# CHAPTER 1

# Futures Market Fundamentals

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The precise origins of the futures markets are obscure but arguably might be traced back to ancient Greece or medieval Europe or perhaps Japan. Modern futures markets as we know them today emerged from the North American grain trade as it evolved during the nineteenth century, driven in large part by the development of grain transportation patterns in the central and eastern United States. In more recent times since the early to mid-1970s, a variety of financial futures have been introduced in addition to the more traditional agricultural or physical commodity futures markets. These instruments now cover products as diverse as interest rate, equity, and foreign exchange markets but have been extended to include somewhat more esoteric items including real estate values, economic indicators, and even weather conditions.

Whereas futures were once regarded as arcane trading vehicles largely used by speculators in search of outsized profits, they are now widely regarded and accepted by institutional and retail traders alike as a legitimate and even essential component of many investment and risk-management programs. The popularity of these instruments has in fact grown to achieve immense scale. The notional value of futures transacted frequently exceeds the values traded in the underlying markets to which these futures are tied. In the process, these instruments have focused attention and interest on Chicago as the epicenter of futures market developments and innovation.

CME Group stands out as the leader in this regard, representing the amalgam of futures exchanges including Chicago Mercantile Exchange (CME), Chicago Board of Trade (CBOT), New York Mercantile Exchange (NYMEX), and Commodity Exchange (COMEX).

It is beyond the scope of this chapter to discuss the many direct and less subtle uses of these versatile risk management and investment tools. Rather, it is our intent to introduce and discuss the fundamental terminology and concepts associated with the futures markets in general and the specific instruments traded on CME Group as the leading derivatives trading organization whose products are distributed worldwide and attract active participation from all parts of the globe.

## WHAT IS A FUTURES CONTRACT?

Perhaps the first and most fundamental question to consider is simply, "What is a futures contract?" A simple answer is that a futures contract represents a standardized commitment to make or take delivery of a specific quantity and quality commodity or security during a specified future delivery month. For example, one may transact CME Group futures contracts based on $1 million face value of Eurodollars; or $100,000 face value of 10-year Treasury notes; or based on a value equal to $50 times the venerable Standard & Poor's 500 (S&P 500) stock price index; or, 12.5 million Japanese yen; or 40,000 pounds of live cattle; or 1,000 barrels of crude oil. Actually, the question becomes a bit more complicated to the extent that not all futures contracts actually call for the physical delivery of the underlying product or security. As discussed later, many futures contracts are settled in cash and never actually entail a physical delivery.

Because futures contracts trading on a particular exchange are standardized or generic, they are *fungible* and readily offset. A fungible item is one that is precisely alike another. Futures are fungible in the sense that one (for example) March 2008 CME Eurodollar futures contract is exactly like every other March 2008 CME Eurodollar futures contract and can be used to offset a previous transaction. That is, a market participant may buy, or "go long," a March 2008 CME Eurodollar futures contract and subsequently sell a March 2008 CME Eurodollar contract at the prevailing market price before entering the delivery or cash settlement process. As a result, the original commitment to buy is canceled. Or a market participant may sell, or "go short," futures and subsequently buy at the prevailing market price before entering the settlement or delivery process. This series of transactions means that the original commitment to sell is canceled.

Although we often speak of the futures markets in the generic, it is noteworthy that futures exchanges also typically offer options on futures contracts. Options generally come in the form of call options and put options. A *call option* conveys the right to buy, or go long (for example), one Eurodollar futures contract at a specific strike or exercise price on or before a specific expiration date. A *put option* conveys the right to sell, or go short (for example), one Japanese yen futures contract at a specific strike or exercise price on or before a specific expiration date. One may either buy or sell (or *write*) puts or calls and, as such, there are four fundamental transactions one may engage in with respect to options. The buyer of an option pays a negotiated premium or price to the seller or writer of an option in consideration for rights received by the buyer and obligations assumed by the seller.

Futures and options on futures contracts (or, simply put, futures markets) are generally considered exchange-traded derivatives. That is, they are developed by organized exchanges authorized by the appropriate government agencies to offer futures trading to an institutional and retail public audience. Exchanges exist fundamentally to allocate access to the trading process. Not too many years ago, futures were largely traded via "open outcry" in physical trading pits that were crowded by many local traders and floor brokers. Accordingly, exchanges sold memberships in an auction-like process to allocate access to the physically confined space in a trading pit. Today, however, roughly 85% of volume in CME Group products is conducted completely electronically through the CME Globex electronic trading platform. Many other futures exchanges around the world operate on a completely electronic basis. As such, distribution and access to the trading process is much enhanced relative to conditions just a few short years ago. Thus, futures market activity in the form of volume or number of contracts traded and open interest or the number of contracts entered into but not yet closed through an offsetting or opposite transaction has been growing very rapidly in the early part of the twenty-first century.

Once a futures trade is executed or matched, records of such transaction are reported to the exchange clearinghouse. The classic explanation is that, once executed and cleared, regardless of the actual counterparty to the specific transaction, the clearinghouse steps in to act as buyer to every seller and seller to every buyer. This is the fundamental nature of a multilateral clearing mechanism that allows transactions to be offset and stricken from the books regardless of who the actual counterparty may be in the opening and closing transactions. Subsequently, a clearinghouse takes on a bookkeeping and surety role by maintaining records of each executed and outstanding futures trade in coordination with the network of brokerage houses and other proprietary trading organizations that act as clearing members of the clearinghouse. These clearing members act on behalf of their ultimate customers by taking financial responsibility for each and every transaction. Market participants holding open futures positions are required to post performance bonds or, in slang, "margins." These margins are generally determined to cover the maximum one day's price movement from close to close with perhaps a 95 to 99% statistical level of confidence.

Futures exchanges are generally closely regulated by the appropriate government agency. In the United States, the Commodity Futures Trading Commission (CFTC) acts as the primary regulator of the futures industry, and the Securities and Exchange Commission (SEC) acts as the primary regulator of the securities industry. This dichotomy is rather unique because a single regulator serves both purposes in most other jurisdictions around the world. In addition, the National Futures Association (NFA) serves as an industry self-regulatory organization to supplement the activities of the CFTC as well as the self-regulatory functions of the exchanges themselves. Note that the CFTC monitors and scrutinizes the rules and operating procedures of U.S. exchanges.

## Historical Development of Futures

Although the origins of futures trading may arguably be traced to ancient Greek or Phoenician times, we recount the development of these markets with a Chicago-centric viewpoint beginning in the early 1800s. Chicago is located at the base of the Great Lakes, close to the farmlands and cattle country of the U.S. Midwest, making it a natural center for transportation, distribution, and trading of agricultural produce. Gluts and shortages of these products caused chaotic fluctuations in price. This led to the development of a market enabling grain merchants, processors, and agriculture companies to trade in "to arrive" or "cash forward" contracts to insulate them from the risk of adverse price change and enable them to hedge.

Forward contracts were quite commonplace at the time. However, forward contracts were quite frequently defaulted on by either the buyer or the seller. For example, consider the execution of a forward contract that calls for the delivery of corn at a fixed price at a fixed date in the future. But if the price of corn dramatically increases by the time the delivery date rolls around, there is a possibility that the seller might default on such delivery, selling his or her corn into the open market at the current higher market price. Or if the price of corn declines dramatically, there is the possibility that the buyer may refuse delivery, opting to purchase his or her corn requirements in the open market at a reduced price. Exacerbating the problem was the fact that these early forward contracts were negotiated bilaterally between two counterparties and were often quite illiquid. An exchange was needed that would bring together potential buyers and sellers of a commodity instead of shifting the burden of finding counterparties to the individual market participants.

The epicenter for much of the early trade in grain forward contracts (nearly futures contracts) was in the city of Buffalo, New York. Buffalo was strategically located as an important bulk grain transshipment hub upon the completion of the Erie Canal in 1825 that linked the Great Lakes to the Hudson River and on to New York City and European export centers. In fact, forward trading in grain sprung up at several cities on the Great Lakes system, including Chicago, Duluth, Toledo, and Milwaukee. Forward trading of various types of grain and other agricultural produce grew up at many other important hubs along other U.S. waterways along the Mississippi and its tributaries, such as Minneapolis, Kansas City, Memphis, and New Orleans; along the Atlantic in New York and Baltimore; and eventually by the early twentieth century on the West Coast in Seattle, Portland, San Francisco, and Los Angeles.

But Chicago emerged as a particularly strategic transshipment point by 1848 with the completion of the Illinois and Michigan Canal along with the completion of the Chicago and Galena Union Railroad. These transportation routes effectively linked the Great Lakes with the Mississippi River system. Eventually, railroad transport proved more economical and became preferred over waterway transport, enhancing Chicago's importance to the extent that a large number of railway systems used Chicago as a key hub in connecting the fertile Midwest farm fields to the bulk of the consuming population on the East Coast and beyond to European export markets.

Thus, the Chicago Board of Trade (CBOT) was formed in 1848 and emerged over time as the preeminent grain exchange. Trading was originally in forward contracts; the first contract on corn was written on March 13, 1851. Standardized futures contracts were introduced on the CBOT in 1865.

In a parallel development, the Chicago Produce Exchange (CPE) was established in 1874, specializing in the cash trade of butter and eggs. The year 1882 witnessed the first use of "time contracts," essentially a futures contract, on the CPE. Several reorganizations saw the introduction of the Produce Exchange Butter & Egg Board (1895) and then the Chicago Butter and Egg Board as a splinter group in 1898. Eventually, in 1919, the Chicago Butter and Egg Board became formally known as Chicago Mercantile Exchange (CME), adopting renewed resolve to promote the use of time or futures contracts and with the foresight that other commodities could be added to the product line in coming years.

The Great Depression of the 1930s, followed by strict price controls of agricultural products during World War II, put a damper on commodity trading. In particular, the postwar support price of $0.25 effectively did away with butter as a viable futures contract. Trading in other agricultural commodities, including potatoes and onions, was introduced but eventually discontinued, sometimes amid turbulent circumstances. Throughout this period, CME's fortunes were flagging. But the 1960s saw renewed vigor at the exchange, led by a group of so-called young Turks including Leo

Melamed, along with a commitment to develop new product lines. As a result, CME launched products in pork bellies (1961), live cattle (1965), and live hogs (1966), breathing new life into the institution.

Deflated grain prices in the postwar period led to some degree of stagnation at the CBOT as well. By the early 1970s, the CBOT was looking far from its origins for new sources of growth. It financed the development of organized stock option trading by creating the Chicago Board Options Exchange (CBOE). As such, "financial" in additional to agricultural or physical commodities started to become fair game for the nation's futures exchanges.

Financial futures trace their origins from the early 1970s and established a revolutionary new direction for the industry. Leo Melamed created the International Monetary Market (IMM) in 1971 for the purpose of developing financial futures. The concept took form in 1972 with the introduction of foreign currency futures including the British pound, Canadian dollar, German mark, Japanese yen, Mexican peso, and Swiss franc. This roughly coincided with the breakdown of the postwar Bretton Woods system, which generally had provided for fixed international exchange rates, in favor of floating market-driven exchange rates. These products quickly emerged as the first successful financial futures products, opening up new vistas for the futures industry. (The IMM was merged with CME by 1976.)

Subsequent years saw the development of financial futures contracts focused on trading in interest rates. These contracts included the GNMA CDR contract introduced on the CBOT in 1975 as the very first interest rate futures contract. This initiative was quickly followed in the late 1970s and throughout the 1980s by products including CME Treasury bills, CBOT Treasury bonds, 10-year, 5-year, and 2-year Treasury notes, and the 90-day Eurodollar contract introduced on CME in 1981. These interest rate contracts had an enormous impact on the financial landscape in general and served to invigorate the development of other derivatives on an over-the-counter (OTC) basis including the interest rate swap (IRS) market. Stock index futures followed soon thereafter with the development of the Value Line Composite Average (VLCA) futures contract on the Kansas City Board of Trade, followed quickly by CME's Standard & Poor's 500 (S&P 500) contract as well as the Nasdaq 100 and Russell 2000 contracts and the Dow Jones Industrial Average (DJIA) offered on CBOT.

Despite the development of financial futures in the early 1970s, the decade proved to be one during which physical commodity trading reigned supreme. In particular, the 1970s witnessed a tremendous surge of inflation that pervaded the U.S. economy to the point that we saw double-digit inflation in the United States in 1979 for the first and only time on record to date. The roots of this massive inflation date back to the 1960s and President Johnson's Great Society social programs, the cost of financing the Vietnam War, and resulting federal spending deficits, generally financed through growth in money supplies. Upward pressure on grain values was further heightened with the Russian grain deal of 1973, which permitted large-scale grain exports from the United States to the then Soviet Union.

As a result, trading of physical commodity futures thrived in the 1970s, led by commodities including grains (soybeans and its derivatives, corn, and wheat on the CBOT) and precious metals (traded on the COMEX in New York as well as on the Chicago exchanges). Brokerage of these markets was led in large part by parochial and often family-owned firms, many headquartered in Chicago and concentrating on retail brokerage activities. This retail clientele viewed futures trading, rightly or wrongly, as a means of hedging against the ravages of inflation.

By the early 1980s, the federal government had begun to take steps to combat this inflation. In one of his last and most enduring acts, President Carter appointed Paul Volcker to step in as chairman of the Federal Reserve. Volcker took bold steps to control inflation by crimping the growth of money supplies, which in the process provided a huge impetus for the acceptance and growth of financial futures.

A fundamental macroeconomic concept balances money supplies with gross domestic product (GDP) or the cost multiplied by the supply of goods and services available in an economy. Further, federal spending must be financed through the aggregation of taxes collected plus funds raised through debt issuance plus money supply growth. If federal spending is financed by large growth in money supplies and productivity in an economy, that is, the availability of goods and services cannot expand to match money supply growth, then the cost of such goods and services must increase. In other words, inflation will be observed.

By establishing limited targets for money supply growth, Volcker essentially forced the federal government to finance deficits through new taxes or by issuing debt. Politicians frequently find it difficult to raise taxes, so, at least in the short term, it was obvious that federal debt issuance would increase sharply and interest rates would soar. This was tough but courageous medicine for an economy accustomed to liberal federal spending programs.

Interest rates did indeed soar in the early 1980s with the prime bank lending rate increasing to over 20%. As a result, commodity price increases were curbed. Those retail speculators who had embraced physical commodities as a hedge against inflation soon found that they could open a money market account and earn upward to 20% in annual interest with little or no risk. Thus, a simple money market investment drew significant interest away from those physical commodity markets.

But in the process, it created tremendous risks for financial institutions holding Treasury, corporate, mortgage, or other debt instruments. As interest rates soared, the price of those debt instruments plummeted. Compounding the problem was a general inversion in the shape of the interest rate yield curve. While interest rates generally increased, short-term rates increased far more sharply than long-term rates. Many banks and savings and loan (S&L) institutions accustomed to borrowing short and lending long found themselves in a massive squeeze. The government reacted by liberalizing the approved activities of federally insured S&Ls. But this prompted some to engage in ever riskier investment activities, sometimes to excess. The fallout of this situation was the eventual collapse of many S&Ls and a resulting large-scale federal bailout with the formation of the Resolution Trust Corporation (RTC), established to liquidate the assets of those failed institutions.

In the short term, Volcker's policies caused much financial turmoil. But in the long term, this courageous policy of tough love, in a monetary policy sense, was effective. Inflation fell from dangerous double-digit territory in 1979 to –3% by 1985. In the process, institutions came to embrace financial futures as an everyday part of their risk-management activities. This policy further breathed life into the domestic stock market, which had stagnated in a long-term holding pattern since the late 1960s. By 1982, equities commenced on a long-term bull trend that continued into the twenty-first century. Finally, the Plaza Hotel Accord of 1985, in which the major economic powers agreed to a long-term devaluation of the U.S. dollar versus other major currencies, led to a long-term bull market in currency futures. The Basel Accord of 1988, which established reserve requirements for international banks, provided breaks for investment in low-risk government securities. This began a long-lived bull trend in government-issued securities across the globe.

The upshot of these developments and market trends is that those retail speculators of the 1970s were largely replaced in the 1980s by institutional risk managers in the futures markets. Retail commodity investors generally began to find a commodity outlet in managed accounts or commodity funds operated by trading professionals. Those family-owned commodity boutique brokerage firms were superseded by New York–based broker-dealers, who viewed futures as one part of the mix of financial products they must offer to their customers to remain competitive. International investors soon found use for financial futures as well. In particular, Japanese corporations were earning huge dollar-denominated revenues and investing those dollars in Treasury securities to the point where Japanese investors were routinely taking upward of 50% of new Treasury auctions. Thus, Japanese and European broker-dealers were joining the Chicago exchanges as clearing members by the late 1980s.

Options on futures contracts were added to the product offerings of futures exchanges by 1982. These contracts offer an added level of sophistication to the risk-management activity of institutional investors. Adding even greater depth has been the development of OTC derivatives in the form of interest rate swaps, currency forwards, credit derivatives, and other instruments that have developed on a generally parallel and largely complementary basis to exchange-traded futures and options on futures.

Futures exchanges outside of the United States have been developed with a nod to EUREX, a subsidiary of the Deutsche Bourse; the London International Financial Futures Exchange (LIFFE) affiliated with Euronext, the European exchange conglomerate; the Singapore Exchange Ltd. (SGX); and numerous others. Interestingly, these exchanges have largely adopted the framework and contract designs established by the Chicago exchanges as the model for their development.

The early to mid-1990s saw another interesting trend in the form of the widespread adaptation of electronic trading systems. These systems, including the CME Globex electronic trading platform, provide exchanges with a way to enhance distribution of, and access to, their product lines. Exchanges are no longer constrained to offering products on a time-zone specific basis in a physical trading environment, intensifying competition among the global exchange community. As of this writing, approximately 85% of the volume on CME Group is directed through the Globex system, and many other exchanges are completely electronic.

Coming hand in hand with the widespread acceptance of electronic trading mechanisms has been a trend toward demutualization among the exchange community. In the past, exchanges were typically organized for the purpose of developing trading opportunities for the express benefit of the exchange membership. But CME, for example, demutualized by adopting a for-profit corporate structure in 2000 and engaged in an initial public offering (IPO) in 2002. Because exchange goals are focused on the profit motive, this is further intensifying competition among derivatives exchanges.

Inevitably, mergers, acquisitions, and other partnership combinations have become relatively common within the exchange community. The IntercontinentalExchange (ICE) had its origins in the late 1990s in the OTC energy derivatives markets but eventually entered the futures markets by acquiring the International Petroleum Exchange (IPE), now ICE Futures, a prominent energy futures exchange. ICE further acquired the New York Board of Trade (NYBOT), specializing in the trade of international "soft" commodities including coffee, cocoa, and sugar as well as cotton. In 2006, the venerable New York Stock Exchange (NYSE) took steps to acquire the LIFFE's "Euronext" electronic exchange to form the first transcontinental securities and derivatives exchange.

CME implemented an historic common clearing link with the CBOT in 2003. As such, CME began providing clearing and settlement services for all CBOT products. In 2006, CME began hosting trading of New York Mercantile Exchange (NYMEX) energy and COMEX metals products on the CME Globex electronic trading platform. These alliances eventually evolved into full-fledged acquisitions. CME was reorganized under the auspices of CME Group and the CME and CBOT holding companies were merged in 2007. This brought together CME's short-term interest rates, stock indexes, currency, and livestock businesses with CBOT's Treasury and grain businesses. Soon thereafter in 2007, CME Group acquired NYMEX and COMEX, bringing together a vast array of energy and metals products under the same roof. The CME, CBOT, NYMEX, and COMEX continue to operate as Self-Regulatory Organizations (SROs) under the auspices of CME Group as the holding company.

As such, the futures markets have transcended their modest midwestern agricultural origins. They have risen in stature to become essential risk-management and trading tools of international financial institutions in all corners of the globe. They are distributed widely, and there is intense competition to find new and innovative futures products that will appeal to the growing audience of market participants.

### Chicago as Futures Innovation Epicenter

Although Chicago is by no means the only venue for successful futures trading, noting that the concept has spread far and wide across the globe, Chicago is nonetheless generally viewed as the epicenter of the futures world. And for good reason: The product designs that have been pioneered in Chicago have been widely mimicked across the globe.

This extends to several basic financial futures contract designs including (1) the so-called IMM Index methodology for quoting short-term interest rate futures first deployed by CME in the context of its T-bill futures introduced in 1977; (2) the CBOT's bond/note contract design featuring a conversion factor invoicing system; (3) the cash settlement mechanism first successfully deployed by CME in the context of its Eurodollar futures in 1981; and (4) the now universal design for stock index futures, which introduced the concept of cash settlement to a fixed monetary multiplier times the index value.

These concepts have been applied to a wide variety of contracts. In particular, CME Group boasts of perhaps the most widely diversified product line of any derivatives exchange worldwide. Principal CME Group product lines and specific product offerings include (1) interest rates including Eurodollars and Treasury contracts; (2) stock index futures including the

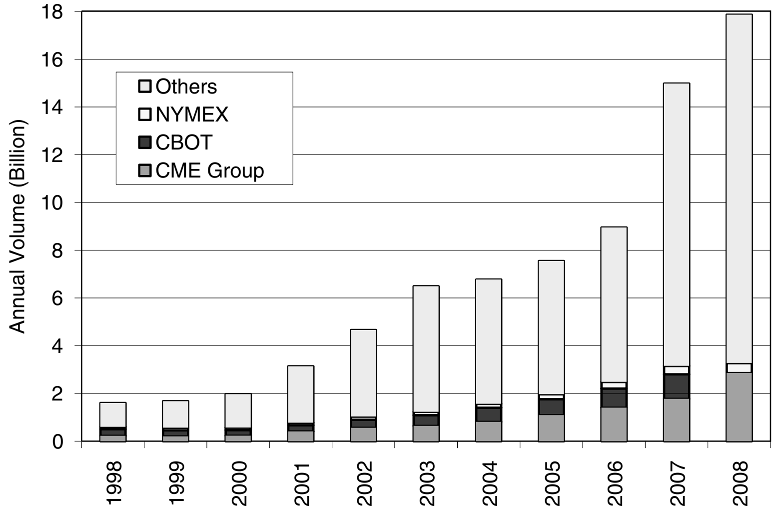


**EXHIBIT 1.1** Worldwide Futures Annual Contract Volume
*Note:* CBOT folded into CME Group by 2008.

S&P 500, Nasdaq 100, DJIA, Nikkei 225, and MSCI EAFE; (3) currencies including the euro, Japanese yen, British pound, Swiss franc, Canadian dollar, Chinese renminbi, and South Korean won; (4) agricultural commodities including grains such as corn, wheat, soybeans, soybean meal, and soybean oil, along with livestock such as live cattle and lean hogs; (5) energy products including crude oil, natural gas, gasoline, and heating oil; (6) metals such as gold, silver, and copper; and (7) so-called alternative products including weather, economic indicators, and real estate.

Other important futures contracts based domestically and abroad include German Bunds and Bobls; Euribor rates; stock indexes, including the euro STOXX, FTSE 100, CAC 40, and DAX; energy products, including crude oil, natural gas, heating oil, and gasoline; soft commodities such as coffee, sugar, and cocoa; and metals including gold, silver, and copper. Worldwide growth of the futures industry (excluding single-stock futures) is depicted in Exhibit 1.1.

### Physical Delivery versus Cash Settlement

A particularly important innovation that enabled the futures markets to grow sharply over the years was the development of cash settlement. Prior to the first successful application of a cash settlement mechanism with the introduction of Eurodollar futures on the CME in 1981, futures contracts generally culminated or were satisfied with an actual physical delivery of a commodity or book entry delivery of a security (e.g., delivery of 40,000 pounds of cattle, transfer of 12.5 million Japanese yen, 5,000 bushels of soybeans, etc.).

Actually, a physical settlement remains the preferred method of constructing a futures contract from the perspective of many financial engineers. The reason is simple: A physical delivery guarantees that cash and futures prices will come together, or "converge," by the time the delivery period comes around. This convergence is a key requirement for a futures contract lest the contract fails to track or price or correlate closely with the commodity, security, or other instrument on which the contract is based.

Before an actual delivery, futures may trade at either a premium or a discount to the cash or spot value. Often, the difference, or *basis*, between cash and futures prices represents "cost of carry" considerations; that is, the basis will reflect the costs associated with buying, carrying, and eventually delivering the spot or cash instrument in satisfaction of an expiring futures contract. For example, one may buy gold bullion and simultaneously sell gold futures with the intent of delivering that gold in the future in satisfaction of the futures contract. In the process, one may finance the carry of the gold bullion by borrowing at prevailing short-term interest rates. The cost of carrying that gold may be reflected in a futures price that is higher than, or in excess of, the spot value of gold bullion. Gold futures calling for delivery in subsequent or deferred months may be priced at higher and higher levels, reflecting greater accruals of interest charges over extended periods of time.

Sometimes, and this is frequently the case in the context of financial futures, the underlying instrument generates a return or a payout of income. For example, a Treasury note generates semiannual coupon payments, stocks generate dividend income, and a foreign currency may be invested at the prevailing foreign interest rate. Receipt of such income reduces the cost of buying and holding the underlying instrument. Thus, futures prices may reflect the spot value of the underlying instrument plus finance charges minus any payout.

$$\text{Futures Price} \cong \text{Spot Value} + \text{Finance Charges} - \text{Payouts}$$

Sometimes those payouts may exceed finance charges, and sometimes the reverse is true. For example, in a normal upwardly sloped yield curve environment where long-term rates exceed short-term financing rates, the price of Treasury bond or note futures should be less than and run to successively lower and lower levels in successively deferred months out into the future. This condition is known as *positive carry* because the payout associated with buying and carrying the bond or note may exceed short-term financing rates.

Consider the normal situation in stock index futures in which dividend yields are less than short-term interest rates. Under these circumstances, stock index futures will be expected to trade at higher and higher levels out into the future. This condition is known as *negative carry* because the payout associated with buying and carrying stocks is less than the cost of financing. Currency futures may price at either positive or negative carry depending on the relationship between interest rates in the two countries whose currencies are represented. For example, a Japanese yen futures contract essentially represents the value of Japanese yen priced in U.S. dollars, and the relationship between Japanese short-term rates (the payout) and U.S. short-term rates (finance charges) dictates whether positive or negative carry prevails.

The terms *positive carry* and *negative carry* are typically applied in the context of financial futures. Positive and negative carry is enforced by arbitrageurs who monitor the value of the basis and take action where profits are possible. For example, if futures were to price at a value that was much greater than the ''carry price,'' then arbitrageurs might be expected to buy cash and sell futures, eventually delivering the underlying instrument in satisfaction of the futures contract. In the process, the arbitrageur would bid up cash prices and/or push down futures, eventually reestablishing ''equilibrium'' pricing conditions. Or if futures were to price at values much less than the carry price, arbitrageurs might sell cash and buy futures, eventually taking repossession of the subject instrument through the futures delivery process and, once again, reestablishing equilibrium pricing conditions.

Physical commodities, including grains, metals, or energy futures, do not produce a payout of any sort. Theoretically, their values should price at higher and higher levels in successively deferred contract months to reflect the cost of financing. This would be known as a *contango*. But other times, these physical commodities may price at levels that are equal to or even lower than the spot commodity value. A *backwardation* is said to occur when these commodities price at levels less than the spot or cash price.

Why might a backwardation occur? Cost of carry pricing conditions are enforced by arbitrage. But where an arbitrage is difficult or costly or possibly impossible altogether, cost of carry pricing may break down. Instead, market pricing may simply be dictated by the influx of buy and sell orders into the market. The volume and timing of those buy and sell orders may be dictated by investor expectations regarding the future course of prices (i.e., traders anticipate future market trends and act accordingly). We may refer to this condition as an ''anticipatory pricing model.''

Some physical commodities price very closely in accordance with cost of carry. For example, the arbitrage is quite efficient in the context of gold and silver futures. Thus, gold and silver futures prices and the spreads between those prices closely reflect prevailing short-term interest rates. But how easy is it to conduct an arbitrage in the context of West Texas Intermediate (WTI) crude oil futures? The NYMEX WTI contract calls for the delivery of 1,000 barrels of oil in Cushing, Oklahoma. But without the requisite infrastructure to facilitate such delivery, one is generally best advised to refrain from participation in a delivery. As such, crude oil futures may resort to an anticipatory pricing model to a larger extent than futures where the arbitrage is facile and inexpensive to conduct.

Still, cash and futures prices must come closer and closer together, and the basis must converge as delivery approaches. But the lynchpin to such convergence and to a cost of carry pricing model is the delivery mechanism. The threat, if not the actual realization of a delivery, is key to the arbitrage that enforces the cost of carry pricing model in a futures market. As such, futures contract designers go to some lengths to develop facile delivery mechanisms.

But sometimes it becomes exceedingly cumbersome to facilitate a delivery. Consider, for example, the S&P 500 stock index, which references 500 different equities. Or the MSCI EAFE, which references in the neighborhood of 1,000 stocks from 21 countries. To the extent that the bookkeeping associated with the delivery of 500 or 1,000 stocks in the appropriate ratios as reflected in the index weightings would be exceedingly difficult, the futures industry developed the cash settlement mechanism.

A cash settlement implies that the futures market is marked-to-market (MTM) on a daily basis just like all futures contracts. In other words, both buyers and sellers pay any losses or collect any profits daily based on the closing or settlement value of the futures contract relative to the prior day's settlement value. But on the final day, the futures settlement price is established at the final settlement value (e.g., the spot value of the S&P 500 or MSCI EAFE). Buyers and sellers are subject to a final mark-to-market at such value, and their positions are liquidated or stricken from the books. That is, their positions simply expire and are settled at the spot value of the underlying index or instrument.

For many years, the futures industry had refrained from adopting this simple but effective mechanism. This hesitancy was due to a number of factors, not the least of which was concern that a cash-settlement mechanism might fall under the jurisdiction of state gambling statutes. These legal and regulatory concerns were laid to rest in the early 1980s, however, and the Eurodollar futures contract was established. This contract is settled to the spot value of Three-Month Eurodollar Interbank Time, a key rate to which many bank loans and OTC interest rate swaps are settled.

This development paved the way for the introduction of myriad stock index futures contracts and many other contracts cutting across all futures market sectors, including commodities, interest rates, equities, currencies, and alternative investment markets such as weather and real estate. History has proven that a cash settlement can be equally effective in ensuring cash/futures convergence as a traditional physical delivery provided that the value to which the contract is finally settled is essentially insusceptible to manipulation.

## Regulatory Landscape of Derivatives Markets

Derivatives may generally be thought of as products that are, quite simply, derived or based off another existing cash or spot or other type of product or financial instrument of a securitized or nonsecuritized nature. Although we focus on exchange-traded futures contracts, they are certainly not the sole form of derivative instrument.

A vast number of derivatives are traded on an OTC basis as well. These OTC derivatives may take the form of forward contracts, swaps, options, and possibly other formats that may not be so readily classified. Further, a variety of derivatives may be registered as securities including stock options and exchange-traded funds (ETFs) based on popular stock indexes, frequently the very same stock indexes that form the basis for popular futures contracts. In some cases, these instruments serve similar purposes or functions. Still, there are some important fundamental distinctions not only in terms of the regulatory environment in which these products reside but also in terms of operation and function (see Exhibit 1.2).

A futures contract may be considered quite similar to an OTC forward contract. Both call for the deferred delivery of, or cash settlement against, some specified financial instrument, value, or commodity. But they are quite different in some significant respects. A forward contract is generally negotiated privately between two counterparties on a bilateral basis as opposed to a multilateral auction-like market that typifies the exchange trading model. However, the OTC market is making growing use of electronic trading platforms to negotiate transactions, blurring the distinction between OTC derivatives and exchange-traded futures.

The financial integrity of OTC derivatives is generally not guaranteed by a clearinghouse although there is movement in that direction in many market sectors. Rather the counterparties generally rely on each other's creditworthiness to secure the transaction. It has become increasingly commonplace, however, for OTC derivative dealers to require collateral resembling a performance bond or margin in a futures context from their customers. Frequently, large institutions establish bilateral netting agreements whereby the cash flows associated with all the various bilateral derivatives deals between the two counterparties are netted for purposes of simplifying money transfers (see Exhibit 1.3).

**EXHIBIT 1.2** Financial Market Regulatory Ecosystem

| | OTC Derivatives | Futures | Securities |
|---|---|---|---|
| Primary products | Interest rate products, primarily swaps (IRSs), account for 70% of market; 8% currencies; 7% in credit derivatives with the rest in equity, and commodity derivatives | Dominated by interest rate and stock index markets; currencies, energy products, grains, livestock, precious and industrial metals also traded | Primarily equities, fixed-income securities, mutual funds, stock options, ETFs |
| Product structure | Very flexible; negotiated bilaterally between counterparties | Generally highly defined structures with limited flexibility | Generally highly defined structures with limited flexibility |
| Regulation | Largely exempt from direct regulation but participation generally restricted to institutions | Closely regulated by government agencies; the CFTC is the relevant U.S. regulator | Closely regulated by government agencies; the SEC is the relevant U.S. regulator |
| Market structure | Sold through loose networks of dealers mostly on a "voice" basis with growing use of electronic trading platforms | Traded on regulated exchanges and sold through "Futures Commission Merchants" (FCMs) per U.S. regulation | Traded on regulated security exchanges and through OTC activities of broker/dealers |
| Participants | Banks, broker/dealers, funds | Institutional and qualified retail traders | Institutional and qualified retail traders |
| Clearing | Contracts held bilaterally; counterparty credit risk becomes a prime concern | Cleared on multilateral basis, guaranteed by a clearinghouse (e.g., CME Clearing House) | Generally cleared on multilateral basis; guaranteed by a clearinghouse (e.g., DTCC or OCC) |

**EXHIBIT 1.3** Notional Value of Over-the-Counter Derivatives Market (Billions USD)

| | Dec-03 | Dec-04 | Dec-05 | Dec-06 | Dec-07 | Dec-08 |
|---|---|---|---|---|---|---|
| TOTAL OTC CONTRACTS | 197,167 | 257,894 | 297,666 | 414,845 | 595,341 | 591,963 |
| Foreign exchange contracts | 24,475 | 29,289 | 31,360 | 40,271 | 56,238 | 49,753 |
| Forwards and FX swaps | 12,387 | 14,951 | 15,873 | 19,882 | 29,144 | 24,562 |
| Currency swaps | 6,371 | 8,223 | 8,504 | 10,792 | 14,347 | 14,725 |
| Options | 5,717 | 6,115 | 6,984 | 9,597 | 12,748 | 10,466 |
| Interest rate contracts | 141,991 | 190,502 | 211,970 | 291,582 | 393,138 | 418,678 |
| Forward rate agreements | 10,769 | 12,789 | 14,269 | 18,668 | 26,599 | 39,262 |
| Interest rate swaps | 111,209 | 150,631 | 169,106 | 229,693 | 309,588 | 328,114 |
| Options | 20,012 | 27,082 | 28,596 | 43,221 | 56,951 | 51,301 |
| Equity-linked contracts | 3,787 | 4,385 | 5,793 | 7,488 | 8,469 | 6,494 |
| Forwards and swaps | 601 | 756 | 1,177 | 1,767 | 2,233 | 1,632 |
| Options | 3,186 | 3,629 | 4,617 | 5,720 | 6,236 | 4,862 |
| Commodity contracts | 1,406 | 1,443 | 5,434 | 7,115 | 8,455 | 4,427 |
| Gold | 344 | 369 | 334 | 640 | 595 | 395 |
| Other commodities | 1,062 | 1,074 | 5,100 | 6,475 | 7,861 | 4,032 |
| Forwards and swaps | 420 | 558 | 1,909 | 2,813 | 5,085 | 2,471 |
| Options | 642 | 516 | 3,191 | 3,663 | 2,776 | 1,561 |
| Credit default swaps | | 6,396 | 13,908 | 28,650 | 57,894 | 41,868 |
| Single-name instruments | | 5,117 | 10,432 | 17,879 | 32,246 | 25,730 |
| Multi-name instruments | | 1,279 | 3,476 | 10,771 | 25,648 | 16,138 |
| Unallocated | 25,508 | 25,879 | 29,199 | 39,740 | 71,146 | 70,742 |
| Exchange-traded derivatives | 36,788 | 46,594 | 57,789 | 70,444 | 79,099 | 59,797 |
| Interest rate contracts | 33,917 | 42,769 | 52,297 | 62,593 | 71,051 | 54,432 |

(*continued*)

**EXHIBIT 1.3** (*Continued*)

| | Dec-03 | Dec-04 | Dec-05 | Dec-06 | Dec-07 | Dec-08 |
|---|---|---|---|---|---|---|
| Foreign exchange contracts | 118 | 164 | 174 | 240 | 291 | 227 |
| Equity index contracts | 2,753 | 3,660 | 5,318 | 7,611 | 7,757 | 5,138 |
| CME Group contracts | 14,289 | 19,135 | 25,713 | 29,432 | 39,083 | 27,651 |

*Source:* Bank for International Settlements (BIS).

OTC derivative transactions are generally not fungible. That is, once the transaction is entered, it may generally only be offset by mutual agreement of both parties. Frequently, even offsetting transactions reside on the books of both counterparties until the transaction comes to full term. This is different than a futures transaction in which offsetting transactions are stricken from the books through the multilateral clearing process. Still, there are some ‘‘tear-up’’ services that identify offsetting transactions in the records of one or more institutions as a means of cleaning up the books. Further, there is a growing trend to extend full-blown multilateral clearing or processing services to the OTC derivatives industry.

Whatever the differences, the usefulness of OTC and exchange-traded derivative products is reflected in terms of their sheer size, rapid growth, and acceptance. As of the end of 2008, the Bank for International Settlements (BIS) estimated there was $592 trillion in outstanding notional value of OTC derivatives worldwide, with another $60 trillion in outstanding notional value in exchange-traded derivatives. If we add those numbers together, we might estimate the notional value of outstanding derivatives of the OTC and exchange-traded variety at $652 trillion as of the conclusion of 2008 or approximately double the $355 trillion counted just three years earlier in December 2005.

That $652 trillion in outstanding notional value of the worldwide derivatives market dwarfs the size of the global spot or cash capital markets by a margin of perhaps 2 to 1 or better, which may give some cause for concern. Note, however, that these are notional values. The notional amount associated with a derivative represents ‘‘the amount on which interest and other payments are based. Notional principal typically does not change hands; it is simply a quantity used to calculate payments. Although notional principal is the most commonly used measure in derivatives markets, it is not an accurate measure of credit exposure . . . which is typically far less than reported notional amounts outstanding.’’[1]

Why the apparent disparity between the notional value of OTC and exchange-traded markets? Actually, these numbers can be a bit misleading because of differences in accounting practices associated with OTC derivatives and exchange-traded derivatives. OTC derivatives are typically transacted as bilateral agreements between the two counterparties. Thus, it is commonplace for a trader, for example, to purchase an interest rate swap from one counterparty and subsequently sell a swap with the same terms to another counterparty, thus offsetting one's risk exposure completely. Still, both transactions are typically carried on one's books until the full term of the agreement, possibly many years later. This creates more reported notional value outstanding.

In the words of Alan Greenspan, "notional values are not meaningful measures of the risks associated with derivatives. Indeed it makes no sense to talk about the market risk of derivatives; such risk can be measured meaningfully only on an overall portfolio basis, taking into account both derivatives and cash positions, and the offsets between them."[2]

Exchange-traded derivatives such as futures, however, use multilateral clearing facilities where transactions among all parties are assigned to a central clearinghouse and offset, thereby reducing open interest or reported notional values outstanding. Thus, it is not strictly accurate to compare reported outstanding notional values of OTC and exchange-traded derivatives. Greenspan explains that a risk comparison "depends critically on the extent to which netting and margining procedures are employed to mitigate the risks. In the case of exchange-traded contracts, of course, daily variation settlements by clearing houses strictly limit, if not totally eliminate, such counterparty risks."[3]

A more reasonable comparison may be found in reported turnover or volume statistics. Although derivatives volume on exchanges is reported on a daily and even on a real-time basis, volume in the (fragmented) OTC markets is not frequently reported to any central facilities. But the BIS conducts a triennial survey of activity as shown in Exhibit 1.4. Note that activity in exchange-traded derivatives at $6,173 billion on a daily basis in April 2007 exceeded the $4,198 billion recorded in OTC derivatives markets by almost a 2-to-1 margin.

Many derivatives are registered and transacted in the United States and in other jurisdictions as securities. Certainly, the stock option markets have grown up in the United States since the early 1970s as a vibrant industry replete with a half-dozen exchanges competitively trading options on the very same equity instruments, including the American Stock Exchange (AMEX), Boston Options Exchange (BOX), Chicago Board Options Exchange (CBOE), International Securities Exchange (ISE), Pacific Stock Exchange (PCX), and the Philadelphia Stock Exchange (PHLX). As you can see in Exhibit 1.5, volumes in 2008 exceeded 3.5 billion contracts.

**EXHIBIT 1.4** Turnover in Over-the-Counter Derivatives Market (Average Daily Turnover in April, Notional Value in Billions)

| | 1995 | 1998 | 2001 | 2004 | 2007 |
|---|---|---|---|---|---|
| Foreign exchange turnover | $688 | $959 | $853 | $1,303 | $2,319 |
| Outright forwards and FX swaps | $643 | $862 | $786 | $1,163 | $2,076 |
| Currency swaps | $4 | $10 | $7 | $21 | $32 |
| Options | $41 | $87 | $60 | $117 | $212 |
| Other | $1 | $0 | $0 | $2 | $0 |
| Interest rate turnover | $151 | $265 | $489 | $1,025 | $1,686 |
| Forwards (FRAs) | $66 | $74 | $129 | $233 | $258 |
| Swaps | $63 | $155 | $331 | $621 | $1,210 |
| Options | $21 | $36 | $29 | $171 | $215 |
| Other | $2 | $0 | $0 | $0 | $1 |
| Estimated gap in reporting | | $39 | $43 | $92 | $193 |
| Total derivatives turnover | $880 | $1,265 | $1,385 | $2,420 | $4,198 |
| Turnover at 4/07 FX rates | | $1,410 | $1,700 | $2,550 | $4,198 |
| Exchange-traded derivatives | $1,221 | $1,382 | $2,198 | $4,547 | $6,173 |
| Currency contracts | $17 | $11 | $10 | $22 | $72 |
| Interest rate contracts | $1,204 | $1,371 | $2,188 | $4,524 | $6,101 |

*Source:* Bank for International Settlements (BIS).

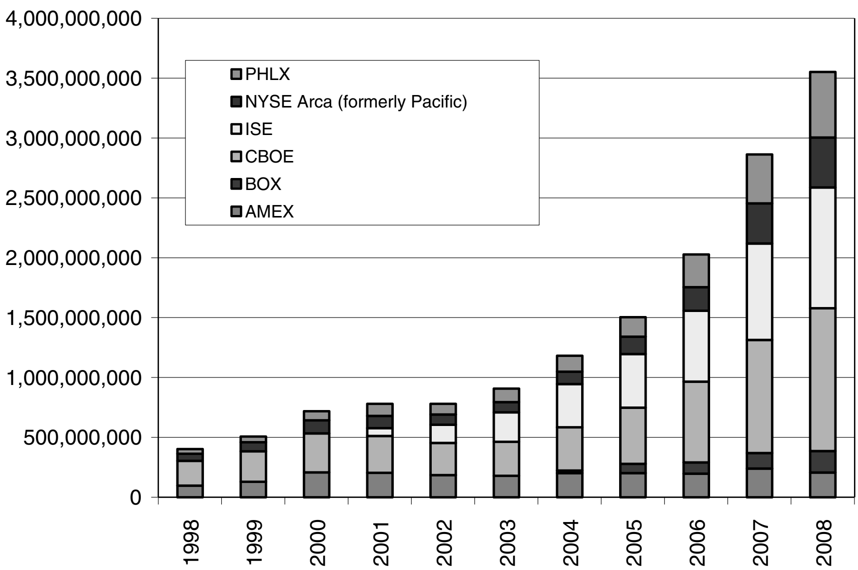


**EXHIBIT 1.5** Domestic Stock Option Volume

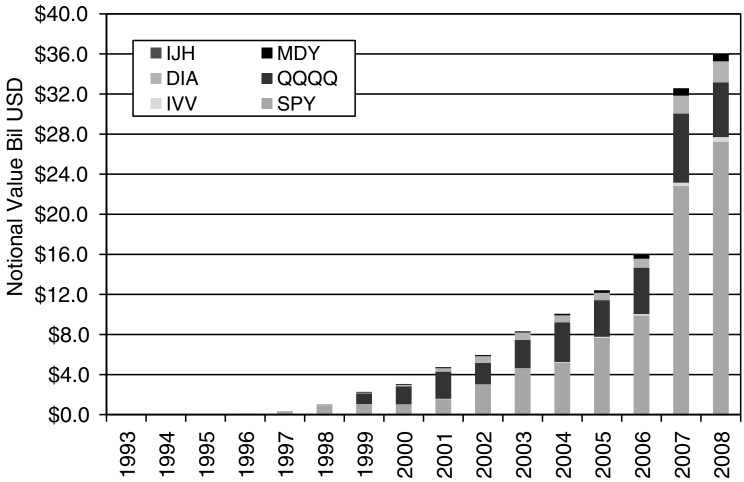


**EXHIBIT 1.6** Volume in Popular ETFs

In the early 1990s, the concept of an exchange-traded fund (ETF) was introduced, and it has grown to become a very popular means of gaining exposure to a portfolio of stocks that comprise popular stock indexes including the Standard & Poor's 500 (Ticker: SPY and IVV), the Nasdaq 100 (Ticker: QQQQ), Dow Jones Industrial Average (Ticker: DIA), S&P Mid-Cap 400 (Tickers: MDY and IJH), and hundreds of other indexes. These securities are akin to futures in the sense that they are highly regulated (by the SEC), traded on organized exchanges, and subject to a multilateral clearing system. Growth in the ETF market has been nothing short of spectacular in recent years (see Exhibit 1.6).

## OVERVIEW OF POPULAR FINANCIAL FUTURES CONTRACTS

Whereas the futures trade has its roots in agriculture, the most popular and fastest growing contracts tend to be financial in character. Thus, let us review the characteristics of some of the most popular currency, interest rate, and stock index futures contracts.

### Currency Futures

Currency futures were the very first financial futures contracts, successfully introduced on CME in 1972. They are available on a variety of foreign currencies, the most popular of which are futures based on the British pound, Canadian dollar, euro, Japanese yen, and Swiss franc. These particular contracts call for the actual delivery of these currencies on deposit at designated foreign financial institutions through the Continuous Linked Settlement (CLS) system, which may be thought of as essentially an escrow service ensuring that payment of one currency is made versus the other currency. Currency or FX futures generally call for delivery during the months of March, June, September, and December (the ''March quarterly cycle'').

Japanese yen futures may be quoted as shown in Exhibit 1.7. Note that the contract is quoted in ''American'' terms (i.e., in terms of dollars per foreign unit). This is at variance from the typical interbank practice of quoting foreign exchange transactions in terms of foreign unit per U.S. dollar. Of course, you can convert these quotes from dollars per foreign unit to foreign units per dollar by simply taking the reciprocal. For example, if September Japanese yen futures close at 0.008832 dollars per yen, this may readily be converted into 113.22 Japanese yen per 1 U.S. dollar (1/0.008832).

Take a look at Exhibit 1.8. Traders who ''go long,'' or buy, Japanese yen futures are committed to take or accept delivery of 12,500,000 Japanese yen, whereas traders who ''go short,'' or sell, Japanese yen futures are committed to make delivery of 12,500,000 Japanese yen. The short making delivery is compensated by the buyer accepting delivery by an amount equal to the futures settlement price quoted in U.S. dollars on the last day of trading.

Noting that the Japanese yen futures contract is based on 12,500,000 marks, this means that the September contract was valued at $110,400.00 (= 12,500,000 yen $\times$ 0.008832 dollars/yen). The minimum allowable price fluctuation, or ''tick,'' in yen futures is $0.000001 yen per dollar or $12.50 (= $0.000001 $\times$ 12,500,000 yen). Exhibit 1.8 illustrates the contract specifications associated with Japanese yen futures along with some of other most actively traded CME currency futures.

Many currency futures traded at CME Group call for the actual or physical delivery of the currency in question. But oftentimes it becomes impractical to provide for such delivery when, for example, exchange restrictions are in force with respect to a particular currency. Under such cases, the currency may trade as a non-deliverable forward (NDF) in the OTC or interbank currency markets. There are, in fact, some currency futures contracts based on non-deliverable currencies that are settled in cash upon futures contract expiration. These contracts include the Chinese renminbi, the Russian ruble, and others.

**EXHIBIT 1.7** Quoting Japanese Yen Futures (June 30, 2006)

| Month | Open | High | Low | Settlement | Change | Volume | Open Interest |
|---|---|---|---|---|---|---|---|
| Sep 2006 | 0.008817–0.008816 | 0.008855 | 0.008809A | 0.008832 | +40 | 73,027 | 147,195 |
| Dec 2006 | 0.008962 | 0.008963B | 0.008962 | 0.008946 | +40 | 164 | 20,509 |
| Mar 2007 | | | | 0.009056 | +42 | | 2 |
| June 2007 | | | | 0.009162 | +41 | | 15 |
| Sep 2007 | | | | 0.009266 | +45 | | 10 |
| TOTAL | | | | | | 67,873 | 167,731 |

**EXHIBIT 1.8** Specifications of Popular Foreign Exchange Futures

| | EuroFX Futures | Japanese Yen Futures | British Pound Futures | Swiss Franc Futures |
|---|---|---|---|---|
| Trade unit | 125,000 euros | 12,500,000 yen | 62,500 pounds | 125,000 francs |
| Minimum price fluctuation (tick) | $0.0001 per euro ($12.50) | $0.000001 per yen ($12.50) | $0.0001 per pound ($6.25) | $0.0001 per franc ($12.50) |
| Price limits | No limits | | | |
| Contract months | First six months in March quarterly cycle (March, June, Sep, and Dec) | | | |
| CME Globex trading hours | Sunday through Monday: 5:00 PM to 4:00 PM the following day (Chicago time) | | | |
| Trading ends at | Second business day before third Wednesday of contract month | | | |
| Delivery | Through Continuous Linked Settlement (CLS) facilities | | | |
| Position limits | No limits | | | |
| Ticker | EC | JY | BP | SF |

## Short-Term Interest Rate Futures

T-bill futures were introduced at CME in 1977 and represent the very first short-term interest rate (STIR) futures contract. This contract is notable because it established the model on which many other STIRs traded domestically and abroad were developed. Still, it is the CME Group Eurodollar contract that emerged after an inauspicious beginning in 1981 to become the predominant STIR contract worldwide.

Eurodollar futures are based on a $1 million face-value short-term debt instrument. The contract is settled in cash based on the British Bankers Association (BBA) surveyed rate for three-month Eurodollar interbank time deposits. Of course, a Eurodollar is simply a U.S. dollar on deposit with a bank outside of the United States. A Eurodollar rate may be subtly distinguished from the London Interbank Offered Rate (LIBOR) by reference to the fact that a Eurodollar might technically be held anywhere outside the United States and not simply in a London-domiciled institution.

Exhibit 1.9 illustrates how Eurodollar futures prices are quoted. Eurodollar futures use the IMM index quotation model, originally established in the context of the T-bill contract. Specifically, the IMM index is equal to 100 less the yield on the security. For example, if the yield equals 0.41%, the index equals 99.59. The minimum price fluctuation is generally equal to

**EXHIBIT 1.9** Quoting Eurodollar Futures (November 27, 2009)

| Month | Open | High | Low | Settlement | Change | Volume | Open Interest |
|---|---|---|---|---|---|---|---|
| Dec 2009 | 99.6925 | 99.7100 | 99.6900 | 99.6975 | −4.5 | 266,412 | 1,022,850 |
| Jan 2010 | | | | 99.6700 | −4.5 | 7,395 | 23,075 |
| Feb 2010 | | | | 99.6300 | −5.0 | 278 | 7,534 |
| Mar 2010 | 99.5800 | 99.6050 | 99.5800 | 99.5900 | −4.0 | 298,050 | 1,013,560 |
| Apr 2010 | | | | 99.5450 | −4.0 | | 265 |
| May 2010 | | | | 99.5000 | −3.5 | | 69 |
| Jun 2010 | 99.4550 | 99.4700 | 99.4500 | 99.4550 | −4.5 | 281,544 | 1,013,560 |
| Sep 2010 | 99.2150 | 99.2150 | 99.2000 | 98.2050 | +1.0 | 253,810 | 759,757 |
| Dec 2010 | 98.8900 | 98.8900 | 98.8550 | 98.8750 | +4.5 | 245,380 | 842,695 |
| Mar 2011 | 98.5600 | 98.5600 | 98.5200 | 98.5500 | +7.0 | 200,026 | 546,715 |
| Jun 2011 | 98.2200 | 98.2200 | 98.1800 | 98.2150 | +8.0 | 146,344 | 525,174 |
| Sep 2011 | 97.9100 | 97.9100 | 97.8700 | 97.9150 | +9.0 | 146,169 | 485,362 |
| Dec 2011 | 97.6150 | 97.6150 | 97.5850 | 97.6250 | +9.0 | 64,643 | 264,883 |
| . . . | | | | | | | |

one-half basis point, or 0.005%. Based on a $1 million face-value 90-day instrument, this equates to $12.50, or $25.00 for one full basis point (0.01%). On this day, March 2010 futures fell by 4.0 basis points. This is equal to $100.00 (= 4.0 × $25).

Eurodollar futures (Exhibit 1.10) generally mature during the months of March, June, September, or December (the "March quarterly cycle") plus some intervening "serial months." These contracts are actually listed out upward to 10 years into the future. These long-term listings distinguish Eurodollars, and to a certain extent other STIR contracts, such as the Euribor contract listed on the Euronext LIFFE exchange, from other futures contracts. Most futures contracts are most actively traded in the nearby or front month or months with little activity in the back or deferred months. But STIR futures such as Eurodollars are tied closely to the OTC interest

**EXHIBIT 1.10** Eurodollar Futures Specifications

| | |
|---|---|
| **Unit** | $1 million face-value, 90-day Eurodollar Time Deposits. |
| **Cash settlement** | Cash settlement based on a British Bankers Association rate for three-month Eurodollar Interbank Time Deposits |
| **Quote** | In terms of the IMM index or 100 less the yield (e.g., a yield of 3.39% is quoted as 96.61) |
| **Minimum price fluctuation or "tick"** | One-half basis point (0.005) equals $12.50, except in nearby month where tick is one-quarter basis point (0.0025), or $6.25 |
| **Months** | March quarterly cycle of March, June, September, and December; plus, the first four "serial" months not in the March quarterly cycle |
| **Hours of trade** | Trading on the floor is conducted from 7:20 AM to 2:00 PM. Trading on the CME Globex electronic trading platform is conducted on Mondays to Thursdays from 5:00 PM to 4:00 PM and 2:00 PM to 4:00 PM; Shutdown period from 4:00 PM to 5:00 PM; Sundays and holidays from 5:00 PM to 4:00 PM |
| **Final trading day** | The second London bank business day immediately preceding the third Wednesday of the contract month. If it is a bank holiday in New York City or Chicago, trading terminates on the first London bank business day preceding the third Wednesday of the contract month. If an exchange holiday, trading terminates on the next preceding business day. |
| **Ticker** | ED or GE on electronic system |

rate swap markets, noting that an IRS may be listed out for many years into the future. Thus, there is frequent use of ‘‘back-month’’ Eurodollar futures contracts, enough so to warrant deferred listings out upward to 10 years.

## Long-Term Interest Rate Futures

Bond and note futures call for delivery of debt securities during the months of March, June, September, or December, extending outward more than two years into the future. In fact, most *financial* futures trade for delivery in the March quarterly cycle. Traders who ‘‘go short,’’ or sell futures, are committed to make delivery of $100,000 face-value securities; traders who ‘‘go long,’’ or buy futures, are committed to take delivery of the $100,000 face-value securities. The terms and conditions associated with the most popular Treasury contracts are depicted in Exhibits 1.11A and 1.11B.

The very first interest rate futures contract was introduced on the CBOT in 1975 with the introduction of the GNMA CDR contract based on mortgage-backed securities. Although this contract did not ultimately survive, it did establish a model for long-term interest rate futures contracts worldwide. It was only a few years later in 1977 that the CBOT rolled out its long-term 30-year Treasury bond futures and, subsequently, its 10-, 5-, 3-, 2-year and Treasury note and ultra Treasury bond contracts that were similarly constructed. The insight associated with these contracts is to provide for the delivery of any of a number of eligible-for-delivery securities at the discretion of the short, with an adjustment to the invoice price paid from long to short upon delivery of any particular security.

Treasury futures contracts are quoted, unlike money market instruments such as T-bills and Eurodollars that are quoted on a yield basis, in percent of par to the nearest 1/32nd of 1% of par (see Exhibit 1.12). For example, one may quote a note at 108-12, or 112% of par plus 12/32nds (112.375 on a decimal basis). Thus, a $100,000 face-value security might be priced at $112,375. If the price moves by 1/32nd from 108-12 to 108-13, this equates to a movement of $31.25. Sometimes these instruments, particularly those of shorter maturities, are quoted in finer increments than 1/32nd. For example, one may quote the security to the nearest half of 1/32nd (or 1/64th) or to the nearest quarter of 1/32nd (or 1/128th). A quote in the Treasury futures markets of 108-122 means 112% of par plus 12/32nds plus 1/128th. A quote of 108-125 means 108% of par plus 12/32nds plus 1/64th. Finally, a quote of 108-127 means 108% of par plus 12/32nds plus 3/128ths.

**EXHIBIT 1.11A** Specifications of T-Note Futures

| | 2-Year Note Futures | 3-Year Note Futures | 5-Year Note Futures | 10-Year Note Futures |
|---|---|---|---|---|
| Contract size | $200,000 face-value U.S. Treasury notes | | $100,000 face-value U.S. Treasury notes | |
| Delivery grade | T-notes with original maturity of not more than 5 years and 3 months and remaining maturity of not less than 1 year and 9 months from first of delivery month but not more than 2 years from last day of delivery month | T-notes with original maturity of not more than 5-1/4 years and a remaining maturity of not more than 3 years but not less than 2 years, 9 months, from last day of delivery month | T-notes with original maturity of not more than 5 years and 3 months and remaining maturity of not less than 4 years and 2 months as of first day of delivery month. | T-notes maturing at least 6-½ years but not more than 10 years, from first day of delivery month. |
| Invoice price | Invoice price = settlement price × conversion factor (CF) plus accrued interest; CF = price to yield 6% | | | |
| Delivery method | Via Federal Reserve book-entry wire transfer | | | |
| Contract months | March quarterly cycle: March, June, September, December | | | |
| Trading hours | Open auction: 7:20 AM to 2:00 PM, Monday to Friday; electronic: 6:00 PM to 4:00 PM, Sunday to Friday (Central Standard Times) | | | |
| Last trading and delivery day | Business day preceding last 7 business days of month; last delivery day is last business day of delivery month | | | |
| Price quote | In percent of par to one quarter of 1/32nd of 1% of par ($15.625 rounded up to nearest cent) | | Quoted in percent of par to one half of 1/32nd of 1% of par ($15.625 rounded up to nearest cent) | |

**EXHIBIT 1.11B** Specifications of T-Bond Futures

| | Ultra T-Bond Futures | 30-Year Bond Futures |
|---|---|---|
| Contract size | $100,000 face-value U.S. Treasury bonds | |
| Delivery grade | T-bonds with minimum of 25 years from the first day of delivery month. | T-bonds not callable for 15 years from first day of delivery month; if callable, a minimum maturity of 15 years from first day of delivery month. |
| Invoice price | Invoice price = settlement price × conversion factor (CF) plus accrued interest; CF = price to yield 6% | |
| Delivery method | Via Federal Reserve book-entry wire transfer | |
| Contract months | March quarterly cycle: March, June, September, December | |
| Trading hours | Open auction: 7:20 AM to 2:00 PM, Monday to Friday; electronic: 6:00 PM to 4:00 PM, Sunday to Friday (Central Standard Times) | |
| Last trading and delivery day | Business day preceding last 7 business days of month; last delivery day is last business day of delivery month | |
| Price quote | Quoted in percent of par to 1/32nd of 1% of par ($31.25) | |

**EXHIBIT 1.12** Quoting 10-Year T-Note Futures (March 27, 2007)

| Month | Open | High | Low | Settlement | Change | Volume | Open Interest |
|---|---|---|---|---|---|---|---|
| Jun 2007 | 108-140 | 108-175 | 108-105 | 108-125 | −0-045 | 921,370 | 2,359,230 |
| Sep 2007 | 108-160 | 108-160 | 108-155 | 108-145 | −0-045 | 7,297 | 24,020 |

### Bond and Note Delivery Grade

Delivery months, price quotations, contract size and margins are uniform for Treasury bond and note futures contracts. What differs are the securities that may be delivered against the contracts (see Exhibits 1.11A and 1.11B). Bond and note futures call for the delivery of *nominally* 6% securities with a particular maturity or range of maturities. T-bond futures, for example, call for the delivery of U.S. Treasury bonds that mature or are noncallable for at least 15 years from the date of delivery. Ultra T-bond futures call for the delivery of U.S. Treasury bonds with at least 25 years from the date of delivery. Ten-year note futures call for the delivery of nominally 6% Treasury securities that mature within 6-1/2 to 10 years from delivery. The 5-year note futures contract calls for the delivery of nominally 6% Treasury securities, originally issued as five-year notes, with at least 4 years, 2 months, to maturity. The 3-year note futures contract calls for the delivery of a nominally 6% coupon Treasury security with between 2-3/4 to 3 years until maturity. The two-year note futures contract calls for the delivery of a nominally 6% Treasury security with between 1-3/4 and 2 years until maturity.

These contracts are based on "nominally" 6% instruments. But this does not imply that shorts are required to deliver 6% coupon securities. Ten-year T-note futures, for example, permit the delivery of *any* note with between 6-1/2 and 10 years until maturity regardless of the coupon. At any given time, there may be a wide variety of securities varying widely in coupon and maturity that meet that qualification. Of course, high-coupon securities are worth more than comparable low-coupon securities. Thus, the "invoice price" paid by buyer to seller upon delivery is calculated to reflect the varying values of different coupon and term securities. Accordingly, bond and note futures employ a "conversion factor" invoicing system to reconcile these differences to the standard 6% coupon. Upon delivery of a note or bond, the "principal invoice price" is calculated as the futures settlement price times $1,000 times the conversion factor.

$$\text{Principal Invoice Price} = \text{Futures Settlement} \times \$1,000 \times \text{Conversion Factor}$$

Conversion factors equal the price of the bond or note to be delivered to yield 6%. Thus, securities with coupons in excess of 6% will have conversion factors greater than 1.0. Securities with coupons under 6% will have conversion factors less than 1.0. (See Exhibit 1.13.)

The conversion factor for the delivery of the 4 5/8% Treasury note of February 2017 against the June 2007 T-note futures contract equals 0.9015. This implies that this 4-5/8% note is worth roughly 90% as much as a 6% note. If June futures settle at 108-125, the principal invoice price may be calculated as follows. Interest accrued since the last semiannual interest payment date is added to the principal invoice price to arrive at a final price that the short invoices the long upon delivery.

$$\begin{aligned}\text{Principal Invoice Price} &= 108\text{-}125(108.390625) \times \$1,000 \times 0.9015 \\ &= \$97,714.15\end{aligned}$$

The conversion factor for the delivery of the 4-3/4% Treasury note of May 2014 against the June 2007 T-note futures contract equals 0.9314. This implies that this 4-3/4% note is worth roughly 93% as much as a 6% note. If June futures settle at 108-125, the principal invoice price may be calculated as follows.

$$\begin{aligned}\text{Principal Invoice Price} &= 108\text{-}125(108.390625) \times \$1,000 \times 0.9314 \\ &= \$100,955.03\end{aligned}$$

The conversion factor invoicing system is intended to render equally economic the delivery of any of the deliverable securities. In other words, one should theoretically be indifferent between the delivery of any eligible for delivery security. In practice, however, a single security generally stands out as "cheapest" or most economic to deliver in light of the relationship between cash and futures prices.

The 4 5/8%-17 note may be purchased in the cash market for 100-03 or $100,093.75 for $100,000 face value; the 4-3/4%-14 note may be purchased for 101-04 or $101,125.00 for $100,000 face value (not including accrued interest). Let's compare these values to the previous principal invoice prices.

| | 4-5/8%-17 | 4-3/4%-14 |
|---|---|---|
| Futures | 108-125 | 108-125 |
| × CF | 0.9015 | 0.9314 |
| = Invoice | $97,714.15 | $100,955.03 |
| − Cash | ($100,093.75) | ($101,125.00) |
| = Return | ($2,379.60) | ($169.97) |

**EXHIBIT 1.13** Eligible for Delivery 10-Year T-Notes and Conversion Factors

| Coupon | Maturity Date | Mar-07 | Jun-07 | Sep-07 | Dec-07 | Mar-08 | Jun-08 |
|---|---|---|---|---|---|---|---|
| 4-1/4% | 11/15/13 | 0.9069 | | | | | |
| 4% | 2/15/14 | 0.8902 | 0.8937 | | | | |
| 4-3/4% | 5/15/14 | 0.9294 | 0.9314 | 0.9335 | | | |
| 4-1/4% | 8/15/14 | 0.8983 | 0.9012 | 0.9040 | 0.9069 | | |
| 4-1/4% | 11/15/14 | 0.8955 | 0.8983 | 0.9012 | 0.9040 | 0.9069 | |
| 4% | 2/15/15 | 0.8774 | 0.8806 | 0.8837 | 0.8870 | 0.8902 | 0.8937 |
| 4-1/8% | 5/15/15 | 0.8822 | 0.8851 | 0.8881 | 0.8910 | 0.8941 | 0.8971 |
| 4-1/4% | 8/15/15 | 0.8873 | 0.8901 | 0.8927 | 0.8955 | 0.8983 | 0.9012 |
| 4-1/2% | 11/15/15 | 0.9013 | 0.9034 | 0.9058 | 0.9080 | 0.9105 | 0.9128 |
| 4-1/2% | 2/15/16 | 0.8990 | 0.9013 | 0.9034 | 0.9058 | 0.9080 | 0.9105 |
| 5-1/8% | 5/15/16 | 0.9398 | 0.9410 | 0.9424 | 0.9436 | 0.9450 | 0.9463 |
| 4-7/8% | 8/15/16 | 0.9209 | 0.9226 | 0.9242 | 0.9259 | 0.9275 | 0.9293 |
| 4-5/8% | 11/15/16 | 0.9015 | 0.9034 | 0.9054 | 0.9074 | 0.9095 | 0.9115 |
| 4-5/8% | 2/15/17 | 0.8995 | 0.9015 | 0.9034 | 0.9054 | 0.9074 | 0.9095 |

This implies that if you deliver the 4-5/8s, a loss of $2,379.60 will result. Delivery of the 4-3/4s results in a loss of only $169.97. Thus, the 4-5/8s are more economic or cheaper to deliver than the 4-3/4s. By performing this analysis for all eligible for delivery securities, one may find the single security that stands out as cheapest or most economic to deliver. Futures prices tend to track or price or correlate most closely with the price of the cheapest to deliver cash security.

What makes one security cheaper to deliver than another? Although the conversion factor system goes a long way toward reconciling the price of a particular security with the 6% standard, certain biases may render a single security as cheapest. When yields are in excess of 6%, the conversion factor system tends to slightly favor the delivery of relatively low-coupon, long-maturity securities. When yields are less than 6%, high-coupon, short-maturity securities may become cheaper. Cash market biases play a strong role as well. For example, some investors prefer discount as opposed to premium securities for tax reasons. The shape of the yield curve can be quite influential as well.

## Stock Index Futures

The most significant stock index based futures contract traded domestically is the S&P 500 or, more specifically, E-mini S&P 500 futures. Other popular stock index futures include the E-mini Nasdaq 100 contract, the MSCI EAFE contract, and the $5 DJIA contract. All of these contracts share similar design characteristics because all are settled in cash based on the product of the spot index value and a fixed contract multiplier.

In the case of the E-mini S&P 500 contract (Exhibit 1.14), that multiplier equals $50 times the index value. Thus, if the futures contract were trading at 1,428.40 index points, that implies a contract value of $71,420 (= 1,428.40 × $50). Note that these contracts are simply quoted in terms of index points.

This particular contract is considered a ‘‘mini’’ contract to the extent that the original S&P 500 futures contract listed on CME in 1982 was

**EXHIBIT 1.14** Quoting E-mini S&P 500 Futures (December 29, 2006)

| Month | Open | High | Low | Settlement | Change | Volume | Open Interest |
|---|---|---|---|---|---|---|---|
| Mar 2007 | 1,434.25 | 1,437.50 | 1,425.50 | 1,428.40 | −5.40 | 527,676 | 1,481,743 |
| Jun 2007 | 1,446.25 | 1,450.00 | 1,439.00 | 1,441.10 | −5.40 | 424 | 12,788 |
| | | | | | | 528,100 | 1,494,531 |

based on the value of $500 times the index, later amended in 1997 to $250 times the index. Around the same time in 1997, CME also listed a mini-sized version valued at $50 times the index and offered exclusively on the CME Globex electronic trading platform as opposed to a floor or pit trading environment. Thus, the contract was dubbed an ''E-mini,'' and the concept was subsequently deployed with respect to other successful futures including the E-mini Nasdaq 100, E-mini S&P MidCap 400,CBOT's $5 DJIA contract and others (see Exhibit 1.15).

Although these contracts share similar design characteristics, they differ of course with respect to the underlying subject. For example, the S&P 500 is a capitalization-weighted index of 500 stocks listed domestically on the NYSE, Nasdaq system, and the American Stock Exchange (Amex). The S&P 500 may be considered a very broadly representative grouping of large capitalization, or large cap, stocks. The DJIA is a price-weighted index of 30 industrial stocks that represents a relatively narrow grouping of so-called blue-chip stocks. The Nasdaq 100 represents the top 100 nonfinancial stocks listed on Nasdaq and weighted per a

**EXHIBIT 1.15** Specifications for Popular Stock Index Futures

| | E-mini S&P 500 | E-mini NASDAQ 100 | E-mini MidCap 400 | E-mini ($5) DJIA |
|---|---|---|---|---|
| Contact multiplier | $50 × S&P 500 Index | $20 × NASDAQ 100 Index | $100 × S&P MidCap 400 | $5 × Dow Jones Industrial Average |
| Minimum price fluctuation (tick) | 0.25 index points ($12.50) | 0.50 index points ($10.00) | 0.10 index points ($10.00) | 1.00 index points ($5.00) |
| Price limits | Limits at 10%, 20%, 30% moves | | | |
| Contract months | First 5 months in March quarterly cycle | | | |
| Trading hours | Monday to Thursday: 5:00 PM to 3:15 PM the following day and 3:30 to 4:30; Sunday: 5:00 PM to 3:15 | | | |
| Trading ends at | 8:30 AM on third Friday of month | | | |
| Cash settlement | Versus Special Open Quote (SOQ) | | | |
| Position limits or accountability | 20,000 standard S&P contracts | 10,000 standard NASDAQ contracts | 5,000 standard MidCap contracts | 50,000 contracts |
| Symbol | ES | NQ | EMD | YM |

modified capitalization weighting scheme. The Nasdaq 100 is often considered a high-tech index because the index is dominated by technology issues such as Microsoft. The S&P/MidCap 400 includes 400 leading mid-cap stocks listed domestically.

Although cash settlement was deployed with respect to the Eurodollar contract prior to the development of stock index futures in 1982, it is perhaps the cash settlement mechanism that enables and defines these contracts. Of course, the cash settlement system is a necessary development in the context of stock index futures. Consider the alternative of delivering a basket of all the stocks represented in the index. This, of course, is quite impossible where you may have upward to 2,000 stocks represented in the index.

## ANATOMY OF A FUTURES TRANSACTION

The processes by which a futures transaction is executed has been changing rapidly over the past decade as the industry transitions from a floor-based, open outcry trading environment to an electronic trading environment. Once visitors to a futures exchange would witness frantic activity, noise, and commotion on the floor of the exchange as the orders of buyers and sellers interacted in a physical trading environment. As of this writing, that activity is diminishing and being replaced by electronic trading platforms and trading rooms that appear to be less frantic, at least superficially.

But this is deceptive because the pace of activity has actually much increased. Of course, the purpose of an exchange is to allocate access to, and otherwise manage, the trading process. In a physical pit trading environment, access is limited to the number of traders who can squeeze into a confined space on a trading floor. Electronic trading systems vastly increase access and distribution so that the ultimate customer can enter orders from virtually anywhere in the world and receive fills in seconds or even fractions of a second.

Although the dominant trend is toward the adaptation of completely automated, electronic trading methods, open outcry still endures. In particular, there are still some situations in which the application of human intervention continues to add value, notably in the context of option markets where one may pursue some very complex strategies involving multiple options. As such, open outcry still thrives in certain markets. But as electronic trading systems inevitably develop to become more flexible with enhanced functionality, it is likely that open outcry will disappear altogether. And not without some regret because this change will spell the end of many long-standing traditions that have defined the futures markets for many years.

### Open Outcry

Traditionally, and before the advent of electronic trading systems, futures were traded exclusively in a manner known as ''open outcry'' (i.e., a physical open auction environment where a number of traders may simultaneously be voicing a bid and an offer). Only members of the exchange are permitted to participate directly in the auction-like proceedings that take place on the exchange floor. Exchange members generally are independent businesspeople who make a living by trading commodities.

There are essentially two types of participants or ''locals'' on the trading floor: the floor trader, or scalper, and the floor broker. Brokers tend to be the less numerous of the two categories of participants. Brokers stand in a pit and execute trades on behalf of outside customers. In return for this service, they accept a fee for each contract traded.

Traders, or scalpers, provide a critical function by essentially acting as market makers. Sometimes these traders take a position in the market either long or short in anticipation of a bullish or bearish price movement. Most of the time, however, they are content to capture the bid/ask spread out of the market. That is, they stand ready to buy at the bid or sell at the offer in order to capture the bid/ask spread. For example, a scalper may buy at the bid against market orders to sell. Then, they will look for buy market orders against which to sell. If they succeed in trading against a market buy order by selling at the offer, they will have bought at the bid and sold at the offer, thereby capturing the bid/ask spread. Because a large number of scalpers are operating competitively, this bid/ask spread is typically very tight. Scalpers, however, assume some measure of risk during the time between the point at which they bought at the bid and are able to sell at the offer. If, for example, the market falls between those two transactions, the scalper's long position is declining in value. If market conditions become unstable, the bid/ask spread may increase.

Thus, these floor traders perform a valuable service. By taking the opposite side of customers' orders, they assure that these outside orders will be filled quickly and at a narrow spread. Although the activity of these locals is often the center of attention for visitors to an exchange floor, it is important to realize that this activity is intended primarily to serve the needs of outside customers.

How do these customer orders reach the trading floor? A customer with an account open with a futures broker typically calls the broker and verbally conveys an order. That order is recorded and stamped with the time at which it was received by the broker. The order is then conveyed directly to the order desk of the brokerage firm for execution on the floor. Many brokerage firms wire the instructions associated with smaller orders or retail orders to the floor. Large orders are typically conveyed verbally through a telephone line to a clerk at the firm's order desk. The clerk records and time-stamps the order. It is handed to a floor messenger, or runner, or is signaled by hand to the floor broker in the pit who will execute the order. Once executed, the information surrounding the order is conveyed backward through the original chain to the customer.

Throughout the course of the day, locals on the floor who have executed business on the floor take their transaction cards to the brokerage firm that is clearing their trades. This information is entered into computer terminals and transmitted to the exchange clearinghouse, at which point the clearinghouse attempts to match buyers and sellers. For every buyer there must be a seller; for every seller, a buyer. If these trading records fail to match, in other words, if the details recorded in connection with each transaction do not coincide, then the trade does not clear. If, subsequent to a number of opportunities to reconcile the trade, it does not clear, it becomes an "out-trade" and is not valid. Once a trade clears, the clearinghouse formally stands as buyer to every seller and seller to every buyer.

## Electronic Trading

Although the legacy of the open outcry system is still available in some markets, electronic trading has become increasingly commonplace. As of this writing, approximately 85% of all transactions in CME Group products are completed through the CME Globex electronic trading platform. Electronic trading platforms offer the advantage of much broader distribution and access to the trading mechanism. Although its primary location is in Chicago, the Globex system maintains numerous connections and offers access through hubs located in London, Dublin, Amsterdam, Paris, Milan, Singapore, Sao Paulo, and Seoul.

As such, direct access to the trading process, which was once limited by physical space constraints on the floor, is much expanded. Further, there are often numerous ways to connect to an exchange electronic trading platform. Most customers connect through a commercial ISV, or independent software vendor, or through a brokerage firm's proprietary system. ISVs are companies that offer front-end trading platforms, frequently Internet enabled, through which customers may trade on a variety of exchanges. In other words, ISVs may in turn connect with any number of futures or securities exchanges. These front-end systems often have unique features and are functionality designed to make trading easy and provide ancillary analytical, accounting, or risk-management services.

Of course, customers must have permission to trade on any particular exchange. CME Group, for example, offers an ''open access'' policy whereby any customer may trade directly on the exchange's electronic trading platform provided the customer maintains an account with, and their activities are financially backed by, a clearing member.

Actually, the reference to the Globex system refers to the matching engine maintained by CME Group that matches buyers and sellers. This matching process is generally accomplished through a variety of matching or allocation algorithms. The most obvious matching algorithm is ''first in, first out,'' or FIFO. This simply means that the first buy or sell order received in the system at a more aggressive price will be filled first. But sometimes other algorithms are employed for a variety of purposes. For example, a pro rata algorithm may fill orders at the same price proportionate to the size of the order.

Sometimes exchanges use a market maker priority, or ''preferencing system,'' that allocates a certain proportion of each order to designated electronic market makers regardless of whether they were the first market participant to show a more aggressive price (i.e., a higher bid or reduced offer price). Of course, anyone with access to the system can enter both bids and offers and attempt to capture the bid-offer spread in much the same way as locals do on the floor of an exchange trading per an open outcry system. However, there are many proprietary trading firms that specialize in acting as electronic, or cyber, market makers. These traders provide liquidity, an essential element in any successful market, by continuously showing a bid and an offer. As a result, exchanges may offer preferencing as an incentive for these ''cyber locals.''

Once a customer's order has been filled and reported back to the customer through the electronic trading system, it is reported to the exchange's clearinghouse. Unlike trade records that come from the floor and must be matched, these trade records are already matched, and therefore there are no out-trades in an electronic context. Exhibit 1.16 provides a flowchart for an electronically executed futures transaction.

## Acceptable Orders

A variety of different types of orders may be accepted on the floor of the exchange or through electronic trading systems. These orders may vary in terms of the price at which they are to be executed and the time at which they may be executed. Typical orders are described next.

A *market order* is simply an open order to buy or sell. Once placed, the broker has discretion to buy or sell at the best available price prevailing in the pit. A customer might expect a market order to buy to be filled at the

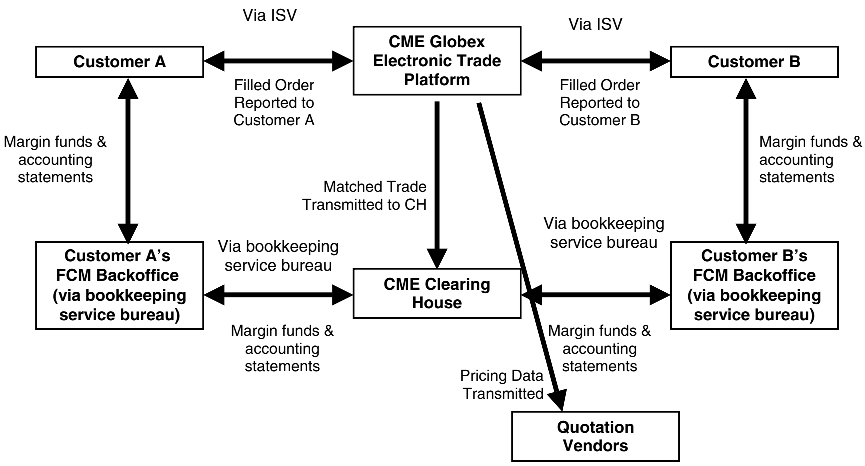


**EXHIBIT 1.16** Anatomy of an Electronic Futures Transaction

prevailing offer, a market sell order to be filled at the bid. But electronic trading systems may not recognize a market order per se and may require one to place orders with a price attached.

A *limit order* is specific with respect to the price at which it may be executed. For example, one may place a limit buy in the Eurodollar futures market at 99.59. This means that the transaction may only be executed if the broker is able to buy at 99.59 or less. A limit sell at 99.595 may only be executed if the broker is able to sell at 99.595 or more.

A *stop*, or *stop-loss*, order is generally placed in conjunction with an order to establish a new position. Assume, for example, that you establish a long position at 99.59. You might place a stop-sell order at 99.54 *below* the market. Or if you sold at 99.595, you may place a stop-buy order at 99.645 *above* the market. A *market if touched* order is an instruction to the broker to execute the buy or sell order at the best available price if the market trades at a particular price at least once.

Orders may also be placed instructing the broker to buy or sell at a particular time of day. For example, a *market on open* (MOO) order instructs the broker to buy or sell on the opening. A *market on close* (MOC) order instructs the broker to buy or sell at the close. An OCO, or *one cancels the other*, order may be thought of as two limit orders or a limit and a stop order. If one of the two orders is executed, then the other becomes invalid. Assume, for example, that the Eurodollar market is at 99.59. You may put in a limit order to buy at 99.54 and a stop buy at 99.64. If the limit order is executed, the stop is canceled or vice versa.

### Multilateral Clearing System

Once orders are executed, they are sent to the exchange's clearinghouse for processing and bookkeeping purposes. Generally speaking, transactions executed in an open outcry environment may require manual intervention to enter the trades into the system. Once in the system, buys and sells must be matched per all the particulars of the trade, including product, price, size, and so on. An electronically executed trade comes to the clearinghouse already matched, negating the possibility of an out-trade.

Whether trades are matched by the clearinghouse or are submitted on a prematched basis, once accepted, the clearinghouse steps in to act as buyer to every seller and seller to every buyer. This is the process of *novation*. Because each futures contract is fungible, they may readily be offset by an opposite transaction regardless of whether the counterparty to the trade is identical or not. This is the essence of a multilateral clearing system.

### Futures Margin Requirements

Eurodollar futures were trading in our previous example at 99.59 and are based on a three-month $1 million face-value instrument. But that $1 million face value is not the amount needed to establish a futures position. When you establish a futures position, long or short, you are required to make an *initial* performance bond or margin deposit. Initial margins may be deposited in cash, T-bills, or other qualifying securities. The customer is entitled to continue to earn the float or interest associated with collateral posted to secure a position. This margin is generally paid into the customer's account with a futures broker firm or futures commission merchant (FCM). The FCM may act as a clearing member of the exchange or might act through another correspondent firm that is a clearing member. The clearing member in turn posts such collateral with the exchange.

Once an initial margin is deposited, futures traders "mark to market"; that is, they are required to pay any losses and entitled to collect any gains daily in cash. "Variation" margins must be met in cash. But these variation margin payments are only required if the account balance falls below the "maintenance" margin level.

For example, assume that a long futures position is established at 99.59. Assume that an initial margin of $750 is required. Note that margin requirements change from time to time based on market volatility and other conditions. On the next day, futures decline 5 basis points to 99.54 for a loss of $125. Now, there is only $625 in equity in the account. Still, no additional funds are required because (we assume) the maintenance margin is $550. On the next day, assume that futures decline another 5 basis points to 99.49 for a loss of an additional $125. The account is now depleted by $250 to $500 and below the initial margin requirement of $750. As such, the trader must replenish the depleted account to the initial level with a $250 cash deposit. Assume that on the next day, futures rally 12 basis points to 99.61 for a gain of $300. This releases $300 to the trader's account in cash.

Futures margins are unlike stock margins. When you purchase stock, you may margin up to 50% of that purchase. That is, you make a down payment equal to at least half the value of the stock and borrow the balance at interest from your broker. Futures margins, however, are unlike stock margins because the character of the transaction is quite different. When you buy or sell futures you do not assume an equity interest in any particular instrument. Rather, you have simply entered into a commitment to make or take delivery of a particular commodity or security. As such, futures margins may reflect a much lower proportion of the value of the underlying instrument. Futures margins may be thought of as good faith deposits or performance bonds, not as a down payment on the purchase of equity. Because futures are *marked to market* daily, they are intended to cover one day's maximum price movement.

### Financial Safeguards

This collateral or margin is required to secure the financial integrity of each transaction on the exchange. Ultimately, the exchange clearinghouse guarantees the financial integrity of transactions on the part of its clearing member firms. It is important to note that the CME Clearing House, which operates as a wholly owned and integrated division of CME, has never experienced a default on the part of its clearing members during its entire history dating from 1898.

If, in the rather unlikely event of a default, the CME Clearing House may draw on its considerable financial safeguards package to cure any possible defaults. As of the conclusion of September 30, 2009, the CME Clearing House held some $85.8 billion in performance bond deposits or collateral on the part of its clearing members. Further, the clearinghouse may draw on the market value of CME Group stock shares and trading rights pledged by member firms, CME surplus funds, the security deposits of clearing members, and, finally, may wield limited assessment powers to cure any possible default.

## CONCLUSION

This chapter provides an introduction to the world of commodity and financial futures. The development of our markets has accelerated in the past few decades. Where once futures were considered a rather provincial marketplace centered in Chicago and concentrating on agricultural commodities, today the market is global and features the trade of financial futures including currency and both short-term and long-term interest rate futures as well as stock index products. But futures are not the only type of derivative product available. In addition to futures, there are also OTC derivatives (e.g., IRSs) available along with securitized derivatives (e.g., ETFs).

Not only has the range of products available in the form of derivatives expanded considerably over the years, but the way in which these markets are traded and accounted for has also evolved. Nowhere is this evolution seen more dramatically than in the development of electronic trading technologies. To the extent that electronics allow an exchange to distribute its product quite efficiently across the globe, volume activity has increased tremendously within the last decade. Finally, we have seen credit issues emerge from time to time including the so-called subprime mortgage crisis. This episode highlights the necessity to maintain a high degree of financial surety as provided by a multilateral clearing system.

Subsequent chapters will flesh out these issues and many more associated with modern futures markets.

## NOTES

1. Thomas F. Seims, ‘‘10 Myths about Financial Derivatives,’’ September 11, 1997.
2. Speech by Alan Greenspan, Futures Industry Association, Boca Raton, Florida, March 19, 1999.
3. Ibid.