CME OPEN INTERESTS

Forward Eurodollar Pricing Revisited

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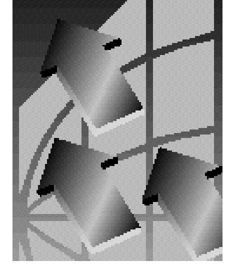

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A common practice used by market participants when pricing non-standard or odd-dated transactions is to simply interpolate between liquid straight dates or standardized futures dates. This approach exposes the user to the risk of mispricing owing to seasonal wrinkles in the yield curve and implied forward rates. A good example can be seen in the discontinuous jumps in forward pricing of Eurodollar time deposits at year-end due to funding pressure.

In *Derivative Week's* October 11 (1993) "Learning Curve," Scott Grimshaw, CIO at BANC ONE, presented a strong argument for applying a polynomial curve-fitting technique as an alternative to simple interpolation to solving implied forward rates for intermediate points on the calendar which fall between standard Eurodollar futures and dates. This Learning Curve lends further weight to his technique.

Grimshaw starts (with) September 13 market data as a reference point of departure. He uses the example of pricing a three-month Eurodollar time deposit four months in the future for value January 13, 1994. Mere interpolation between the December future (96.54 – 3.45%) and the March future (96.52 – 3.48%) suggests that the three-month deposit four months forward would be 3.47%.

By contrast, Grimshaw's polynomial curve-fitting approach produces a rate of 3.37%, which is supported by interbank quoted rates of 3.39% on equivalent 4x7 Forward Rate Agreements (FRAs). We offer a fourth alternative which supports Grimshaw's findings. In addition to futures contracts on three-month Eurodollar deposits, the Chicago Mercantile Exchange (CME) also lists a companion futures contract on one-month LIBOR. While the Eurodollar futures expire in the familiar quarterly cycle, the LIBOR contracts expire monthly.

Conceptually, the implied forward rates on any three successive one-month LIBOR contracts can be compounded up to an equivalent forward three-month deposit covering the same time horizon. This method can be applied to solve the three-month Eurodollar deposit beginning on January 13, 1994 price as of September 13, 1994. On September 13, the relevant strip of one-month LIBOR futures settled at the following prices: Jan 96.73 (3.27%), Feb 96.69 (3.31%), Mar 96.61 (3.39%).

On a compounded basis, the Jan, Feb, Mar strip weighed in at an implied three-month forward rate of 3.34% assuming a start date of January 19, 1994 and a maturity date of April 20, 1994. Note that the start date differs from Grimshaw's January 13 start date. This is due to the standardized expiration dates of the LIBOR futures contracts. Yet,the compounded rate, 3.34%, compares favorably with both Grimshaw's curve-fitting technique and the interbank 4x7 FRA quote. Given the parity pricing relationship between compounded strips of one-month it becomes plain that these contracts are a good price discovery and hedging tool for less liquid FRA maturities. For example, by combining only the January and February one-month LIBOR contracts from the above example, a 4x6 FRA could be structured. One obvious relationship that stands out, however, is the link between any three one-month LIBOR contracts that match one of the quarterly three-month Eurodollar futures contracts. Conceptually, the implied rates in both markets should be more or less the same, taking into account legitimate differences due to bid/offer spreads and transaction costs. However, this is not always the case. A timely example is the divergent paths taken by the December 1992 Eurodollar futures versus the December, January and February one-month LIBOR futures during November and December of 1992.

On November 2, 1992, the difference between the Dec 1992 Eurodollar future and the Dec 92, Jan 93, Feb 93 LIBOR strip was six basis points.

As November wore on the spread became volatile and year-end funding pressure appeared to make the Eurodollar contract cheap relative to LIBOR futures. Year-end funding pressure may have weighed more heavily on the Euros than the LIBOR contracts, but this tendency was relatively mild in 1992 compared to previous years. To capture the full mispricing, the arbitrager would have to buy the Dec Eurodollar futures and sell the (Dec, Jan, Feb) one-month LIBOR futures. At expiration of the Dec contracts, the arbitrager would borrow one-month LIBOR and lend three-month, and apply the gains and/or losses of the Dec futures to the position. The short positions in the Jan and Feb one-month LIBOR futures would be retained to hedge the subsequent rollovers of the one-month cash borrowing to match the term of the three-month deposit.

11/27/92		*12/14/92 Dec Expiry*	
3-MO Eurodollar Futures		**Market to Market**	**P&L**
Buy	150 Dec '92 @ 95.99	Dec '92 @ 96.27	$142,500
1-MO LIBOR Futures			
Sell	58 Dec '92 @ 95.71	Dec '92 @ 96.31	(87,000)
	47 Jan '93 @ 96.55	Buy 47 Jan '93 @ 96.54	(10,575)
	47 Feb '93 @ 96.43	Buy 47 Feb '93 @ 96.57	(16,450)
		Total P & L:	$28,475
		Less Commission @ $8.00 per turn:	(2,416)
		Net profit:	$26,059
		Estimated Margin Requirement:	$40,000
		Return on Margin:	65.15%

An easier, more leveraged way to take advantage of the abnormally wide spread without guaranteeing a full convergence of the mispricing would have been to liquidate all the futures when the Dec contracts expired, without resorting to cash transactions — a license to print money!

NOTE: In March 1995, the CME significantly reduced performance bond requirements for equally weighted "Boomerang" trades. To qualify for the lower performance bond requirements, the spread in this example would have had to consist of an equal number of Eurodollar and LIBOR futures e.g., 150 Dec Eurodollars against 50 December, 50 January, and 50 February LIBOR contracts.

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