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RESEARCH AND PRODUCT DEVELOPMENT

Trading the 30-Day Fed Funds vs. Eurodollar Spread

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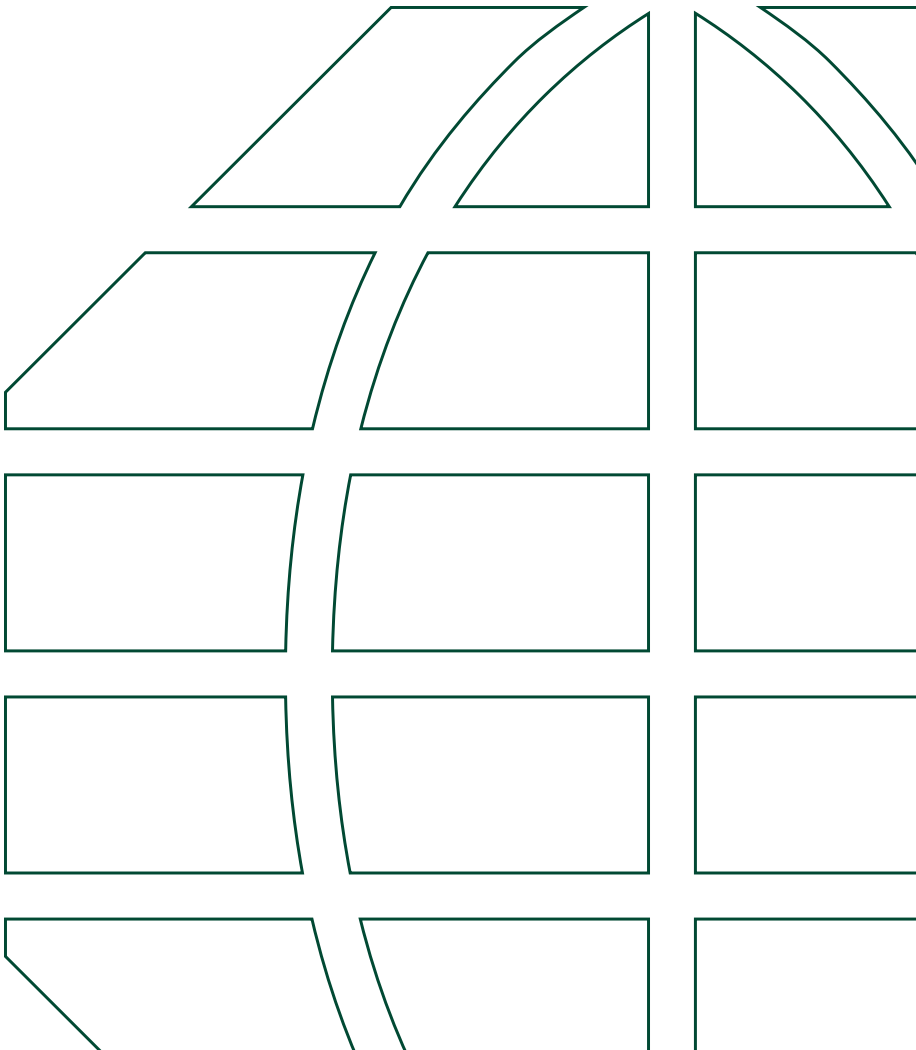


30-Day Fed Funds and Eurodollar futures can be used to construct positions that create exposure to both credit and yield curve conditions.

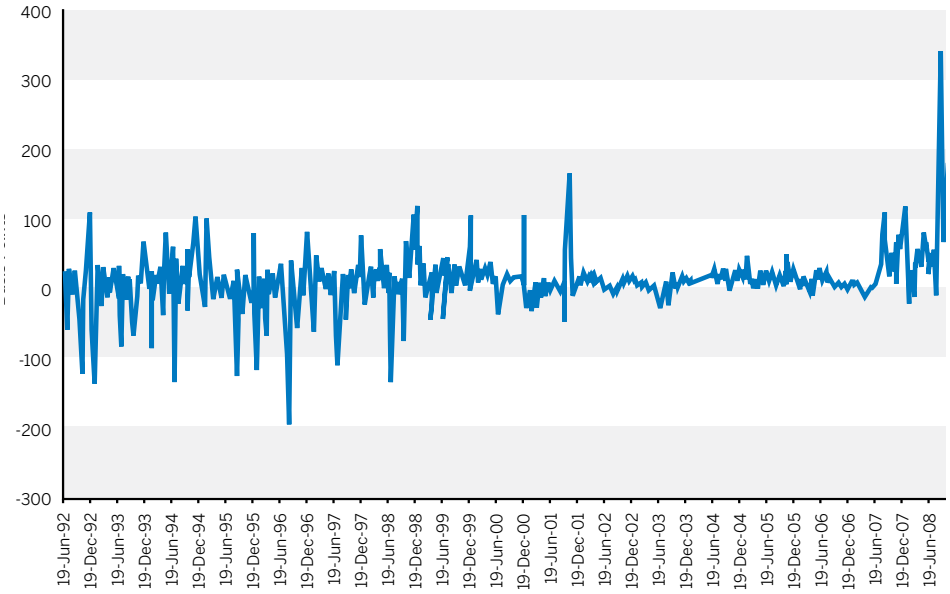
Recent events in credit markets have resulted in unprecedented volatility in a variety of fixed income markets, including liquid futures markets traded on organized exchanges. Particularly noteworthy has been the "de-coupling" of the historically extremely tight relationship between the benchmark overnight Fed Funds and LIBOR interest rates.

The changing relationship between Fed Funds – as reflected in the overnight "Daily Effective Federal Funds" rate – and LIBOR has been evidenced by the rapid and large changes in spreads between 30-Day Federal Funds futures, Eurodollar futures and 1-Month LIBOR futures traded at the CME Group. A fairly stable relationship for several years in which Fed Funds traded within a tight range relative to LIBOR, the recent unpredictability and volatility in the spread eloquently expresses the current uncertainty in credit markets.

Given the close link between behavior of the Fed Funds/Eurodollar futures spread and the recent developments in credit markets, the spread has become a critical instrument for those expressing views and hedging positions related to credit conditions. The following research piece shows market participants how to construct futures spread positions using Fed Funds (FF) and Eurodollar (ED) futures that create exposure to both credit and yield curve conditions.

Part 1 discusses calculating the ratio for an FF-ED spread, *Part 2* explains the variances in the FF and ED expiration calendars, and *Part 3* describes the alternatives for constructing the FF leg of the spread.

Exhibit 1:
Daily One-Month LIBOR Rate minus Federal Funds Effective Rate
July 1992 to November 2008.



Source: Federal Reserve Bank of New York; Bloomberg

PART 1:
Setting the Ratio for FF-ED Spreads

Assume, for illustration, that you wish to spread FF against 1,000 of the nearby quarterly ED contract. Your aim is to profit from changes in the spread between the overnight federal funds rate (the interest rate underlying FF) and the 3-month LIBOR (the interest rate underlying ED).

If you expect this interest rate spread to widen, you'll buy FF against an offsetting short position of 1,000 ED. If you look for this interest rate spread to narrow, you'll sell FF against an offsetting long position of 1,000 ED.

Clearly, you should structure your FF-ED spread so that, as nearly as possible, it changes in value only in response to changes in the interest rate spread. You do not want it to register either profit or loss in response to parallel moves in the overnight fed funds rate and 3-month LIBOR that leave the spread between them unchanged.

You'll achieve this, to a very good approximation, by choosing a number of FF contracts with the same interest rate sensitivity as 1,000 ED contracts:

FF position interest rate sensitivity	=	ED position interest rate sensitivity

Given the DV01 – the dollar value of a one bp change in interest rate levels – for both FF and ED, determining the appropriate spread ratio is straightforward:

By rulebook definition, the DV01 for an ED contract – any ED contract – is $25. Thus the DV01 of your 1,000-contract ED position is $25,000 (i.e., 1,000 contracts times $25 per contract).

Similarly, by rulebook definition, the DV01 for an FF contract – with one exception, any FF contract–is $41.67.[1]

Thus, for a one bp move in both the overnight fed funds rate and 3-month LIBOR, the following equality should hold:

(Number of FF) x ($41.67 / FF contract) =
(1,000 ED) x ($25 / ED contract)

This yields the desired result of:

600 FF = (1,000 ED) x ($25 / ED contract) / ($41.67 / FF contract)

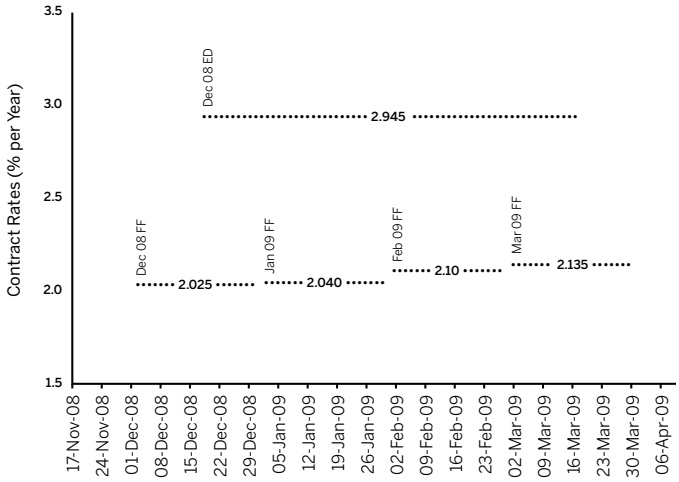
In short, the correct spread ratio is 3:5, or 600 FF for every 1,000 ED.

1 While the DV01 of FF is $41.67 by product definition, the effective DV01 of FF declines as its time to expiration falls below one calendar month. For simplicity, we suppress this complication in the ensuing calculations. If a particular FF-ED spread employs the spot month FF contract, suitable adjustment should be applied. In the Appendix, "Important Exceptions for Nearby FF," contains a brief discussion on this matter.

PART 2:
How Contract Expiration Calendars Mesh

The interval of interest rate exposure embodied in the nearby quarterly ED contract overlaps, in whole or in part, the exposure intervals for four FF contracts. Exhibit 2 illustrates this with Dec 08 ED and the strip of four FF contracts expiring between Dec 08 and Mar 09.

Exhibit 2:
FF Futures Contract Rates and ED Futures Contract Rates
Closing Levels on September 3, 2008.



Dec 08 ED is based upon the LIBOR that applies to a bank deposit settling on Wednesday, December 17 (the December IMM date, the third Wednesday of the contract expiration month), and that matures three months (in this case, 91 days) later on Tuesday, March 17, 2009.

Dec 08 FF is based upon the average effective overnight fed funds rate for all days in December. As such, it shares only 15 days of interest rate exposure (December 17 through 31) with Dec 08 ED.

Jan 09 FF and Feb 09 FF are based on the average effective overnight fed funds rates for January and February, respectively. In each case, the entire one-month interval of exposure is contained within the Dec 08 ED exposure interval.

At the far end of the strip, Mar 09 FF (like Dec 08 FF) has partial overlap with the Dec 08 ED interval of interest rate exposure, spanning the 17 days from March 1 through 17.

In what follows, we'll use shorthand – "FF1", "FF2", "FF3", and "FF4," respectively – to refer to any strip of FF contracts that occupies the same generic temporal relationship to the nearby quarterly ED futures contract as we observe above in the temporal relationship between Dec 08 ED and the FF futures strip from Dec 08 to Mar 09.

> Note 1: As used here, this shorthand notation represents a different chronological sequence of contract expirations than it does in the context of various financial analytical platforms, such as Bloomberg or Reuters. For example, during the month of September 2008,
>
> > "FF1" as used here represents Dec 08 FF, that is, the fourth expiration in the listing cycle for 30-Day Fed Fund futures, whereas "FF1" as used on Bloomberg, for example, references Sep 08 FF, the nearby expiration in the listing cycle.

Note 2: There is more than one way to construct the FF leg of an FF-ED spread. Among the choices, you can execute a precisely weighted strip of FF contracts involving all four corresponding expirations, or you can stack your FF position using just one of these expirations. A more detailed discussion is found in Part 3.

PART 3:
Putting Down Stakes on the FF Strip

The reasoning in Parts 1 and 2 establishes that a proper standard ratio for spreading FF against nearby quarterly ED is 3:5. It leaves open, however, the question of which FF contract or contracts you should use in constructing the spread. Unsurprisingly, the answer depends upon your objective.

Objective for Hedgers: Precision and Structure

Suppose you are a commercial market participant – a bank treasurer, say – who decides in September to use the FF-ED spread to lock in the interest rate spread on a $1 billion 3-month LIBOR loan (or other forward-starting asset earning 3-month LIBOR) that:

- is expected to settle on the December 2008 IMM date (making its tenor identical to the interval of interest rate exposure covered by Dec 08 ED futures), and
- will be financed by overnight borrowings in the Fed Funds market.

The purchase of 1,000 Dec 08 ED will suffice to hedge the 3-month LIBOR loan. The 600 contracts in the FF leg of the futures spread, on the other hand, should be chosen so as to replicate, as closely as the FF strip permits, 91 days of overnight rate exposure. One obvious means of doing so is to apportion the contracts along the FF strip according to the extent to which they overlap with the Dec 08 ED interest rate exposure interval. Exhibit 3 illustrates how you might achieve this goal (in this case, by building on the convention that LIBOR and overnight federal funds rates are both governed by the actual/360 day count convention).

Exhibit 3:
Setting the FF-ED Spread Ratio to Hedge an Overnight/3-Month Money Market Spread.

FF Contract	Length of Overlap of FF Interest Rate Exposure Interval with Dec 08 ED Interest Rate Exposure Interval (Days)	Fraction of Dec 08 ED Interest Rate Exposure Interval	Number of FF Contracts
[a]	[b]	[c] = [b] / 91	[d] = [c] x 600
Dec 08 (FF1)	15	0.165	99
Jan 09 (FF2)	31	0.341	204
Feb 09 (FF3)	28	0.308	185
Mar 09 (FF4)	17	0.187	112
Column Totals	91	1.00	600

To summarize, you would sell the FF-ED spread by establishing a short position of 600 FF – comprising 99 Dec 08, 204 Jan 09, 185 Feb 09, and 112 Mar 09, as shown in Exhibit 3 – against a long position of 1,000 Dec 08 ED.

A quick, generic, approximate rendition of this would entail selling 100 each of Dec 08 FF and Mar 09 FF and 200 each of Jan 09 FF and Feb 09 FF (for the requisite total of 600 contracts) against a long position of 1,000 Dec 08 ED.

Objective for Speculators: Convenience and Correlation

Suppose instead you are an exchange local who wants to use ED simply as a means of laying off risk in FF (or vice versa). Alternatively, you might be a proprietary trader who wishes to trade the money market yield curve, or segments of it, by spreading the FF contract for a particular month against ED.

Either way – for reasons of speed in the case of the local, or for reasons of yield curve pitch, curvature, or misvaluation in the case of the prop trader – the FF-ED spread you employ will frequently take the form of a one-month stack of FF against a stack of ED.

Let's assume for simplicity that you want to spread 1,000 Dec 08 ED against 600 FF chosen from the corresponding four-contract FF strip. The overall strength of correlation between the two legs of the spread will be a key consideration (probably the leading consideration for the exchange local in search of an effective means of risk lay-off). The 5-year correlations appearing in Exhibit 4 point to the third contract in the strip (i.e., Feb 09 FF) as the most suitable candidate.

Exhibit 4:
Nearby Quarterly Eurodollar Futures versus the Corresponding Strip of 30-Day Fed Fund Futures[2]
(Correlation of daily price changes, December 2003 to November 2008)

FF1	FF2	FF3	FF4
0.617	0.672	0.699	0.687

If one were to look at these very same quarterly correlations, but conclude the 5-year time series on June 2007 as in Exhibit 5, you will see the effect that the current financial crisis has had on the correlations between Eurodollar futures and Fed Funds futures.

Exhibit 5:
Nearby Quarterly Eurodollar Futures versus the Corresponding Strip of 30-Day Fed Fund Futures
(Correlation of daily price changes, July 2002 to June 2007)

FF1	FF2	FF3	FF4
0.856	0.948	0.960	0.938

One factor might incline you to prefer stacking with Jan 04 FF rather than Feb 04 FF: In ED futures, a contract's liquidity tends to be better the nearer its expiration.

An argument for sticking with FF3, or the Fed 09 FF contracts, is an examination of short-term correlations, which in this case, also leads to the same conclusion arrived at by the long-term (5-year) correlations presented in Exhibit 4.

If, for example, you compute a series of moving quarterly (63-business-day) correlations using the same 5-year data interval used in computing the statistics in Exhibit 4, then you will find that FF3's local correlation with nearby quarterly ED exceeds local correlations for other members of the FF strip nearly 77 percent of the time. As Exhibit 6 reveals, this criterion would give FF3 the dominant position more often than FF2 as the stack hedge of choice.

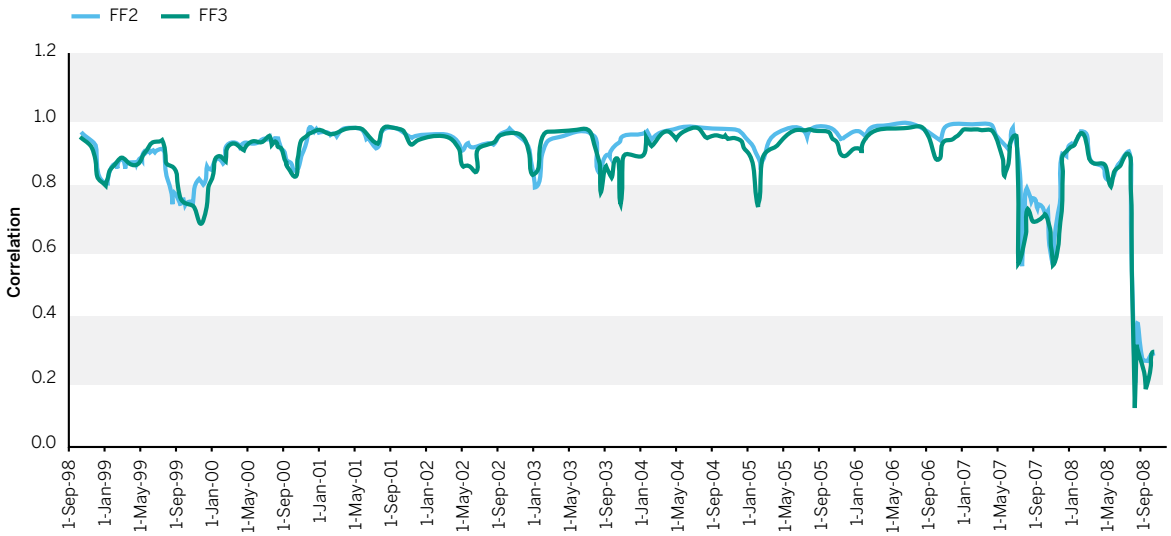
Exhibit 6:
Which Member of the FF Strip Has the Strongest Correlation with the Nearby Quarterly ED?
(Percentage share of days on which an FF contract's local correlation with nearby quarterly ED exceeds local correlation for other members of the corresponding FF strip. Local correlation is defined as the centered moving quarterly (63-business-day) correlation of daily price changes. FF1, FF2, FF3, and FF4 are as defined in Part 2. Data are from December 2003 to November 2008.)

FF1	FF2	FF3	FF4
0.0	13.9	76.5	9.6

To convey some notion of the variability in local correlation over the five-year sample period, Exhibit 7 on the next page illustrates the plot of local correlations between price changes in FF2 and FF3 versus price changes in nearby quarterly ED. You will notice that correlations began to deteriorate during the summer of 2007 as the financial crisis began. Correlations returned strongly thereafter, only to deteriorate once again during the fall of 2008. Upon analyzing this data, one can surmise that the correlations may weaken during market turmoil, but have a tendency to snap back quickly towards the long term mean a market conditions improve.

2 For more information on construction of the data set underlying these and other statistics in this essay, please see "Calculations" in "Final Notes".

Exhibit 7:
Nearby ED versus FF2 and FF3 Moving Quarterly (63-Business-Day) Correlations September 1998 to November 2008



FINAL NOTES:

Important Exception for Nearby FF

The spread logic spelled out above and in Parts 1 and 2 applies with full force to any FF-ED spread for which the expiration dates for an ED contract and the first contract in the corresponding FF strip (FF1) lie beyond the calendar month in which you are trading the spread. The rules of the game will change slightly, however, if you trade the spread during the expiration month for ED and FF1–if, for example, it is early September 2008, and you are trading Sep 08 ED against the corresponding strip consisting of Sep 08, Oct 08, Nov 08, and Dec 08 FF.

The reason is that, for a FF contract already in its expiration month (Sep 08 FF in this example), pricing is governed by an averaging process that takes into account the elapsed days of the expiration month, i.e., days for which the effective overnight federal funds rate is already known. A direct implication is that the impact upon the contract's price of a one bp move in interest rates diminishes as the contract glides toward its month-end expiration day. That is, for practical purposes, a FF contract's DV01 declines from $41.67 per bp at the beginning of its expiration month to zero at month's end. This in turn affects the ratio for spreading FF1 against ED, either alone or in combination with FF2, FF3, and FF4.

Calculations

In constructing the data set for the analysis above, the convention we use to define nearby quarterly ED assumes that market participants roll out of the nearby contract into the first deferred contract on the last business day of the month preceding the nearby contract's expiration month. For example, throughout August "nearby ED" would be the September expiration; on the first day of September "nearby ED" would become the December expiration. Contracts in the corresponding FF futures strip are chosen similarly. For example, throughout August, FF2 would be the October expiration; on the first day of September, FF2 would become the following January expiration.

For more information, visit www.cmegroup.com/interestrates.

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