Futures

Futures refer to a futures contract which is a financial security created by an organized exchange for the purpose of buying or selling a commodity for future delivery.

Characteristics

There are basically three related ways to buy or sell a commodity: (1) the spot market, (2) the forward market, and (3) the futures market.

The first method is the cash or spot market for immediate delivery. The price at which the exchange takes place is called the "cash" or "spot" price.

The second method is by entering a forward contract. A forward contract is an agreement made today between a buyer and seller of a commodity to exchange the commodity for cash at a predetermined future date (not today) at a price agreed upon today. The agreed-upon price is called the "forward" price.

The third method is by entering a futures contract. A futures contract is a financial security, issued by an organized exchange, to buy or sell a commodity at a predetermined future date (not today) at a price agreed upon today. The agreed-upon price is called the "futures" price. However, to guarantee that the buyers and sellers of the security will honor their future commitment, a system of margin requirements and daily settlements is implemented by the exchange. It is this daily settlement procedure which differentiates futures contracts from forward contracts and futures prices from forward prices.

Daily settlement is called "marking to market." Usually, when the buyer or seller of the futures contract opens a position, a margin account is also opened. A margin account is similar to a security deposit (usually cash or interest-bearing securities) held in the buyer or seller's name to guarantee that the terms of the futures contract are fulfilled. Marking to market occurs when the margin account's balance is adjusted at the end of each trading day. It is adjusted by the daily change in the futures price. For example, if the futures price increases on any particular day, the change in the futures price will be added to a buyer's margin account. Conversely, if the futures price falls, the change will be subtracted from a buyer's margin account. Daily settlement, in effect, pays out in cash the daily change in the value of the futures contract. The value of the futures contract, thus, returns to zero at the end of each trading day. If the margin account falls too low, additional margin will be requested. If the margin account's balance becomes too large, the surplus can be removed. Futures contracts only trade on organized exchanges.

Futures Exchanges and Futures Commodities Traded

Unlike forward contracts, which have been around for thousands of years, futures contracts are a more recent phenomenon. The first futures contracts were begun in
with the opening of the Chicago Board of Trade. Since that time, trading in futures contracts has greatly increased.

Futures contracts are currently traded all over the world and against different types of commodities. In 1990 there were 11 exchanges in the United States alone and 39 exchanges in foreign countries. The three largest U.S. exchanges, in terms of volume of trade in 1990, were the Chicago Board of Trade, the Chicago Mercantile Exchange, and the New York Mercantile Exchange. The largest five foreign futures exchanges, in terms of volume of trade in 1990, were the London International Financial Futures Exchange (U.K.), Le Marché à Terme des Instruments Financiers (France), the Osaka Securities Exchange (Japan), the Tokyo Stock Exchange (Japan), and the Tokyo Commodity Exchange (Japan).

Futures contracts are written against over 50 different commodities. These commodities are divided into four types: (1) agricultural commodities and metals (e.g., corn, oats, wheat, crude oil, lumber, cotton, sugar, gold, silver, platinum), (2) interest-earning securities (e.g., U.S. Treasury bills, U.S. Treasury notes, U.S. Treasury bonds, eurodollar deposits, municipal bonds issued in the United States), (3) foreign currencies (e.g., British pound, Japanese yen), and (4) equity indexes (e.g., the Standard and Poor’s 500, the New York Stock Exchange Index, the Japanese Nikkei index). Although the four types of commodities are exhaustive, the examples are not.

The commodity upon which a futures contract is written is necessarily standardized with respect to quality and quantity. Standardization facilitates increased volume. Futures contracts may require physical delivery of the commodity at the terminate date or require cash settlement. Furthermore, additional contractual requirements often are associated with traded futures in terms of price and position limits. These are imposed to reduce the likelihood of market manipulation.

The futures contracts traded and the exchanges upon which they trade are constantly evolving. Just 30 years ago, in fact, there were no contracts trading on interest-bearing securities, foreign currencies, or equity indices. In 1990, however, these three commodity types accounted for over 60 percent of all the contracts traded.

Uses

There are three major uses of futures contracts: (1) price discovery, (2) hedging, and (3) speculation. Price discovery is the use of futures prices to predict spot prices that will prevail in the future. These predictions are useful for production decisions involving the various commodities. The forecasting ability of futures prices differs significantly across the various commodities. Some futures prices provide good predictions, and others do not.

Hedging is the use of futures contracts to reduce the return variability of an investment portfolio or production process involving the cash commodity. This is, perhaps, the most important use of futures contracts. It is also the prime justification used for the approval of new commodity contracts by the Commodity Futures Trading Commission (CFTC). For example, consider an investment in the U.S. stock market by a mutual fund which has experienced an unusually good performance over the past year. To lock in these gains and to hedge possible adverse movements in the stock market, the mutual fund could short futures contracts on a stock index like the Standard and Poor’s 500. As a second example, consider a farmer who is planting wheat for future harvesting when current cash prices are high. To lock in his high expected profits, he can sell wheat futures today for future delivery.
Speculation is the use of futures contracts to take an investment position and potentially profit from special information concerning the future spot price of a cash commodity. Futures markets are an efficient vehicle for speculation because of low transaction costs and high implicit leverage. The alternative to futures markets is taking a direct position in the cash commodity with storage.

Theory

It is possible under perfect market assumptions to determine the exact relationships among the spot price, forward price, and futures price. Consider an economy with frictionless trading in the spot commodity. That is, the spot commodity has no storage costs associated with it and it is possible to short sell the spot commodity with no restrictions imposed on the timing or quantity of the short sales. Furthermore, assume that the economy has traded sufficient assets to span all risks relevant to both the pricing of the spot commodity and the term structure of interest rates. This situation is called a "complete market."

We need some notation to describe these relationships. Let \( S_t \) be the spot commodity's price at time \( t \) where \( t \) is between 0 and \( T \). Let \( F_t \) be the time \( t \) forward price for delivery of the spot commodity at time \( T \). Let \( F_t \) be the time \( t \) futures price for delivery of the spot commodity at time \( T \). Let \( B_t \) be the time \( t \) value of a money-market account starting with an initial investment of 1 dollar at time 0. Finally, let \( P_t \) be the time \( t \) value of a default-free zero coupon bond paying 1 dollar at time \( T \) for sure.

Under the above perfect market structure, it can be shown that there exists a simple method for calculating present values. The method involves the use of risk-adjusted probabilities, called "pseudo-" or "risk-neutral" probabilities. To calculate the present value of a future cash flow, simply take its expected value using the pseudo-probabilities, but only after discounting by the time value of money.

For example, letting \( E() \) be expectation with respect to the pseudo- or risk-neutral probabilities, the spot price can be written as its expected time \( T \) value, appropriately discounted, i.e.,

\[
S_t = E[S_T(B_t/B_T)]
\]

The quantity \( (B_t/B_T) \) corresponds to the interest earned on a money market account over the time period \( (t, T) \). As a second example, the zero-coupon bond's price is equal to the expected value of a dollar received at time \( T \), i.e.,

\[
P_t = E[1 (B_t/B_T)]
\]

The first result available is the cost-of-carry relationship between the spot price and the forward price, and it is given by

\[
F_t = S_t/P_t
\]

The forward price is equal to the spot price, augmented by the interest earned by storing the spot commodity over the time period \( (t, T) \). Using the previous equations for the spot commodity's price and the zero-coupon's price, we can rewrite this cost-of-carry relationship as:

\[
F_t = E[S_T(B_t/B_T)] / E(B_T/B_t)
\]

This will be useful later on for comparison with the formula for futures prices.

Futures prices can be shown to equal the undiscounted expectation of the future spot price, i.e.,

\[
f_t = E(S_T)
\]
The reason for this is that, to a risk-neutral speculator, the futures price is an unbiased predictor of the future spot price.

The relationship between forward prices and futures prices can now be clarified. If interest rates are deterministic, then the forward price equals the spot price because \( B_t / B_t \) is nonstochastic, and it can be moved outside the expectations operator and cancelled. Otherwise, the futures price and the forward price differ. They differ because of the correlation between interest rate movements and the spot commodity's storage return.

It is possible to generalize these relationships to incorporate both more realistic market frictions and incomplete markets. Nonetheless, this simplest economy described above is enough to illustrate both the differences between these three prices and the fact that forward contracts are distinct from futures contracts.

References


(See also Commodity exchange)