CME OPEN INTERESTS

Strips:

Arbitraging the Eurodollar Cash and Futures Markets

(Updated June 2001)

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In December of 1981, the Chicago Mercantile Exchange (CME) introduced a futures contract based on 3-month Eurodollar interest rates. In the nearly twenty years since its inception, this contract has become one of the most versatile trading and hedging vehicles offered on the listed markets. The contract represents a $1,000,000, 3-month London Interbank Offered Rate (LIBOR) deposit. CME Eurodollar futures are cash-settled, therefore, there is no delivery of a cash instrument upon expiration because cash Eurodollar time deposits are not transferable.

Of the contract's many uses, one of the most significant has been by arbitrageurs in the money markets who often combine cash and futures positions to create a synthetic instrument called a "strip." Many of the trades in the quarterly Eurodollar futures contracts are devoted to these strategies. A strip can mean combining cash deposits (borrowings) with a long (short) position in the futures contracts. Such a trade is initiated when it is determined that the trader can lock in a higher return or a lower borrowing cost than are otherwise available in a cash-only money market transaction. The term "strip" is derived from the practice of using two or more consecutive quarterly futures expirations in combination with a Eurodollar cash position. The traders must determine for themselves whether the spread between the strip interest rate and the cash-only transaction is wide enough to make such a trade worthwhile. Below, we will calculate a strip rate using actual market rates, but first it might be beneficial to review how Eurodollar futures are priced.

On April 19, 2000, the September 2000 Eurodollar futures traded at an index price of 93.21. The CME calculates this price by subtracting the ED interest rate (in this case, 6.79%) from 100. Although the contract is referred to as 3-month Eurodollar futures, it did not match that day's prevailing cash 3-month LIBOR rate of 6.31%. The futures contract is meant to represent a 3-month implied forward rate on the date of the contract's expiration on September 18, 2000, or 152 days hence.

To illustrate how closely the Eurodollar futures will track the implied forward rates, it might be useful to derive a 3-month forward Eurodollar rate. We can then compare this rate to that of the September futures contract, whose rate is meant to match that of a 3-month cash deposit which settles on September 20. The futures contract is based on a 90-day rate (and therefore a constant $25 per $.01 change in price), even though the period actually covered by the futures contract may very well be different. Recognition of this potential mismatch in basis point values between the futures contract and the deposit to be hedged will influence the number of contracts used to hedge a given exposure.

We also assume in this example that deposit transactions settle two business days after trades are agreed, and that deposits mature on the same calendar date as the settlement, "n" months in the future. Counting days in this manner from April 19, 2000, the September 2000 futures expire (or "fix") in 152 days (on September 18), and settle in 154 days (on September 20). The interest rate on the 3-month deposit that the futures contract represents is fixed on September 18, actual funds are received on September 20, and the deposit matures 91 days later on December 20; 245 days from April 19.

We assume that an investor should be indifferent between investing for 245 days, and investing for 154 days and rolling the proceeds for 91 days. If this is the case, "fair value" for the September futures contract is the 91-day rate at which a 154-day investment could be rolled at maturity so that its return equals that of a 245-day investment made on April 19. LIBOR cash rates are usually quoted for overnight, one week, and then in maturities month-to-month up to one year. The 154- and 245-day periods may seem like unusual durations for deposits, but these would correspond to 5-month and 8-month LIBOR rates. However, the most readily available rates from banks are usually quarterly rates such as 3-, 6-, 9- and 12-month rates. Therefore, if there were no readily available markets for these 154- and 245-day maturities, a linear interpolation could be performed from the most readily available Eurodollar rates. Although they might not represent the exact rates that a bank might offer, they do facilitate the derivation of forward rates. A 154-day rate could be derived from a 6-month rate of 6.52% and a 3-month rate of 6.31% as follows:

6 month = 180 days = .0652
3 month = 90 days = .0631
Total Difference = .002100

Difference/day = .0021/90 days = .000023
154-day rate = 90 day rate + (.000023 x 64 days)
= .063100 + .001472
= .064572 ≈ 6.46%

Similarly, a 245-day rate can be interpolated from the 6-month rate of 6.52% and a 9-month rate of 6.72875% to arrive at 6.67%. The forward rate can be derived using the following break-even formula where r* is the implied forward rate.

$$[1+.0646(154/360)][1+r^*(91/360)]=[1+.0667(245/360)]$$

The forward rate of r* is 6.84%, which is extremely close to the rate on April 19 for the September Eurodollar futures contract of 6.79% (93.21). At times these forward rates are quite close to the futures prices while, at other times, market dynamics may cause the futures prices to diverge dramatically from cash prices. When the futures contract expires, the settlement price is a function of cash LIBOR rates on the last day of trading, so cash and futures rates converge as expiration approaches. Futures may look "cheap" or "expensive" to cash, and this can assist hedgers in determining which futures contract should be bought or sold. Arbitrageurs, usually large bank dealers, will enter the market to take advantage of these discrepancies by doing a strip transaction.

While most traders of strips will utilize computer software to identify profitable cash/futures spreads, the process of determining a strip rate is relatively simple, as the equation below shows.

STRIP % =
{[1+Rcash(n/360)][1+Rfutures(t/360)] – 1}360/n+t

This equation is the basic method for deriving a strip rate within one year. The maturity of the first cash deposit (or borrowing) is represented by "n." This first cash transaction is also known as the "front tail" or "stub," which is multiplied by a cash interest rate (Rcash) for that period.

The second part of the equation is the rate and tenure that the first futures contract represents. The figure "t" represents the time period, in days, between the settlement of the nearby and the next maturing quarterly futures contract. Following this would be further components representing other futures contracts in the strip. The trader can compare the approximation that the strip yield represents to an actual cash market rate to see if a combination of cash and futures will outperform a cash-only trade.

For example, we can derive a strip rate for the morning of April 19, 2000. We assume that a trader has acquired funds and can place them at LIBOR for a period of 11 months ending on March 20, 2001. The strip will involve placing funds in a 2-month cash deposit at LIBOR of 6.21% and purchasing June 2000 Eurodollar futures contracts at 93.395 (6.605%), September 2000 at 93.21 (6.79%), and December 2000 at 93.05 (6.95%). The mechanics of the long strip involve placing the cash deposit for a period that runs up to two days following the expiration of the first long futures contract — in this case, June 21, 2000, 63 days hence. In theory, after the first futures contracts are sold off, the cash deposit will be rolled over for a period corresponding to the length of time between the June settlement on June 21, and the September settlement on September 20. It is assumed that this process continues throughout the expiration of the December contract when funds will be placed in the cash market until March 21, 2001. In the long strip, the whole idea is that you create a synthetic asset by using futures. The funds are initially placed in the cash markets but are rolled forward into new deposits as the futures mature. If the reinvestment rate declines, i.e., futures prices rise, this is offset by the futures gains. If interest rates rise, i.e., futures prices fall, the futures losses are offset by the higher reinvestment rate cash deposits.

Let us consider our proposed transaction. In the cash market, 11-month LIBOR rates are 6.80375% on April 19, 2000. Below is the derivation of the strip rate of 6.84%.

6.84% =
{[1+(.0621)63/360][1+(.06605)91/360][1+(.0679)91/360][1+ (.0695)91/360] – 1}360/63+91+91+91

The decision to employ a strip depends upon several factors. In the case above, the higher strip yield might justify the transaction. It would, however, also depend on how much basis risk the investor would accept and whether the premium received by the strip would compensate for the transaction cost of futures commissions. The above equation with its futures maturities of 91,91, and 91 days suggest a uniform number of days between each settlement. However, this is not always the case. Depending on the year, these periods could run from 90 to 98 days. This illustrates the risk that the investor may not be able to find deposits whose maturities exactly match futures expirations. It is because of risks such as this that many in the markets may not put on such a trade unless a premium of 25 to 30 basis points could be guaranteed. The markets have been heavily arbitraged in recent years and trades such as this are no longer "easy pickings."

There are other concerns for investors who might consider such a trade. In our example, we restricted ourselves to LIBOR for our deposit rates. But money can be borrowed and deposits made at rates such as LIBID and LIMEAN, with spreads above or below these levels depending upon the customer's creditworthiness. While the example of an 11-month deposit versus a strip was good for illustrative purposes, the end date for such a transaction frequently will not match the implied settlement date of a Eurodollar futures contract such as March 21, 2001. However, we must be able to do the strip transaction starting any day and for any period of time to match a cash rate, even though there may not be a convenient end date matching a CME expiration.

We can address this problem by employing the same strategy for 12 months instead of only 11. Assume the investor received funds for one year until April 19, 2001. The investor could end up buying additional March 2001 Eurodollar futures contracts on April 19, 2000 at 93.01 (6.99%). The previous strip equation would be amended to include the component for March 2001 futures of $[1+(.0699)(29/360)]360/336+29$. This would give us a strip rate of 6.88% versus a cash one-year LIBOR rate of 6.84%.

The slightly higher strip yield means that this might be preferable to the straight cash deposit as a more attractive investment. The strip also presents us once again with the predicament of mismatching dates. The contract covers the period of March 21, 2001 to June 20, 2001. The period we want to cover is March 21 to April 19, a time span of 29 days, not the 91 covered by the futures contract. In this case, we are hedging a 29-day period with a derivative product that represents a 3-month duration. If a $100 million position were to be covered, we could try to achieve dollar equivalency with the futures contract by purchasing 32 of the March 2001 Eurodollar futures (100MM x 29/91) instead of approximately 100 that might be employed with the June, September and December expirations.

The number of contracts might well cover the face value and duration of the cash position, but it is an approximation that could be further fine-tuned. For example, the above case called for constructing a "tail." In addition, many hedgers will underweight the size of their hedge slightly as a function of the tenures of the hedge and underlying instrument as well as the cost of financing their margin flows. This adjustment in their hedge ratio accounts for interest earned on profits from positive margin flows and interest paid on outflows due to margin calls.