The following is a review of the Derivatives principles designed to address the learning outcome statements set forth by CFA Institute. This topic is also covered in:

FORWARD MARKETS AND CONTRACTS

Study Session 17

EXAM FOCUS

This topic review introduces forward contracts in general and covers the characteristics of forward contracts on various financial securities, as well as interest rates. It is not easy material, and you should take the time to learn it well. This material on forward contracts provides a good basis for futures contracts and many of the characteristics of both types of contracts are the same. Take the time to understand the intuition behind the valuation of forward rate agreements.

FORWARD CONTRACTS

A **forward contract** is a bilateral contract that obligates one party to buy and the other to sell a specific quantity of an asset, at a set price, on a specific date in the future. Typically, neither party to the contract pays anything to get into the contract. If the expected future price of the asset increases over the life of the contract, the right to buy at the contract price will have positive value, and the obligation to sell will have an equal negative value. If the future price of the asset falls below the contract price, the result is opposite and the right to sell (at an above-market price) will have the positive value. The parties may enter into the contract as a speculation on the future price. More often, a party seeks to enter into a forward contract to hedge a risk it already has. The forward contract is used to eliminate uncertainty about the future price of an asset it plans to buy or sell at a later date. Forward contracts on physical assets, such as agricultural products, have existed for centuries. The Level I CFA curriculum, however, focuses on their (more recent) use for financial assets, such as T-bills, bonds, equities, and foreign currencies.

LOS 61.a: Explain delivery/settlement and default risk for both long and short positions in a forward contract.

CFA® Program Curriculum, Volume 6, page 28

The party to the forward contract that agrees to buy the financial or physical asset has a **long forward position** and is called the *long*. The party to the forward contract that agrees to sell or deliver the asset has a **short forward position** and is called the *short*.

We will illustrate the mechanics of the basic forward contract through an example based on the purchase and sale of a Treasury bill. Note that while forward and futures contracts on T-bills are usually quoted in terms of a discount percentage from face value, we will use dollar prices to make the example easy to follow. Actual pricing conventions and calculations are among the contract characteristics covered later in this review.

Consider a contract under which Party A agrees to buy a $1,000 face value, 90-day Treasury bill from Party B 30 days from now at a price of $990. Party A is the long and Party B is the short. Both parties have removed uncertainty about the price they will pay/receive for the T-bill at the future date. If 30 days from now T-bills are trading at $992, the short must deliver the T-bill to the long in exchange for a $990 payment. If T-bills are trading at $988 on the future date, the long must purchase the T-bill from the short for $990, the contract price.

Each party to a forward contract is exposed to **default risk** (or **counterparty risk**), the probability that the other party (the counterparty) will not perform as promised. It is unusual for any cash to actually be exchanged at the inception of a forward contract, unlike futures contracts in which each party posts an initial deposit (margin) as a guarantee of performance.

At any point in time, including the settlement date, only one party to the forward contract will owe money, meaning that side of the contract has a negative value. The other side of the contract will have a positive value of an equal amount. Following the example, if the T-bill price is $992 at the (future) settlement date and the short does not deliver the T-bill for $990 as promised, the short has defaulted.

LOS 61.b: Describe the procedures for settling a forward contract at expiration, and how termination prior to expiration can affect credit risk.

CFA® Program Curriculum, Volume 6, page 29

The previous example was for a **deliverable forward contract**. The short contracted to deliver the actual instrument, in this case a $1,000 face value, 90-day T-bill.

This is one procedure for settling a forward contract at the *settlement date* or expiration date specified in the contract.

An alternative settlement method is **cash settlement**. Under this method, the party that has a position with negative value is obligated to pay that amount to the other party. In the previous example, if the price of the T-bill were $992 on the expiration date, the short would satisfy the contract by paying $2 to the long. Ignoring transactions costs, this method yields the same result as asset delivery. If the short had the T-bill, it could be sold in the market for $992. The short's net proceeds, however, would be $990 after subtracting the $2 payment to the long. If the T-hill price at the settlement date were $988, the long would make a $2 payment to the short. Purchasing a T-bill at the market price of $988, together with this $2 payment, would make the total cost $990, just as it would be if it were a deliverable contract.

On the expiration (or settlement) date of the contract, the long receives a payment if the price of the asset is above the agreed-upon (forward) price; the short receives a payment if the price of the asset is below the contract price.

Terminating a Position Prior to Expiration

A party to a forward contract can **terminate the position** prior to expiration by entering into an opposite forward contract with an expiration date equal to the time remaining on the original contract.

Recall our example and assume that ten days after inception (it was originally a 30-day contract), the 20-day forward price of a $1,000 face value, 90-day T-bill is $992. The short, expecting the price to be even higher by the delivery date, wishes to terminate the contract. Since the short is obligated to sell the T-bill 20 days in the future, he can effectively exit the contract by entering into a new (20-day) forward contract to buy an identical T-bill (a long position) at the current forward price of $992.

The position of the original short now is two-fold, an obligation to sell a T-bill in 20 days for $990 (under the original contract) and an obligation to purchase an identical T-bill in 20 days for $992. He has locked in a $2 loss, but has effectively exited the contract since the amount owed at settlement is $2, regardless of the market price of the T-bill at the settlement date. No matter what the price of a 90-day T-bill is 20 days from now, he has the contractual right and obligation to buy one at $992 and to sell one at $990.

However, if the short's new forward contract is with a different party than the first forward contract, some **credit risk** remains. If the price of the T-bill at the expiration date is above $992, and the counterparty to the second forward contract fails to perform, the short's losses could exceed $2.

An alternative is to enter into the second (offsetting) contract with the same party as the original contract. This would avoid credit risk since the short could make a $2 payment to the counterparty at contract expiration, the amount of his net exposure. In fact, if the original counterparty were willing to take the short position in the second (20-day) contract at the $992 price, a payment of the present value of the $2 (discounted for the 20 days until the settlement date) would be an equivalent transaction. The original counterparty would be willing to allow termination of the original contract for an immediate payment of that amount.

If the original counterparty requires a payment larger than the present value of $2 to exit the contract, the short must weight this additional cost to exit the contract against the default risk he bears by entering into the offsetting contract with a different counterparty at a forward price of $992.

LOS 61.c: Distinguish between a dealer and an end user of a forward contract.

CFA® Program Curriculum, Volume 6, page 30

The **end user of a forward contract** is typically a corporation, government unit, or nonprofit institution that has existing risk they wish to avoid by locking in the future price of an asset. A U.S. corporation that has an obligation to make a payment in Euros 60 days from now can eliminate its exchange rate risk by entering into a forward

contract to purchase the required amount of Euros for a certain dollar-denominated payment with a settlement date 60 days in the future.

Dealers are often banks, but can also be nonbank financial institutions such as securities brokers. Ideally, dealers will balance their overall long positions with their overall short positions by entering forward contracts with end users who have opposite existing risk exposures. A dealer's quote desk will quote a buying price (at which they will assume a long position) and a slightly higher selling price (at which they will assume a short position). The bid/ask spread between the two is the dealer's compensation for administrative costs as well as bearing default risk and any asset price risk from unbalanced (unhedged) positions. Dealers will also enter into contracts with other dealers to hedge a net long or net short position.

LOS 61.d: Describe the characteristics of equity forward contracts and forward contracts on zero-coupon and coupon bonds.

CFA® Program Curriculum, Volume 6, page 32

Equity forward contracts where the underlying asset is a single stock, a portfolio of stocks, or a stock index, work in much the same manner as other forward contracts. An investor who wishes to sell 10,000 shares of IBM stock 90 days from now and wishes to avoid the uncertainty about the stock price on that date, could do so by taking a short position in a forward contract covering 10,000 IBM shares. (We will leave the motivation for this and the pricing of such a contract aside for now.)

A dealer might quote a price of $100 per share, agreeing to pay $1 million for the 10,000 shares 90 days from now. The contract may be deliverable or settled in cash as described above. The stock seller has locked in the selling price of the shares and will get no more if the price (in 90 days) is actually higher, and will get no less if the price actually lower.

A portfolio manager who wishes to sell a portfolio of several stocks 60 days from now can similarly request a quote, giving the dealer the company names and the number of shares of each stock in the portfolio. The only difference between this type of forward contract and several forward contracts each covering a single stock, is that the pricing would be better (a higher total price) for the portfolio because overall administration/origination costs would be less for the portfolio forward contract.

A forward contract on a stock index is similar except that the contract will be based on a notional amount and will very likely be a cash-settlement contract.

Example: Equity index forward contracts

A portfolio manager desires to generate $10 million 100 days from now from a portfolio that is quite similar in composition to the S&P 100 index. She requests a quote on a short position in a 100-day forward contract based on the index with a notional amount of $10 million and gets a quote of 525.2. If the index level at the settlement date is 535.7, calculate the amount the manager will pay or receive to settle the contract.

Answer:

The actual index level is 2% *above* the contract price, or:

$$535.7 / 525.2 - 1 = 0.02 = 2\%$$

As the short party, the portfolio manager must pay 2% of the $10 million notional amount, $200,000, to the long.

Alternatively, if the index were 1% below the contract level, the portfolio manager would receive a payment from the long of $100,000, which would approximately offset any decrease in the portfolio value.

Dividends are usually not included in equity forward contracts, as the uncertainty about dividend amounts and payment dates is small compared to the uncertainty about future equity prices. Since forward contracts are custom instruments, the parties could specify a total return value (including dividends) rather than simply the index value. This would effectively remove dividend uncertainty as well.

Forward Contracts on Zero-Coupon and Coupon Bonds

Forward contracts on short-term, zero-coupon bonds (T-bills in the United States) and coupon interest-paying bonds are quite similar to those on equities. However, while equities do not have a maturity date, bonds do, and the forward contract must settle before the bond matures.

As we noted earlier, T-bill prices are often quoted as a percentage discount from face value. The percentage discount for T-bills is annualized so that a 90-day T-bill quoted at a 4% discount will be priced at a (90 / 360) × 4% = 1% discount from face value. This is equivalent to a price quote of (1 – 0.01) × $1,000 = $990 per $1,000 of face value.

Example: Bond forwards

A forward contract covering a $10 million face value of T-bills that will have 100 days to maturity at contract settlement is priced at 1.96 on a discount yield basis. Compute the dollar amount the long must pay at settlement for the T-bills.

Answer

The 1.96% annualized discount must be "unannualized" based on the 100 days to maturity.

0.0196 × (100 / 360) = 0.005444 is the actual discount.

The dollar settlement price is (1 – 0.005444) × $10 million = $9,945,560.

Please note that when market interest rates increase, discounts increase, and T-bill prices fall. A long, who is obligated to purchase the bonds, will have losses on the forward contract when interest rates rise, and gains on the contract when interest rates fall. The outcomes for the short will be opposite.

The price specified in forward contracts on coupon-bearing bonds is typically stated as a yield to maturity as of the settlement date, exclusive of accrued interest. If the contract is on bonds with the possibility of default, there must be provisions in the contract to define default and specify the obligations of the parties in the event of default. Special provisions must also be included if the bonds have embedded options such as call features or conversion features. Forward contracts can be constructed covering individual bonds or portfolios of bonds.

LOS 61.e: Describe the characteristics of the Eurodollar time deposit market, and define LIBOR and Euribor.

CFA® Program Curriculum, Volume 6, page 36

Eurodollar deposit is the term for deposits in large banks outside the United States denominated in U.S. dollars. The lending rate on dollar-denominated loans between banks is called the London Interbank Offered Rate (LIBOR). It is quoted as an annualized rate based on a 360-day year. In contrast to T-bill discount yields, LIBOR is an add-on rate, like a yield quote on a short-term certificate of deposit. LIBOR is used as a reference rate for floating rate U.S. dollar-denominated loans worldwide.

Example: LIBOR-based loans

Compute the amount that must be repaid on a $1 million loan for 30 days if 30-day LIBOR is quoted at 6%.

Answer:

The add-on interest is calculated as $1 million × 0.06 × (30 / 360) = $5,000. The borrower would repay $1,000,000 + $5,000 = $1,005,000 at the end of 30 days.

LIBOR is published daily by the British Banker's Association and is compiled from quotes from a number of large banks; some are large multinational banks based in other countries that have London offices.

There is also an equivalent Euro lending rate called Euribor, or Europe Interbank Offered Rate. Euribor, established in Frankfurt, is published by the European Central Bank.

The floating rates are for various periods and are quoted as such. For example, the terminology is 30-day LIBOR (or Euribor), 90-day LIBOR, and 180-day LIBOR, depending on the term of the loan. For longer-term floating-rate loans, the interest rate is reset periodically based on the then-current LIBOR for the relevant period.

LOS 61.f: Describe forward rate agreements (FRAs) and calculate the gain/loss on a FRA.

LOS 61.g: Calculate and interpret the payoff of a FRA and explain each of the component terms of the payoff formula.

CFA® Program Curriculum, Volume 6, page 35

A **forward rate agreement** (FRA) can be viewed as a forward contract to borrow/lend money at a certain rate at some future date. In practice, these contracts settle in cash, but no actual loan is made at the settlement date. This means that the creditworthiness of the parties to the contract need not be considered in the forward interest rate, so an essentially riskless rate, such as LIBOR, can be specified in the contract. (The parties to the contract may still be exposed to default risk on the amount owed at settlement.)

The long position in an FRA is the party that would borrow the money (long the loan with the contract price being the interest rate on the loan). If the floating rate at contract expiration (LIBOR or Euribor) is above the rate specified in the forward agreement, the long position in the contract can be viewed as the right to borrow at below market rates and the long will receive a payment. If the reference rate at the expiration date is below the contract rate, the short will receive a cash payment from the long. (The right to lend at rates *higher than* market rates would have a positive value.)

To calculate the cash payment at settlement for a forward rate agreement, we need to calculate the value as of the settlement date of making a loan at a rate that is either above or below the market rate. Since the interest savings would come at the end of the loan period, the cash payment at settlement of the forward is the present value of the interest savings. We need to calculate the discounted value at the settlement date of the interest savings or excess interest at the end of the loan period. An example will illustrate the calculation of the payment at expiration and some terminology of FRAs.

Example: FRAs

Consider an FRA that:

- Expires/settles in 30 days.
- Is based on a notional principal amount of $1 million.
- Is based on 90-day LIBOR.
- Specifies a forward rate of 5%.

Assume that the actual 90-day LIBOR 30-days from now (at expiration) is 6%. Compute the cash settlement payment at expiration, and identify which party makes the payment.

Answer:

If the long could borrow at the contract rate of 5%, rather than the market rate of 6%, the interest saved on a 90-day $1 million loan would be:

$$(0.06 - 0.05)(90 / 360) \times 1 \text{ million} = 0.0025 \times 1 \text{ million} = \$2{,}500$$

The $2,500 in interest savings would not come until the end of the 90-day loan period. The value at settlement is the present value of these savings. The correct discount rate to use is the actual rate at settlement, 6%, not the contract rate of 5%.

The payment at settlement from the short to the long is:

$$\frac{2{,}500}{1+[(0.06) \times (90/360)]} = \$2{,}463.05$$

In doing the calculation of the settlement payment, remember that the term of the FRA and the term of the underlying "loan" need not be the same and are *not* interchangeable. While the settlement date can be any future date, in practice it is usually some multiple of 30 days. The specific market rate on which we calculate the value of the contract will typically be similar, 30-day, 60-day, 90-day, or 180-day LIBOR. If we describe an FRA as a 60-day FRA on 90-day LIBOR, settlement or expiration is 60 days from now and the payment at settlement is based on 90-day LIBOR 60 days from now. Such an FRA could be quoted in (30-day) months, and would be described as a 2-by-5 FRA (or 2 × 5 FRA). The 2 refers to the number of months until contract expiration and the 5 refers to the total time until the end of the interest rate period (2 + 3 = 5).

The general formula for the payment to the long at settlement is:

$$(\text{notional principal})\frac{(\text{floating} - \text{forward})\left(\frac{\text{days}}{360}\right)}{1+\left[(\text{floating})\left(\frac{\text{days}}{360}\right)\right]}$$

where:
days = number of days in the loan term

The numerator is the interest savings in percent, and the denominator is the discount factor.

Note that if the *floating* rate underlying the agreement turns out to be below the *forward* rate specified in the contract, the numerator in the formula is negative and the short receives a payment from the long.

FRAs for non-standard periods (e.g., a 45-day FRA on 132-day LIBOR) are termed off-the-run FRAs.

LOS 61.h: Describe the characteristics of currency forward contracts.

CFA® Program Curriculum, Volume 6, page 38

Under the terms of a **currency forward contract**, one party agrees to exchange a certain amount of one currency for a certain amount of another currency at a future date. This type of forward contract in practice will specify an exchange rate at which one party can buy a fixed amount of the currency underlying the contract. If we need to exchange 10 million Euros for U.S. dollars 60 days in the future, we might receive a quote of USD0.95. The forward contract specifies that we (the long) will purchase USD9.5 million for EUR10 million at settlement. Currency forward contracts can be deliverable or settled in cash. As with other forward contracts, the cash settlement amount is the amount necessary to compensate the party who would be disadvantaged by the actual change in market rates as of the settlement date. An example will illustrate this.

Example: Currency forwards

Gemco expects to receive EUR50 million three months from now and enters into a cash settlement currency forward to exchange these euros for U.S. dollars at USD1.23 per euro. If the market exchange rate is USD1.25 per euro at settlement, what is the amount of the payment to be received or paid by Gemco?

Answer:

Under the terms of the contract Gemco would receive:

$$\text{EUR50 million} \times \frac{\text{USD}}{\text{EUR}} 1.23 = \text{USD61.5 million}$$

Without the forward contract, Gemco would receive:

$$\text{EUR50 million} \times \frac{\text{USD}}{\text{EUR}} 1.25 = \text{USD62.5 million}$$

The counterparty would be disadvantaged by the difference between the contract rate and the market rate in an amount equal to the advantage that would have accrued to Gemco had they not entered into the currency forward.

Gemco must make a payment of USD1.0 million to the counterparty.

A direct calculation of the value of the long (USD) position at settlement is:

$$\left(\frac{\text{USD}}{\text{EUR}} 1.23 - \frac{\text{USD}}{\text{EUR}} 1.25\right) \times \text{EUR50 million} = -\text{USD1.0 million}$$

KEY CONCEPTS

LOS 61.a

A deliverable forward contract on an asset specifies that the long (the buyer) will pay a certain amount at a future date to the short, who will deliver a certain amount of an asset.

Default risk in a forward contract is the risk that the other party to the contract will not perform at settlement, because typically no money changes hands at the initiation of the contract.

LOS 61.b

A forward contract with cash settlement does not require delivery of the underlying asset, but a cash payment at the settlement date from one counterparty to the other, based on the contract price and the market price of the asset at settlement.

Early termination of a forward contract can be accomplished by entering into a new forward contract with the opposite position, at the then-current expected forward price. This early termination will fix the amount of the gain or loss at the settlement date. If this new forward is with a different counterparty than the original, there is credit or default risk to consider since one of the two counterparties may fail to honor its obligation under the forward contract.

LOS 61.c

An end user of a forward contract is most often a corporation hedging an existing risk.

Forward dealers, large banks, or brokerages originate forward contracts and take the long side in some contracts and the short side in others, with a spread in pricing to compensate them for actual costs, bearing default risk, and any unhedged price risk they must bear.

LOS 61.d

An equity forward contract may be on a single stock, a customized portfolio, or an equity index, and is used to hedge the risk of equity prices at some future date.

- Equity forward contracts can be written on a total return basis (including dividends), but are typically based solely on an index value.
- Index forwards settle in cash based on the notional amount and the percentage difference between the index value in the forward contract and the actual index level at settlement.

Forward contracts in which bonds are the underlying asset may be quoted in terms of the discount on zero-coupon bonds (e.g., T-bills) or in terms of the yield to maturity on coupon bonds. Forwards on corporate bonds must contain special provisions to deal with the possibility of default as well as with any call or conversion features. Forward contracts may also be written on portfolios of fixed income securities or on bond indexes.

LOS 61.e

Eurodollar time deposits are USD-denominated short-term unsecured loans to large money-center banks outside the United States.

The London Interbank Offered Rate (LIBOR) is an international reference rate for Eurodollar deposits and is quoted for 30-day, 60-day, 90-day, 180-day, or 360-day (1-year) terms.

Euribor is the equivalent for short-term Euro-denominated bank deposits (loans to banks).

For both LIBOR and Euribor, rates are expressed as annual rates and actual interest is based on the loan term as a proportion of a 360-day year.

LOS 61.f

Forward rate agreements (FRAs) serve to hedge the uncertainty about short-term rates (e.g., 30- or 90-day LIBOR) that will prevail in the future. If rates rise, the long receives a payment at settlement. The short receives a payment if the specified rate falls to a level below the contract rate.

LOS 61.g

The payment to the long at settlement on an FRA is:

$$\text{notional ptincipal amount} \left\{ \frac{(\text{reference rate at settlement} - \text{FRA rate}) \left[\frac{\text{days in loan term}}{360} \right]}{1 + \text{reference rate at settlement} \times \left[\frac{\text{days in loan term}}{360} \right]} \right\}$$

The numerator is the difference between the rate on a loan for the specified period at the forward contract rate and the rate at settlement, and the denominator is to discount this interest differential back to the settlement date at the market rate at settlement.

LOS 61.h

Currency forward contracts specify that one party will deliver a certain amount of one currency at the settlement date in exchange for a certain amount of another currency.

Under cash settlement, a single cash payment is made at settlement based on the difference between the exchange rate fixed in the contract and the market exchange rate at the settlement date.

Concept Checkers

1. The short in a deliverable forward contract:
   A. has no default risk.
   B. is obligated to deliver the specified asset.
   C. makes a cash payment to the long at settlement.

2. On the settlement date of a forward contract:
   A. the short may be required to sell the asset.
   B. the long must sell the asset or make a cash payment.
   C. at least one party must make a cash payment to the other.

3. Which of the following statements regarding early termination of a forward contract is *most accurate*?
   A. A party who enters into an offsetting contract to terminate has no risk.
   B. A party who terminates a forward contract early must make a cash payment.
   C. Early termination through an offsetting transaction with the original counterparty eliminates default risk.

4. A dealer in the forward contract market:
   A. cannot be a bank.
   B. may enter into a contract with another dealer.
   C. gets a small payment for each contract at initiation.

5. Which of the following statements regarding equity forward contracts is *least accurate*?
   A. Equity forwards may be settled in cash.
   B. Dividends are never included in index forwards.
   C. A short position in an equity forward could not hedge the risk of a purchase of that equity in the future.

6. Which of the following statements regarding forward contracts on 90-day T-bills is *most accurate*?
   A. The face value must be paid by the long at settlement.
   B. There is no default risk on these forwards because T-bills are government-backed.
   C. If short-term yields increase unexpectedly after contract initiation, the short will profit on the contract.

7. A Eurodollar time deposit:
   A. is priced on a discount basis.
   B. may be issued by a Japanese bank.
   C. is a certificate of deposit denominated in Euros.

8. One difference between LIBOR and Euribor is that:
   A. LIBOR is for London deposits.
   B. they are for different currencies.
   C. LIBOR is slightly higher due to default risk.

9. Which of the following statements regarding a LIBOR-based FRA is *most accurate*?
   A. The short will settle the contract by making a loan.
   B. FRAs can be based on interest rates for 30-, 60-, or 90-day periods.
   C. If LIBOR increases unexpectedly over the contract term, the long will be required to make a cash payment at settlement.

10. Consider a $2 million FRA with a contract rate of 5% on 60-day LIBOR. If 60-day LIBOR is 6% at settlement, the long will:
   A. pay $3,333.
   B. receive $3,300.
   C. receive $3,333.

11. Party A has entered a currency forward contract to purchase €10 million at an exchange rate of $0.98 per euro. At settlement, the exchange rate is $0.97 per euro. If the contract is settled in cash, Party A will:
   A. make a payment of $100,000.
   B. receive a payment of $100,000.
   C. receive a payment of $103,090.

12. If the quoted discount yield on a 128-day, $1 million T-bill decreases from 3.15% to 3.07%, how much has the holder of the T-bill gained or lost?
   A. Lost $284.
   B. Gained $284.
   C. Gained $800.

13. 90-day LIBOR is quoted as 3.58%. How much interest would be owed at maturity for a 90-day loan of $1.5 million at LIBOR + 1.3%?
   A. $17,612.
   B. $18,300.
   C. $32,925.

14. A company treasurer needs to borrow 10 million euros for 180 days, 60 days from now. The type of FRA and the position he should take to hedge the interest rate risk of this transaction are:

	FRA	Position
A.	2 × 6	Short
B.	2 × 8	Long
C.	2 × 8	Short

ANSWERS – CONCEPT CHECKERS

1. B The short in a forward contract is obligated to deliver the specified asset at the contract price on the settlement date. Either party may have default risk if there is any probability that the counterparty may not perform under the terms of the contract.

2. A A forward contract may call for settlement in cash or for delivery of the asset. Under a deliverable contract, the short is required to deliver the asset at settlement, not to make a cash payment.

3. C Terminating a forward contract early by entering into an offsetting forward contract with a different counterparty exposes a party to default risk. If the offsetting transaction is with the original counterparty, default risk is eliminated. No cash payment is required if an offsetting contract is used for early termination.

4. B Forward contracts dealers are commonly banks and large brokerage houses. They frequently enter into forward contracts with other dealers to offset long or short exposure. No payment is typically made at contract initiation.

5. B Index forward contracts may be written as total return contracts, which include dividends. Contracts may be written to settle in cash, or to be deliverable. A *long* position is used to reduce the price risk of an expected future purchase.

6. C When short-term rates increase, T-bill prices fall and the short position will profit. The price of a T-bill prior to maturity is always less than its face value. The deliverable security is a T-bill with 90 days to maturity. There is default risk on the *forward*, even though the underlying asset is considered risk free.

7. B Eurodollar time deposits are U.S. dollar-denominated accounts with banks outside the United States and are quoted as an add-on yield rather than on a discount basis.

8. B LIBOR is for U.S. dollar-denominated accounts while Euribor is for euro-denominated accounts. Neither is location-specific. Differences in these rates are due to the different currencies involved, not differences in default risk.

9. B A LIBOR-based contract can be based on LIBOR for various terms. They are settled in cash. The long will receive a payment when LIBOR is higher than the contract rate at settlement.

10. B $(0.06 - 0.05) \times (60 / 360) \times \$2 \text{ million} \times 1 / (1 + 0.06 / 6) = \$3{,}300.33$.

11. A ($0.98 – $0.97) × 10 million = $100,000 loss. The long, Party A, is obligated to buy euros at $0.98 when they are only worth $0.97 and must pay $0.01 × 10 million = $100,000.

12. B The actual discount has decreased by:

$$(0.0315 - 0.0307) \times \frac{128}{360} = 0.0284\% \text{ of } \$1{,}000{,}000, \text{ or } \$284.$$

A decrease in the discount is an increase in value.

13. B $(0.0358 + 0.013)\left(\frac{90}{360}\right)1.5 \text{ million} = \$18{,}300$. Both LIBOR and any premium to LIBOR are quoted as annualized rates.

14. B This requires a long position in a 2 × 8 FRA.