GLOSSARY

Accounting risk The risk associated with accounting standards that vary from country to country or with any uncertainty about how certain transactions should be recorded.

Add-on interest A procedure for determining the interest on a bond or loan in which the interest is added onto the face value of a contract.

American option An option that can be exercised on any day through the expiration day. Also referred to as *American-style exercise*.

Amortizing and accreting swaps A swap in which the notional principal changes according to a formula related to changes in the underlying.

Arbitrage The condition in a financial market in which equivalent assets or combinations of assets sell for two different prices, creating an opportunity to profit at no risk with no commitment of money. In a well-functioning financial market, few arbitrage opportunities are possible. Equivalent to the *law of one price*.

Arrears swap A type of interest rate swap in which the floating payment is set at the end of the period and the interest is paid at that same time.

At the money An option in which the underlying value equals the exercise price.

Backwardation A condition in the futures markets in which the benefits of holding an asset exceed the costs, leaving the futures price less than the spot price.

Basis point value (BPV) Also called *present value of a basis point* or *price value of a basis point* (PVBP), the change in the bond price for a 1 basis point change in yield.

Basis swap A swap in which both parties pay a floating rate.

Bear spread An option strategy that involves selling a put with a lower exercise price and buying a put with a higher exercise price. It can also be executed with calls.

Beta A measure of the relationship between the return on a stock portfolio and the return on the market portfolio, which is a portfolio containing *all* risky assets in the market.

Binomial model A model for pricing options in which the underlying price can move to only one of two possible new prices.

Binomial tree A diagram representing price movements of the underlying in a binomial model.

Bond option An option in which the underlying is a bond; primarily traded in over-the-counter markets.

Box spread An option strategy that combines a bull spread and a bear spread having two different exercise prices, which produces a risk-free payoff of the difference in the exercise prices.

Brokers See *futures commission merchants*.

Bull spread An option strategy that involves buying a call with a lower exercise price and selling a call with a higher exercise price. It can also be executed with puts.

Butterfly spread An option strategy that combines two bull or bear spreads and has three exercise prices.

Call An option that gives the holder the right to buy an underlying asset from another party at a fixed price over a specific period of time.

Cap A combination of interest rate call options designed to hedge a borrower against rate increases on a floating-rate loan.

Caplet Each component call option in a cap.

Capped swap A swap in which the floating payments have an upper limit.

Cash flow at risk (CFAR) A variation of VAR that reflects the risk of a company's cash flow instead of its market value.

Cash price or spot price The price for immediate purchase of the underlying asset.

Cash settlement A procedure used in certain derivative transactions that specifies that the long and short parties engage in the equivalent cash value of a delivery transaction.

Centralized risk management or companywide risk management When a company has a single risk

management group that monitors and controls all of the risk-taking activities of the organization. Centralization permits economies of scale and allows a company to use some of its risks to offset other risks. See also *enterprise risk management.*

Cheapest to deliver A bond in which the amount received for delivering the bond is largest compared with the amount paid in the market for the bond.

Cherry-picking When a bankrupt company is allowed to enforce contracts that are favorable to it while walking away from contracts that are unfavorable to it.

Clearinghouse An entity associated with a futures market that acts as middleman between the contracting parties and guarantees to each party the performance of the other.

Closeout netting Netting the market values of *all* derivative contracts between two parties to determine one overall value owed by one party to another in the event of bankruptcy.

Collar An option strategy involving the purchase of a put and sale of a call in which the holder of an asset gains protection below a certain level, the exercise price of the put, and pays for it by giving up gains above a certain level, the exercise price of the call. Collars also can be used to provide protection against rising interest rates on a floating-rate loan by giving up gains from lower interest rates.

Commodity forward A contract in which the underlying asset is oil, a precious metal, or some other commodity.

Commodity futures Futures contracts in which the underlying is a traditional agricultural, metal, or petroleum product.

Commodity option An option in which the asset underlying the futures is a commodity, such as oil, gold, wheat, or soybeans.

Commodity swap A swap in which the underlying is a commodity such as oil, gold, or an agricultural product.

Constant maturity swap or CMT swap A swap in which the floating rate is the rate on a security known as a constant maturity treasury or CMT security.

Constant maturity treasury or CMT A hypothetical U.S. Treasury note with a constant maturity. A CMT exists for various years in the range of 2 to 10.

Contango A condition in the futures markets in which the costs of holding an asset exceed the benefits, leaving the futures price more than the spot price.

Contingent claims Derivatives in which the payoffs occur if a specific event occurs; generally referred to as options.

Continuous time Time thought of as advancing in extremely small increments.

Convenience yield The nonmonetary return offered by an asset when the asset is in short supply, often associated with assets with seasonal production processes.

Conversion factor An adjustment used to facilitate delivery on bond futures contracts in which any of a number of bonds with different characteristics are eligible for delivery.

Cost of carry The costs of holding an asset.

Cost of carry model A model for pricing futures contracts in which the futures price is determined by adding the cost of carry to the spot price.

Covariance A measure of the extent to which the returns on two assets move together.

Covered call An option strategy involving the holding of an asset and sale of a call on the asset.

Covered interest arbitrage A transaction executed in the foreign exchange market in which a currency is purchased (sold) and a forward contract is sold (purchased) to lock in the exchange rate for future delivery of the currency. This transaction should earn the risk-free rate of the investor's home country.

Credit derivatives A contract in which one party has the right to claim a payment from another party in the event that a specific credit event occurs over the life of the contract.

Credit risk or default risk The risk of loss due to nonpayment by a counterparty.

Credit spread option An option on the yield spread on a bond.

Credit swap A type of swap transaction used as a credit derivative in which one party makes periodic payments to the other and receives the promise of a payoff if a third party defaults.

Credit VAR, Default VAR, or Credit at Risk A variation of VAR that reflects credit risk.

Credit-linked notes Fixed-income securities in which the holder of the security has the right to withhold payment of the full amount due at maturity if a credit event occurs.

Cross-product netting Netting the market values of all contracts, not just derivatives, between parties.

Currency forward A forward contract in which the underlying is a foreign currency.

Currency option An option that allows the holder to buy (if a call) or sell (if a put) an underlying currency at a fixed exercise rate, expressed as an exchange rate.

Currency swap A swap in which each party makes interest payments to the other in different currencies.

Current credit risk The risk associated with the possibility that a payment currently due will not be made.

Daily settlement See *marking to market.*

Day trader A trader holding a position open somewhat longer than a scalper but closing all positions at the end of the day.

Decentralized risk management A system that allows individual units within an organization to manage risk. Decentralization results in duplication of effort but has the advantage of having people closer to the risk be more directly involved in its management.

Deep in the money Options that are far in-the-money.

Deep out of the money Options that are far out-of-the-money.

Delivery A process used in a deliverable forward contract in which the long pays the agreed-upon price to the short, which in turn delivers the underlying asset to the long.

Delivery option The feature of a futures contract giving the short the right to make decisions about what, when, and where to deliver.

Delta The relationship between the option price and the underlying price, which reflects the sensitivity of the price of the option to changes in the price of the underlying.

Delta hedge An option strategy in which a position in an asset is converted to a risk-free position with a position in a specific number of options. The number of options per unit of the underlying changes through time, and the position must be revised to maintain the hedge.

Delta-normal method A measure of VAR equivalent to the analytical method but that refers to the use of delta to estimate the option's price sensitivity.

Derivative A financial instrument that offers a return based on the return of some other underlying asset.

Derivatives dealers The commercial and investment banks that make markets in derivatives. Also referred to as market makers.

Diff swaps A swap in which the payments are based on the difference between interest rates in two countries but payments are made in only a single currency.

Discount interest A procedure for determining the interest on a loan or bond in which the interest is deducted from the face value in advance.

Discrete time Time thought of as advancing in distinct finite increments.

Duration A measure of the size and timing of the cash flows paid by a bond. It quantifies these factors by summarizing them in the form of a single number. For bonds without option features attached, duration is interpreted as a weighted average maturity of the bond.

Dynamic hedging A strategy in which a position is hedged by making frequent adjustments to the quantity of the instrument used for hedging in relation to the instrument being hedged.

Earnings at risk (EAR) A variation of VAR that reflects the risk of a company's earnings instead of its market value.

Economic exposure The risk associated with changes in the relative attractiveness of products and services offered for sale, arising out of the competitive effects of changes in exchange rates.

Enhanced derivatives products companies (EDPC) or special purpose vehicles (SPVs) A type of subsidiary engaged in derivatives transactions that is separated from the parent company in order to have a higher credit rating than the parent company.

Enterprise risk management A form of *centralized risk management* that typically encompasses the management of a broad variety of risks, including insurance risk.

Equitizing cash A strategy used to replicate an index. It is also used to take a given amount of cash and turn it into an equity position while maintaining the liquidity provided by the cash.

Equity forward A contract calling for the purchase of an individual stock, a stock portfolio, or a stock index at a later date at an agreed-upon price.

Equity options Options on individual stocks; also known as stock options.

Equity swap A swap in which the rate is the return on a stock or stock index.

Eurodollar A dollar deposited outside the United States.

European option An option that can be exercised only at expiration. Also referred to as *European-style exercise.*

Exchange for physicals (EFP) A permissible delivery procedure used by futures market participants, in which the long and short arrange a delivery procedure other than the normal procedures stipulated by the futures exchange.

Exercise or exercising the option The process of using an option to buy or sell the underlying.

Exercise price, strike price, striking price, or strike The fixed price at which an option holder can buy or sell the underlying.

Exercise rate or strike rate The fixed rate at which the holder of an interest rate option can buy or sell the underlying.

Expiration date The date on which a derivative contract expires.

Fiduciary call A combination of a European call and a risk-free bond that matures on the option expiration day and has a face value equal to the exercise price of the call.

Financial futures Futures contracts in which the underlying is a stock, bond, or currency.

Fixed-income forward A forward contract in which the underlying is a bond.

Floating-rate loan A loan in which the interest rate is reset at least once after the starting date.

Floor A combination of interest rate put options designed to hedge a lender against lower rates on a floating-rate loan.

Floor traders or locals Market makers that buy and sell by quoting a bid and an ask price. They are the primary providers of liquidity to the market.

Floored swap A swap in which the floating payments have a lower limit.

Floorlet Each component put option in a floor.

Forward contract An agreement between two parties in which one party, the buyer, agrees to buy from the other party, the seller, an underlying asset at a later date for a price established at the start of the contract.

Forward price or forward rate The fixed price or rate at which the transaction scheduled to occur at the expiration of a forward contract will take place. This price is agreed on at the initiation date of the contract.

Forward rate agreement (FRA) A forward contract calling for one party to make a fixed interest payment and the other to make an interest payment at a rate to be determined at the contract expiration.

Forward swap A forward contract to enter into a swap.

Futures commission merchants (FCMs) Individuals or companies that execute futures transactions for other parties off the exchange.

Futures contract A variation of a forward contract that has essentially the same basic definition but with some additional features, such as a clearinghouse guarantee against credit losses, a daily settlement of gains and losses, and an organized electronic or floor trading facility.

Futures exchange A legal corporate entity whose shareholders are its members. The members of the exchange have the privilege of executing transactions directly on the exchange.

Gamma A numerical measure of how sensitive an option's delta is to a change in the underlying.

Hedge ratio The relationship of the quantity of an asset being hedged to the quantity of the derivative used for hedging.

Hedging A general strategy usually thought of as reducing, if not eliminating, risk.

Historical method A method of estimating VAR that uses data from the returns of the portfolio over a recent past period and compiles this data in the form of a histogram.

Historical simulation method Another term for the historical method of estimating VAR. This term is somewhat misleading in that the method involves not a *simulation* of the past but rather what *actually happened* in the past, sometimes adjusted to reflect the fact that a different portfolio may have existed in the past than is planned for the future.

Homogenization Creating a contract with standard and generally accepted terms, which makes it more acceptable to a broader group of participants.

Implied repo rate The rate of return from a cash-and-carry transaction implied by the futures price relative to the spot price.

Implied volatility The volatility that option traders use to price an option, implied by the price of the option and a particular option-pricing model.

Implied yield A measure of the yield on the underlying bond of a futures contract implied by pricing it as though the underlying will be delivered at the futures expiration.

Index amortizing swap An interest rate swap in which the notional principal is indexed to the level of interest rates and declines with the level of interest rates according to a predefined scheduled. This type of swap is frequently used to hedge securities that are prepaid as interest rates decline, such as mortgage-backed securities.

Index option An option in which the underlying is a stock index.

Initial margin requirement The margin requirement on the first day of a transaction as well as on any day in which additional margin funds must be deposited.

Interest rate call An option in which the holder has the right to make a known interest payment and receive an unknown interest payment.

Interest rate cap or cap A series of call options on an interest rate, with each option expiring at the date on which the floating loan rate will be reset, and with each option having the same exercise rate. A cap in general can have an underlying other than an interest rate.

Interest rate collar A combination of a long cap and a short floor, or a short cap and a long floor. A collar in general can have an underlying other than an interest rate.

Interest rate floor or floor A series of put options on an interest rate, with each option expiring at the date on which the floating loan rate will be reset, and with each option having the same exercise rate. A floor in

general can have an underlying other than the interest rate.

Interest rate forward (See *forward rate agreement*)

Interest rate option An option in which the underlying is an interest rate.

Interest rate parity A formula that expresses the equivalence or parity of spot and forward rates, after adjusting for differences in the interest rates.

Interest rate put An option in which the holder has the right to make an unknown interest payment and receive a known interest payment.

Interest rate swap A swap in which the underlying is an interest rate. Can be viewed as a currency swap in which both currencies are the same and can be created as a combination of currency swaps.

In-the-money Options that, if exercised, would result in the value received being worth more than the payment required to exercise.

Intrinsic value or exercise value The value obtained if an option is exercised based on current conditions.

Inverse floater A floating-rate note or bond in which the coupon is adjusted to move opposite to a benchmark interest rate.

Law of one price The condition in a financial market in which two financial instruments or combinations of financial instruments can sell for only one price. Equivalent to the principle that no arbitrage opportunities are possible.

Legal risk The risk that the legal system will not enforce a contract in case of dispute or fraud.

Leveraged floating-rate note or leveraged floater A floating-rate note or bond in which the coupon is adjusted at a multiple of a benchmark interest rate.

Limit down A limit move in the futures market in which the price at which a transaction would be made is at or below the lower limit.

Limit move A condition in the futures markets in which the price at which a transaction would be made is at or beyond the price limits.

Limit up A limit move in the futures market in which the price at which a transaction would be made is at or above the upper limit.

Liquidity The ability to trade a futures contract, either selling a previously purchased contract or purchasing a previously sold contract.

Liquidity risk The risk that a financial instrument cannot be purchased or sold without a significant concession in price due to the size of the market.

Locked limit A condition in the futures markets in which a transaction cannot take place because the price would be beyond the limits.

London Interbank Offer Rate (LIBOR) The Eurodollar rate at which London banks lend dollars to other London banks; considered to be the best representative rate on a dollar borrowed by a private, high-quality borrower.

Long The buyer of a derivative contract. Also refers to the position of owning a derivative.

Long-term equity anticipatory securities (LEAPS) Options originally created with expirations of several years.

Lower bound The lowest possible value of an option.

Macaulay duration The duration before dividing by $1 + y_B$. The term, named for one of the economists who first derived it, is used to distinguish the calculation from modified duration. See also *modified duration.*

Maintenance margin requirement The margin requirement on any day other than the first day of a transaction.

Margin The amount of money that a trader deposits in a margin account. The term is derived from the stock market practice in which an investor borrows a portion of the money required to purchase a certain amount of stock. In futures markets, there is no borrowing so the margin is more of a down payment or performance bond.

Market risk The risk associated with interest rates, exchange rates, and equity prices.

Marking to market A procedure used primarily in futures markets in which the parties to a contract settle the amount owed daily. Also known as the *daily settlement.*

Model risk The use of an inaccurate pricing model for a particular investment, or the improper use of the right model.

Modified duration An adjustment of the duration for the level of the yield. Contrast with *Macaulay duration.*

Moneyness The relationship between the price of the underlying and an option's exercise price.

Monte Carlo simulation method An approach to estimating VAR that produces random outcomes to examine what might happen if a particular risk is faced. This method is widely used in the sciences as well as in business to study a variety of problems.

Netting When parties agree to exchange only the net amount owed from one party to the other.

Nondeliverable forwards (NDFs) Cash-settled forward contracts, used predominately with respect to foreign exchange forwards.

Normal backwardation The condition in futures markets in which futures prices are lower than expected spot prices.

Normal contango The condition in futures markets in which futures prices are higher than expected spot prices.

Off-market FRA A contract in which the initial value is intentionally set at a value other than zero and therefore requires a cash payment at the start from one party to the other.

Offsetting A transaction in exchange-listed derivative markets in which a party re-enters the market to close out a position.

Operations risk or operational risk The risk of loss from failures in a company's systems and procedures (for example, due to computer failures or human failures) or events completely outside of the control of organizations (which would include "acts of God" and terrorist actions).

Option A financial instrument that gives one party the right, but not the obligation, to buy or sell an underlying asset from or to another party at a fixed price over a specific period of time. Also referred to as contingent claims.

Option price, option premium, or premium The amount of money a buyer pays and seller receives to engage in an option transaction.

Out-of-the-money Options that, if exercised, would require the payment of more money than the value received and therefore would not be currently exercised.

Overnight index swap (OIS) A swap in which the floating rate is the cumulative value of a single unit of currency invested at an overnight rate during the settlement period.

Payer swaption A swaption that allows the holder to enter into a swap as the fixed-rate payer and floating-rate receiver.

Payment netting A means of settling payments in which the amount owed by the first party to the second is netted with the amount owed by the second party to the first; only the net difference is paid.

Payoff The value of an option at expiration.

Performance guarantee A guarantee from the clearinghouse that if one party makes money on a transaction, the clearinghouse ensures it will be paid.

Plain vanilla swap An interest rate swap in which one party pays a fixed rate and the other pays a floating rate, with both sets of payments in the same currency.

Position trader A trader who typically holds positions open overnight.

Potential credit risk The risk associated with the possibility that a payment due at a later date will not be made.

Pre-investing The strategy of using futures contracts to enter the market without an immediate outlay of cash.

Present (price) value of a basis point (PVBP) The change in the bond price for a 1 basis point change in yield. Also called *basis point value* (BPV).

Price discovery A feature of futures markets in which futures prices provide valuable information about the price of the underlying asset.

Price limits Limits imposed by a futures exchange on the price change that can occur from one day to the next.

Protective put An option strategy in which a long position in an asset is combined with a long position in a put.

Put An option that gives the holder the right to sell an underlying asset to another party at a fixed price over a specific period of time.

Put–call parity An equation expressing the equivalence (parity) of a portfolio of a call and a bond with a portfolio of a put and the underlying, which leads to the relationship between put and call prices.

Put–call–forward parity The relationship among puts, calls, and forward contracts.

Ratio spread An option strategy in which a long position in a certain number of options is offset by a short position in a certain number of other options on the same underlying, resulting in a risk-free position.

Receiver swaption A swaption that allows the holder to enter into a swap as the fixed-rate receiver and floating-rate payer.

Regulatory risk The risk associated with the uncertainty of how derivative transactions will be regulated or with changes in regulations.

Replacement value The market value of a swap.

Rho The sensitivity of the option price to the risk-free rate.

Risk budgeting The establishment of objectives for individuals, groups, or divisions of an organization that takes into account the allocation of an acceptable level of risk.

Risk governance The setting of overall policies and standards in risk management.

Risk management The process of identifying the level of risk an entity wants, measuring the level of risk the entity currently has, taking actions that bring the actual level of risk to the desired level of risk, and monitoring the new actual level of risk so that it continues to be aligned with the desired level of risk.

Risk-neutral probabilities Weights that are used to compute a binomial option price. They are the probabilities that would apply if a risk-neutral investor valued an option.

Risk-neutral valuation The process by which options and other derivatives are priced by treating investors as though they were risk neutral.

Sandwich spread An option strategy that is equivalent to a short butterfly spread.

Scalper A trader who offers to buy or sell futures contracts, holding the position for only a brief period of time. Scalpers attempt to profit by buying at the bid price and selling at the higher ask price.

Scenario analysis A risk management technique involving the examination of the performance of a portfolio under specified situations. Closely related to *stress testing.*

Seats Memberships in a derivatives exchange.

Settlement date or payment date The date on which the parties to a swap make payments.

Settlement period The time between settlement dates.

Settlement price The official price, designated by the clearinghouse, from which daily gains and losses will be determined and marked to market.

Settlement risk When settling a contract, the risk that one party could be in the process of paying the counterparty while the counterparty is declaring bankruptcy.

Short The seller of a derivative contract. Also refers to the position of being short a derivative.

Single-payment loan A loan in which the borrower receives a sum of money at the start and pays back the entire amount with interest in a single payment at maturity.

Spread An option strategy involving the purchase of one option and sale of another option that is identical to the first in all respects except either exercise price or expiration.

Storage costs or carrying costs The costs of holding an asset, generally a function of the physical characteristics of the underlying asset.

Straddle An option strategy involving the purchase of a put and a call with the same exercise price. A straddle is based on the expectation of high volatility of the underlying.

Strangle A variation of a straddle in which the put and call have different exercise prices.

Strap An option strategy involving the purchase of two calls and one put.

Stress testing A risk management technique in which the risk manager examines the performance of the portfolio under market conditions involving high risk and usually high correlations across markets. Closely related to *scenario analysis.*

Strip An option strategy involving the purchase of two puts and one call.

Structured note A variation of a floating-rate note that has some type of unusual characteristic such as a leverage factor or in which the rate moves opposite to interest rates.

Swap An agreement between two parties to exchange a series of future cash flows.

Swap spread The difference between the fixed rate on an interest rate swap and the rate on a Treasury note with equivalent maturity; it reflects the general level of credit risk in the market.

Swaption An option to enter into a swap.

Synthetic call The combination of puts, the underlying, and risk-free bonds that replicates a call option.

Synthetic forward contract The combination of the underlying, puts, calls, and risk-free bonds that replicates a forward contract.

Synthetic index fund An index fund position created by combining risk-free bonds and futures on the desired index.

Synthetic put The combination of calls, the underlying, and risk-free bonds that replicates a put option.

Tax risk The uncertainty associated with tax laws.

Tenor The original time to maturity on a swap.

Termination date The date of the final payment on a swap; also, the swap's expiration date.

Theta The rate at which an option's time value decays.

Time to expiration The time remaining in the life of a derivative, typically expressed in years.

Time value decay The loss in the value of an option resulting from movement of the option price toward its payoff value as the expiration day approaches.

Time value or speculative value The difference between the market price of the option and its intrinsic value, determined by the uncertainty of the underlying over the remaining life of the option.

Total return swap A swap in which one party agrees to pay the total return on a security. Often used as a credit derivative, in which the underlying is a bond.

Tracking error The condition in which the performance of a portfolio does not match the performance of an index that serves as the portfolio's benchmark.

Transaction exposure The risk associated with a foreign exchange rate on a specific business transaction such as a purchase or sale.

Translation exposure The risk associated with the conversion of foreign financial statements into domestic currency.

Underlying An asset that trades in a market in which buyers and sellers meet, decide on a price, and the seller then delivers the asset to the buyer and receives payment. The underlying is the asset or other

derivative on which a particular derivative is based. The market for the underlying is also referred to as the spot market.

Valuation The process of determining the value of an asset or service.

Value The amount for which one can sell something, or the amount one must pay to acquire something.

Value at risk (VAR) A probability-based measure of loss potential for a company, a fund, a portfolio, a transaction, or a strategy over a specified period of time.

Variation margin Additional margin that must be deposited in an amount sufficient to bring the balance up to the initial margin requirement.

Vega The relationship between option price and volatility.

Yield beta A measure of the sensitivity of a bond's yield to a general measure of bond yields in the market that is used to refine the hedge ratio.

Yield spread The difference between the yield on a bond and the yield on a default-free security, usually a government note, of the same maturity. The yield spread is primarily determined by the market's perception of the credit risk on the bond.

Zero-cost collar A transaction in which a position in the underlying is protected by buying a put and selling a call with the premium from the sale of the call offsetting the premium from the purchase of the put. It can also be used to protect a floating-rate borrower against interest rate increases with the premium on a long cap offsetting the premium on a short floor.

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Analysis of Derivatives for the CFA® Program: Equations

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3-3. Value of Futures Contract During Its Life

$v_{t+}(T) = f_t(T) - f_{t-1}(T)$ *an instant before the account is marked to market*

$v_{t-}(T) = 0$ *as soon as the account is marked to market*

3-4. Futures Price When Underlying Has No Costs, Benefits, or Cash Flows

$$f_0(T) = S_0(1+r)^T$$

3-5. Futures Price When Underlying Has Storage Costs

$$f_0(T) = S_0(1+r)^T + FV(SC,0,T)$$

3-6. Futures Price When Underlying Generates Positive Cash Flows

$$f_0(T) = S_0(1+r)^T - FV(CF,0,T)$$

3-7. Futures Price When Underlying Generates Costs Minus Benefits

$$f_0(T) = S_0(1+r)^T + FV(CB,0,T)$$

3-8. Treasury Bill Futures Price

$$f_0(h) = B_0(h+m)[1 + r_0(h)]^{h/365}$$

3-9. Implied Repo Rate for Treasury Bill Futures

$$r_0(h)^* = \left[\frac{f_0(h)^*}{B_0(h + m)}\right]^{365/h} - 1$$

3-10. Discount Rate Implied by Treasury Bill Futures Price

$$r_0^{df}(h) = [1 - f_0(h)]\left(\frac{360}{m}\right)$$

3-11. Treasury Note and Bond Futures Price

$$f_0(T) = B_0^c(T + Y)[1 + r_0(T)]^T - FV(CI,0,T)$$

3-12. Treasury Note and Bond Futures Price Based on Conversion Factor

$$f_0(T) = \frac{B_0^c(T + Y)[1 + r_0(T)]^T - FV(CI,0,T)}{CF(T)}$$

3-13. Stock Index Futures Price Based on Compound Value of Dividends

$$f_0(T) = S_0(1 + r)^T - FV(D,0,T)$$

3-14. Stock Index Futures Price Based on Present Value of Dividends

$$f_0(T) = [S_0 - PV(D,0,T)](1 + r)^T$$

3-15. Stock Index Futures Price Based on Discrete Dividend Yield: Variation 1

$$f_0(T) = \left(\frac{S_0}{(1 + \delta)^T}\right)(1 + r)^T$$

3-16. Stock Index Futures Price Based on Discrete Dividend Yield: Variation 2

$$f_0(T) = S_0(1 - \delta^*)(1 + r)^T$$

3-17. Stock Index Futures Price Based on Continuous Dividends

$$f_0(T) = (S_0 e^{-\delta^c T})e^{r^c T}$$

3-18. Currency Futures Price Based on Discrete Interest

$$f_0(T) = \left(\frac{S_0}{(1 + r^f)^T}\right)(1 + r)^T$$

3-19. Currency Futures Price Based on Continuous Interest

$$f_0(T) = (S_0 e^{-r^{f_c} T})e^{r^c T}$$

CHAPTER 4: Option Markets and Contracts

4-1. Payoff of Interest Rate Call

$$\text{(Notional Principal)Max(0,Underlying rate at expiration} - \text{Exercise rate)}\left(\frac{\text{Days in underlying rate}}{360}\right)$$

4-2. Payoff of Interest Rate Put

$$\text{(Notional Principal)Max(0,Exercise rate} - \text{Underlying rate at expiration)}\left(\frac{\text{Days in underlying rate}}{360}\right)$$

4-3. Value at Expiration (Payoff) of European and American Calls

$$c_T = \text{Max}(0,S_T - X)$$
$$C_T = \text{Max}(0,S_T - X)$$

4-4. Value at Expiration (Payoff) of European and American Puts

$$c_T = \text{Max}(0, X - S_T)$$
$$P_T = \text{Max}(0, X - S_T)$$

4-5. Minimum Values of European and American Calls and Puts

$$c_0 \geq 0, C_0 \geq 0$$
$$p_0 \geq 0, P_0 \geq 0$$

4-6. Maximum Values of European and American Calls

$$c_0 \leq S_0, C_0 \leq S_0$$

4-7. Maximum Values of European and American Puts

$$p_0 \leq X/(1 + r)^T, P_0 \leq X$$

4-8. Lower Bounds (Intrinsic Values) of American Calls and Puts

$$C_0 \geq \text{Max}(0, S_0 - X)$$
$$P_0 \geq \text{Max}(0, X - S_0)$$

4-9. Lower Bounds of European and American Calls

$$c_0 \geq \text{Max}[0, S_0 - X/(1 + r)^T]$$
$$C_0 \geq \text{Max}[0, S_0 - X/(1 + r)^T]$$

4-10. Lower Bounds of European and American Puts

$$p_0 \geq \text{Max}[0, X/(1 + r)^T - S_0]$$
$$P_0 \geq \text{Max}(0, X - S_0)$$

4-11. Relationship Between Prices of Calls of Different Expirations

$$c_0(T_2) \geq c_0(T_1)$$
$$C_0(T_2) \geq C_0(T_1)$$

4-12. Relationship Between Prices of Puts of Different Expirations

$p_0(T_2)$ can be either greater or less than $p_0(T_1)$

$$P_0(T_2) \geq P_0(T_1)$$

4-13. Put–Call Parity for European Options

$$c_0 + X/(1 + r)^T = p_0 + S_0$$

4-14. Relationship Between American and European Call and Put Prices

$$C_0 \geq c_0$$
$$P_0 \geq p_0$$

4-15. Hedge Ratio for Binomial Model

$$n = \frac{c^+ - c^-}{S^+ - S^-}$$

4-16. European Call Prices in One-Period Binomial Model

$$c = \frac{\pi c^+ + (1 - \pi)c^-}{1 + r}$$

4-17. Risk-Neutral (Binomial) Probability

$$\pi = \frac{1 + r - d}{u - d}$$

4-18. European Call Prices at Time 1 in Two-Period Binomial Model

$$c^{+} = \frac{\pi c^{++} + (1 - \pi)c^{+-}}{1 + r}$$

4-19. European Call Prices at Time 2 in Two-Period Binomial Model

$$c^{-} = \frac{\pi c^{-+} + (1 - \pi)c^{--}}{1 + r}$$

4-20. Hedge Ratios for Two-Period Binomial Model

$$n = \frac{c^{+} - c^{-}}{S^{+} - S^{-}}$$

$$n^{+} = \frac{c^{++} - c^{+-}}{S^{++} - S^{+-}}$$

$$n^{-} = \frac{c^{-+} - c^{--}}{S^{-+} - S^{--}}$$

4-21. Black–Scholes–Merton Model for Calls and Puts

$$c = S_0 N(d_1) - Xe^{-r^c T} N(d_2)$$

$$p = Xe^{-r^c T}[1 - N(d_2)] - S_0[1 - N(d_1)]$$

4-22. d_1 and d_2 in Black–Scholes–Merton Model

$$d_1 = \frac{\ln(S_0/X) + [r^c + (\sigma^2/2)]T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

4-23. Option Delta

$$\text{Delta} = \frac{\text{Change in option price}}{\text{Change in underlying price}}$$

4-24. Payoffs of Options on Futures

$$c_T = \text{Max}[0, f_T(T) - X]$$

$$p_T = \text{Max}[0, X - f_T(T)]$$

4-25. Minimum and Maximum Prices of European and American Options on Futures

$$0 \le c_0 \le f_0(T)$$

$$0 \le C_0 \le f_0(T)$$

$$0 \le p_0 \le X/(1 + r)^T$$

$$0 \le P_0 \le X$$

4-26. Lower Bounds of European Options on Futures

$$c_0 \ge \text{Max}\{0, [f_0(T) - X]/(1 + r)^T\}$$

$$p_0 \ge \text{Max}\{0, [X - f_0(T)]/(1 + r)^T\}$$

4-27. Lower Bounds (Intrinsic Values) of American Options on Futures

$$C_0 \ge \text{Max}[0, f_0(T) - X]$$

$$P_0 \ge \text{Max}[0, X - f_0(T)]$$

4-28. Put–Call Parity for Options on Forward Contracts

$$c_0 + [X - F(0,T)]/(1 + r)^T = p_0$$

CHAPTER 5: Swap Markets and Contracts

5-1. Fixed Rate on Interest Rate Swap

$$FS(0, n, m) = \frac{1.0 - B_0(h_n)}{\sum_{j=1}^{n} B_0(h_j)}$$

5-2. Market Value of Equity Swap During Its Life

$$\left(\frac{S_t}{S_0}\right) - B_t(h_n) - FS(0,n,m) \sum_{j=1}^{n} B_t(h_j)$$

5-3. Payoff of Payer Swaption

$$Max[0, FS(0, n, m) - x] \sum_{j=1}^{n} B_0(h_j)$$

5-4. Payoff of Receiver Swaption

$$Max[0, x - FS(0, n, m)] \sum_{j=1}^{n} B_0(h_j)$$

CHAPTER 6: Risk Management Applications of Forward and Futures Strategies

6-1. Sensitivity of Futures Price to Yield Change

$$\Delta f \simeq -MDUR_f f \, \Delta y_f$$

6-2. Sensitivity of Bond Yield to Implied Yield on Bond Futures

$$\Delta y_B = \beta_y \Delta y_f$$

6-3. Hedge Ratio for Bond Futures

$$N_f = -(MDUR_B/MDUR_f)(B/f)\beta_y$$

6-4. Number of Bond Futures to Adjust Duration

$$N_f = \left(\frac{MDUR_T - MDUR_B}{MDUR_f}\right)\left(\frac{B}{f}\right)\beta_y$$

6-5. Number of Stock Index Futures to Adjust Beta

$$N_f = \left(\frac{\beta_T - \beta_S}{\beta_f}\right)\left(\frac{S}{f}\right)$$

6-6. Number of Stock Index Futures to Create Synthetic Index Fund

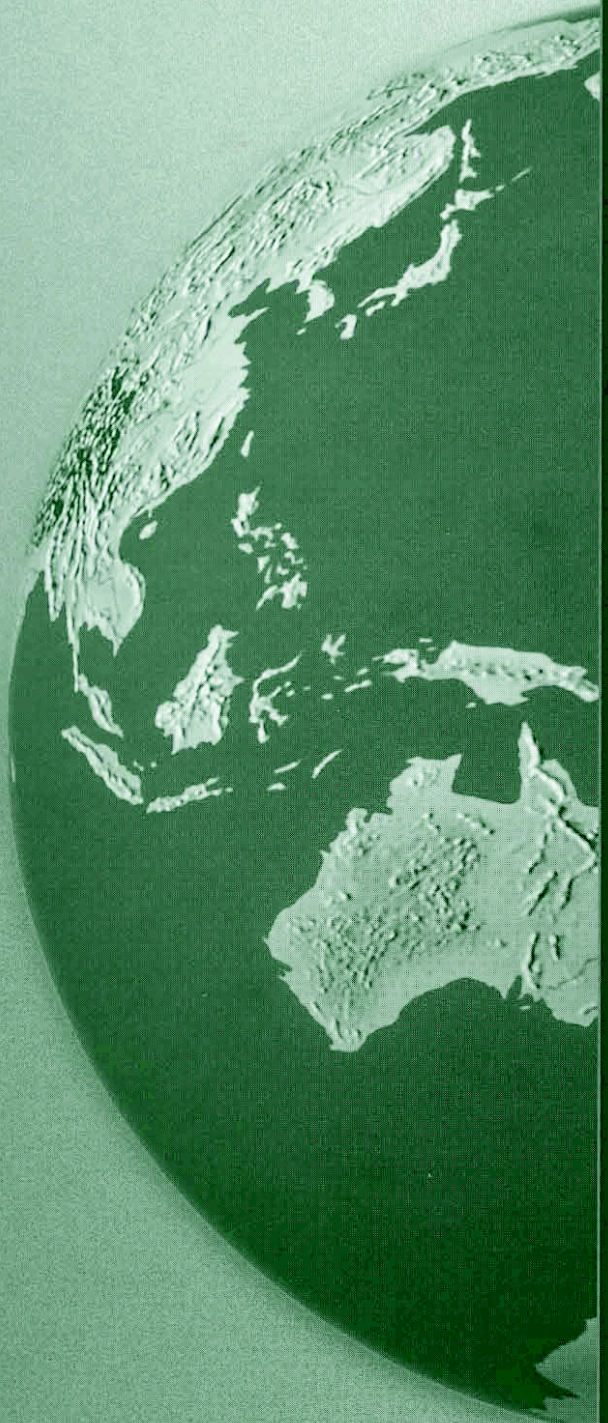
$$N_f^* = \frac{V(1 + r)^T}{qf} \qquad \text{(rounded to an integer)}$$

6-7. Effective Amount Invested in Synthetic Index Fund Using Futures

$$V^* = \frac{N_f^* qf}{(1 + r)^T}$$

6-8. Effective Amount of Stock Converted to Cash Using Futures

$$V^* = \frac{-N_f^* qf}{(1 + r)^T}$$



Analysis of Derivatives for the CFA® Program

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