowing from the broker to buy securities. If the price of the security purchased "on margin" falls, the broker will require the investor to put up more "margin" by making additional cash deposits.

Mark-to-market Adjust the recorded value of a security or portfolio to reflect actual current market values.

Market value (or price) The price at which willing buyers and sellers trade similar items in a free and open market.

Maturity date Date on which payment on some financial contract becomes due and payable. In the case of options, the maturity date is the final date on which the option owner can buy or sell the underlying asset.

Option The right, but not the obligation, to buy or sell some specified underlying asset for a specified price on (or before) a specified date.

- **Call option** Gives its buyer the right to buy some underlying asset at a fixed price on or before a specified date in the future.
- **Put option** Gives its buyer the right to sell some underlying asset at a fixed price on or before a specified date in the future.
- **American option** Option that can be exercised on or before the expiration date.
- **European option** Option that can be exercised only on the expiration date.

Option premium Price an option buyer must pay an option seller for an option contract.

Out-of-the-money Term used to describe an option contract that has an exercise price above the current market price of the underlying asset in the case of a call option, and below the current price of the underlying asset in the case of a put option.

Over-the-counter (OTC) Market in which securities transactions are conducted through a telephone and computer network connecting dealers in stocks and bonds, rather than on the floor of an organized exchange.

Put-call parity Relationship between put and call option prices that, if held in parity, prevents arbitrage opportunities.

Put option See **Option.**

Settlement date Date by which an executed order must be settled, either by a buyer paying for the securities with cash or by a seller delivering the securities and receiving the proceeds of the sale for them.

Speculation Assumption of risk in anticipation of gain, but often implying a higher than average possibility of loss.

Spot price Current delivery price of some physical commodity or financial asset traded in the spot market.

Strike price See **Exercise price.**

Swap Exchange of one asset or liability with particular terms and conditions for another asset or liability with different terms and conditions for a specified period of time.

Transaction costs Cost of buying or selling a security, which consists mainly of the brokerage commission, the dealer markdown or markup, or fee (as would be charged by a bank).

Zero-coupon security Security that makes no periodic interest payments but instead is sold at a deep discount from its face value.

Sally Jameson: Valuing Stock Options in a Compensation Package (Abridged)

Sally Jameson, a second-year MBA student at Harvard Business School, was thrilled but confused. It was late May 1992, graduation was approaching, and she had finally landed the job of her choice. She had just finished an early morning telephone conversation with Bob Marks, the MBA recruiting coordinator at Telstar Communications, a large, publicly held multinational company. Mr. Marks had offered Ms. Jameson a unique position in operations at Telstar, and from the description, it sounded exactly like the job that she wanted. Since her first interview with Telstar, she had been very impressed with the company and its people. While Ms. Jameson was certain that she would accept the job, there was still one unsettled, yet crucial, matter—her compensation.

During the conversation with Marks, Jameson had asked what her compensation package would be.

Marks: "Well, Sally, we are all very impressed with you and would like to offer you a starting salary of $50,000. In addition, you will also receive a signing bonus."

Jameson: "The base salary is a little below what I had expected. Is that negotiable?"

Marks: "I'm afraid not. That's the same starting package all MBAs get. However, you will receive a bonus upon accepting our offer. You can receive $5,000 in cash, or choose stock options instead."

Jameson: "I'm not too familiar with stock options. Could you explain to me what they are?"

Marks: "Sure. Executives at Telstar have been eligible to receive stock options for years. The goal was to tie management's compensation more closely to increases in shareholder value. Although our stock has performed erratically over the last ten years, the board continues to believe that stock options are the best form of incentive compensation. Because the options represent the right to buy Telstar stock at a set price, after a set period of time, management has an incentive to take actions to move the stock price upward. Several months ago, we had a consulting firm examine our compensation structure. They recommended that we extend eligibility for stock options to all employees as part of our new incentive-based compensation plans. Thus, the two MBAs that we hope to hire this year will be the first employees who will be offered stock options. Given that this is an experiment, we decided to give MBAs a choice between cash or options."

Jameson: "How much are these options worth?"

Marks: "To tell you the truth, I'm not really sure. All I know are the details: each of the 3,000 options you'll be granted allows you to buy one share of Telstar stock at $35.00 per share at the time of your fifth anniversary with the firm.[1] Yesterday, our stock, which pays no dividend and is not expected to pay one in the foreseeable future, closed at $18.75. Should you leave at any point before your fifth year, you lose the options. You can't take them with you.

[1]Casewriter's note: Stock options of this sort would more typically have been written with a strike price equal to or just slightly above the current price.

Professor Peter Tufano and Research Associate Michael Lewittes prepared this case. HBS cases are developed solely as the basis for class discussion. Certain details have been disguised. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.