INTEREST RATES

Eurodollars as Risk Management Tools

How the world advances

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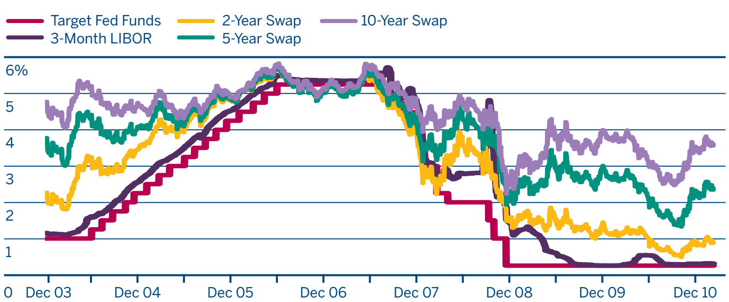
Introduction

The interest rate markets have witnessed unprecedented fluctuations in recent years. In particular, the subprime mortgage and credit crisis prompted the Federal Open Market Committee (FOMC) to push the target Fed Funds rate to the lowest level in history at 0 – 0.25%, with longer-term rates generally following suit.

The Federal Reserve initiated significant monetary easing in 1990, 1998, 2001 and 2007. These accommodative periods have typically been followed by periods of monetary tightening, e.g., 1994, 1999 and 2004. While there is significant uncertainty as to when the Fed might reverse its current easy money policy, investor expectations have nonetheless begun to reflect that possibility.

As such, financial institutions have started to hedge against the possibility that rising rates may adversely impact the liabilities on their books. Meanwhile, asset managers continue to search for investment opportunities in the fixed income and money markets.

Swap, LIBOR and Fed Funds Rates



Throughout these periods of economic uncertainty and market turbulence, CME Group continues to provide risk-management tools that serve to assist financial institutions managing both asset and liability based risks.

This document is intended to provide an overview regarding how one may utilize CME Group Eurodollar futures as an essential element of risk management programs on the part of borrowers such as corporations and investors including asset managers. This paper will review common applications of Eurodollar futures and options for purposes of pricing and hedging floating rate loans, money market assets and over-the-counter (OTC) interest rate swap (IRS) transactions.

Managing Risk

There is an old saying — "You can't manage what you can't measure." In the fixed-income security markets, one generally measures interest rate risk exposure by reference to either duration or basis point value.

Duration is a concept that was originated by the British actuary Frederick Macauley. Mathematically, it is a reference to the weighted average present value of all the cash flows associated with a fixed-income security, including coupon income as well as the receipt of the principal or face value upon maturity. Duration reflects the expected percentage change in value given a 1%, or 100 basis point, change in yield.

E.g., a 5-year note may have a duration of 4 years, suggesting that it is expected to decline 4% in value given a 1% advance in yields. As such, duration represents a useful and popular measure of risk for medium to long-term coupon bearing securities.

But basis point value (BPV) is the preferred reference in the context of short-term, non-coupon bearing instruments, i.e., money market instruments such as Eurodollars, Treasury bills, Certificates of Deposit (CDs), etc.

BPV is a concept that is closely related to duration. It measures the expected monetary change in the price of a security given a 1 basis point (0.01%) change in yield. It may be measured in dollars and cents based upon a particular face value security, commonly $1 million face value. It is also referred to as the "dollar value of an 01" or simply "DV of an 01."

Basis point values may be calculated as a function of the face value and the number of days until maturity associated with a money market instrument, per the following formula.

$$BPV = FaceValue \times \left(\frac{Days}{360}\right) \times 0.01\%$$

E.g., a $10 million 180-day money market instrument carries a BPV = $500.

$$BPV = \$10{,}000{,}000 \times \left(\frac{180}{360}\right) \times 0.01\% = \$500$$

E.g., a $100 million 60-day money market instrument has a BPV = $1,666.67.

$$BPV = \$100{,}000{,}000 \times \left(\frac{60}{360}\right) \times 0.01\% = \$1{,}666.67$$

E.g., a $1 million face value, 90-day money market instrument may be calculated as $25.00.

$$BPV = \$1{,}000{,}000 \times \left(\frac{90}{360}\right) \times 0.01\% = \$25$$

Note that Eurodollar futures contracts are based upon a $1 million face value 90-day instrument and that a one basis point (1 bp) change in yield is associated with a $25.00 fluctuation in the value of a single contract.[1]

Basis point values may similarly be calculated for money market instruments of other terms and face values, as shown in the table below.

Basis Point Value (BPV) of Money Market Instruments

Days	$500K	$1MM	$10MM	$100M
1	$0.14	$0.28	$2.78	$27.78
7	$0.97	$1.94	$19.44	$194.44
30	$4.17	$8.33	$83.33	$833.33
60	$8.33	$16.67	$166.67	$1,666.67
90	$12.50	$25.00	$250.00	$2,500.00
180	$25.00	$50.00	$500.00	$5,000.00
270	$37.50	$75.00	$750.00	$7,500.00
360	$50.00	$100.00	$1,000.00	$10,000.00

[1] Eurodollar futures were introduced on the Chicago Mercantile Exchange (CME) in December 1981. They are now recognized as a "flagship" contract as evidenced by its significant trading volume and liquidity. They are based on a nominal $1 million face value, 90-day Eurodollar time deposit. They are settled in cash at the 3-month Eurodollar Time Deposit Rate calculated daily by the British Bankers Association (BBA) through a survey process. The contract settles on the 2nd business day prior to the 3rd Wednesday of the contract month ("IMM dates"). Contracts are available in the March quarterly cycle of March, June, September and December extending 10 years into the future. The 1st four "serial" or non-March quarterly cycle months are also available for trade. The contract is quoted per the "IMM Index," or 100 less the yield. Thus, a yield of 0.855% is quoted at 99.145 (= 100.00 – 0.855). Options exercisable for Eurodollar futures are also traded.

Hedging Short-Term Rate Exposure

The essence of any hedging or risk management program is to match up any change in risk exposures to be hedged ($\triangle Value_{risk}$) with an offsetting change in the value of a futures contract ($\triangle Value_{futures}$) or other derivative instrument.

$$\triangle Value_{risk} \sim \triangle Value_{futures}$$

The appropriate hedge ratio (HR) may be calculated as the expected change in the value of the risk exposure relative to the expected change in the value of the futures contract that is utilized to hedge such risk.

$$HR = \triangle Value_{risk} \div \triangle Value_{futures}$$

Change in value (denoted by the Greek letter delta or "△") is a rather abstract concept, but it may be measured by reference to the BPV as discussed above. Thus, we may "operationalize" the equation by substituting BPV for this abstract concept of change.

$$\triangle Value \sim BPV$$

Noting that the BPV of one Eurodollar futures contract is unchanging at $25.00, we may identify a generalized Eurodollar futures hedge ratio as follows.

$$HR = BPV_{risk} \div BPV_{futures} = BPV_{risk} \div \$25.00$$

The London Interbank Offering Rate (LIBOR) is a frequent reference to which floating rate bank loans are tied.[2] A corporation may arrange a commercial bank loan at LIBOR rates plus some (fixed) premium that reflects the credit status of the corporation, e.g., LIBOR + 50 basis points (0.50%), LIBOR + 125 basis points (1.25%). As such, the corporation faces the risk of rising rates. On the other hand, an investor or asset manager planning to purchase the loan may be concerned about the prospect of declining rates.

E.g., a corporation anticipates it will require a $100 million loan for a 90-day period beginning in six months time that will be based on 3-month LIBOR rates plus some fixed premium. The BPV of this loan may be calculated as $2,500.

$$BPV = \$100{,}000{,}000 \times \left(\frac{90}{360}\right) \times 0.01\% = \$2{,}500$$

The corporation is concerned that rates may rise before the loan is needed and that it will, therefore, be required to pay higher interest rates. This exposure may be hedged by selling 100 Eurodollar futures that mature six months from the current date.

$$HR = \$2{,}500 \div \$25 = 100$$

[2] The "benchmark" standard for LIBOR is found in the British Bankers Association (BBA) 3-month Eurodollar Time Deposit Rate. This figure is calculated on a daily basis through a time-test survey process. It is accepted as the standard measure for short-term interest rates against which literally trillions of dollars worth of investments, loans and over-the-counter (OTC) derivatives, including forward rate agreements (FRAs) and interest rate swaps (IRS), are pegged. This is the rate against which CME Group Eurodollar futures are cash-settled.

E.g., similarly, the asset manager planning to purchase the $100 million loan may be concerned that rates will decrease. Thus, the asset manager might buy 100 Eurodollar futures as a hedge.

Sell Eurodollar futures → Hedge risk of rising interest rates

Buy Eurodollar futures → Hedge risk of declining interest rates

In these illustrations, we assume that the loan is tied to 3-month LIBOR rates. However, commercial loans are often based on alternate rates including prime rate, commercial paper, etc. Those rates may not precisely parallel LIBOR movements, i.e., there may be some basis risk between the instrument to be hedged and the Eurodollar futures contract that is employed to execute the hedge.

It is important to establish a high degree of correlation between LIBOR rates, as reflected in Eurodollar futures prices, and the specific rate exposure to be hedged. In particular, use of a BPV hedge ratio implies an expectation that yields on both instruments fluctuate in parallel, i.e., by the same number of basis points. This correlation is central to the effectiveness of the hedge and to niceties such as qualification for hedge accounting treatment per FASB Statement No. 133.[3]

Strips

Many loans are structured such that the rate floats periodically as a function of LIBOR plus a fixed premium. This introduces a periodic risk that rates may fluctuate before the time of each periodic loan reset date. Eurodollar futures may be used to address this possibility to the extent that they are listed on a quarterly basis extending some ten (10) years out into the future.

E.g., assume that it is March 2011 and a corporation assumes a 2-year bank loan repayable in March 2013 for $100 million. The loan rate is reset every 3 months at LIBOR plus a fixed premium. As such, the loan may be "decomposed" into a series, or strip, of 8 successively deferred 3-month periods.

Note that if the loan is secured currently, the effective rate may be fixed at the current rate for the first 3 months. Thus, there is no risk over the first 3-month period between March and June 2011. However, the corporation remains exposed to the risk that rates advance by each of the 7 subsequent loan rate reset dates.

If we assume that each 3-month period equates to 90 days, there are 630 days (= 7 reset dates x 90 days) over which the loan rate is at risk. As such, the BPV of this loan equals $17,500.

$$BPV = \$100{,}000{,}000 \times \left(\frac{630}{360}\right) \times 0.01\% = \$17{,}500$$

This suggests that the corporation might sell 700 Eurodollar futures to address the risk of rising rates.

$$HR = \$17{,}500 \div \$25 = 700$$

[3] Statement of Financial Accounting Standards No. 133, "Accounting for Derivative Financial Instruments and Hedging Activities" (FAS 133), generally addresses accounting and reporting standards for derivative instruments in the United States. The statement allows one to match or simultaneously recognize losses (gains) in a hedged investment with offsetting gains (losses) in a derivatives contract under certain conditions. But to apply such "hedge accounting treatment," it is necessary to demonstrate that the hedge is likely to be "highly effective" for addressing the specifically identified risk exposure. One method for making such a demonstration is through statistical analysis. The "80/125" rule suggests that the actual gains and losses of the derivative(s) should fall within 80% to 125% of the gains/losses for the hedged item. This may be interpreted to require a correlation of 80% or better to qualify for hedge accounting treatment.

But should the hedge be placed by selling 700 June 2011 contracts or by selling 700 December 2012 contracts? I.e., should the hedge be stacked in the nearby month or in the deferred month? Consider the impact on the hedge if the shape of the yield curve were to change.

When the yield curve flattens or inverts, that implies that short-term yields rise relative to longer-term yields. If the corporation expected the curve to flatten or invert, stack the hedge in nearby June 2011 futures that represent rates associated with the first of the decomposed 7 loan periods.

If yield curve expected to flatten or invert → **Stack short hedge in nearby futures**

If yield curve expected to steepen → **Stack short hedge in deferred futures**

When the yield curve steepens, this implies that short-term yields decline relative to longer-term yields (or, long-term yields rise more than short-term yields). If the corporation expected the curve to steepen, stack the hedge in deferred December 2012 futures that represent rates associated with the last of the 7 loan periods.

But a more precise answer that minimizes yield curve "basis risk," is found by considering that the floating rate loan may be "decomposed" into seven successively deferred 90-day loans. The BPV associated with each of those 7 loans equals $2,500.

$$BPV = \$100{,}000{,}000 \times \left(\frac{90}{360}\right) \times 0.01\% = \$2{,}500$$

This suggests that, rather than stacking the hedge in any single contract month, the corporation might sell 100 Eurodollar futures in successive quarterly contract months to match the 7 successive quarterly loan reset dates.

As such, one might effectively hedge each of the 7 loan periods separately. This transaction is often referred to as a "strip," or a series of short (or long) Eurodollar futures in successively deferred contract months to hedge the risk of rising (declining) rates, respectively.

Reset Date	Action to Hedge Rate Reset
June 2011	Sell 100 Jun-11 futures
September 2011	Sell 100 Sep-11 futures
December 2011	Sell 100 Dec-11 futures
March 2012	Sell 100 Mar-12 futures
June 2012	Sell 100 Jun-12 futures
September 2012	Sell 100 Sep-12 futures
December 2012	Sell 100 Dec-12 futures

"Synthetic" Term Investment

Strips of 90-day Eurodollar futures may be bought or sold effectively to replicate the performance of longer-term loans.

E.g., a 2-year strip effectively conveys the performance of a 2-year investment while a 5-year strip may generate a yield that reflects 5-year rates. The effective yield on a strip may be calculated as the compounded value of each successive quarterly investment as follows.

$$Strip = \left(\prod_{i=1}^{n} \left[1 + R_i \, x \left(\frac{days_i}{360} \right) \right] - 1 \right) \div \left(\frac{term}{360} \right)$$

R_i = rate associated with each successive period; $days_i$ = number of days in each successive period; and term = number of days associated with the cumulative period over which the strip extends.

E.g., assume it is December 2010 and an asset manager wants to create a 1-year investment in the form of a strip. This may be accomplished by investing in a 3-month term instrument currently and buying Mar-11, Jun-11 and Sep-11 Eurodollar futures. The purchase of this series or strip of Eurodollar futures effectively "locks-in" an investment value over each subsequent 3-month period. The compounded yield associated with this hypothetical strip transaction, as detailed in Exhibit 1 in our appendix, equals 1.014%.

Asset managers often compare the value of "synthetic" investments created with Eurodollar futures strips to yields associated with comparable term investments in search of enhanced returns or "alpha." Yield curve traders frequently spread strips with comparable term investments to capitalize on perceived mispricings.

E.g., one may compare the yield on a strip vs. the yield on comparable term Treasury securities. This is known as a "TED," or Treasury vs. Eurodollar spread. Eurodollars represent private credit risks while Treasuries reflect public credit risk or the "risk-free" rate.

Thus, we normally expect strips to generate higher returns than comparable maturity Treasuries. But when the relationship between these securities departs from normally expected patterns, one may buy the instrument considered "cheap" and sell the instrument that is "rich."

Compare strip yield to yields of comparable term securities

↓

Buy cheap and sell rich instruments

Packs and Bundles

Because strips are frequently placed, the Exchange has created ways to trade them conveniently in the form of "packs" and "bundles."

A bundle represents a series of successively quarterly Eurodollar futures. E.g., one may buy (sell) a 2-year bundle by buying (selling) the first 8 quarterly Eurodollar futures. A 5-year bundle represents the first 20 quarterly Eurodollar futures. A "pack" represents a series of 4 successively deferred Eurodollar futures in a single "contract year." E.g., it is March 2011, one may buy (sell) a 2-year pack by buying (selling) Mar-12, Jun-12, Sep-12 and Dec-12 futures. Buy (sell) a 5-year pack by buying (selling) Mar-15, Jun-15, Sep-15 and Dec-15 futures.

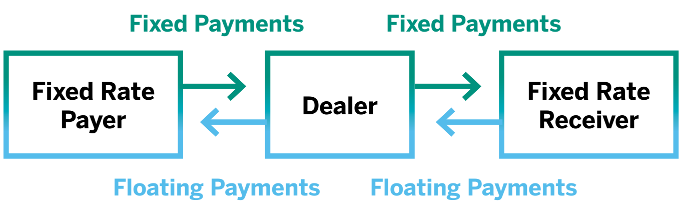
Packs and bundles are quoted as a single value representing the average change in all Eurodollar futures included in the package, e.g., +4 basis points, –7.5 basis points. Once transacted, prices are assigned to the individual legs of the pack or bundle.

Interest Rate Swaps

An interest rate swap is a financial transaction that entails multiple, periodic payments (swaps) of a sum determined by reference to a fixed rate of interest and payable by the swap "buyer," vs. a sum determined by reference to a floating or variable rate of interest and payable by the swap "seller." The buyer is generally referred to as the fixed rate payer while the seller or floating rate payer is often referred to as the fixed rate receiver.

E.g., one may swap a quarterly payment based upon a specified fixed rate of interest, such as 1%, applied to a principle value of $10 million for the next 5 years; for a quarterly payment based upon 3-month LIBOR rates applied to a principle value of $10 million for the next 5 years. These periodic fixed vs. floating rate payments are typically netted such that only the net amount due is passed between buyer and seller.

Interest Rate Swap (IRS)

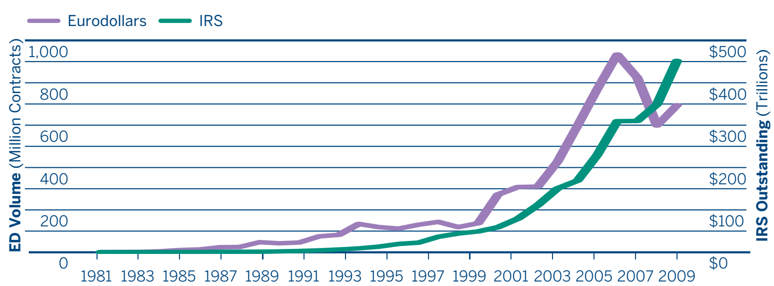


Clearly, the fixed rate payer hopes that floating rates rise such that his future receipts are increased. The floating rate payer, or fixed rate receiver, hopes that floating rates decline such that his future payments are diminished.

The seminal interest rate swap transaction was concluded in 1980, while Eurodollar futures were originally introduced in 1981. Since that time, the IRS market has grown to some $451.8 trillion in outstanding notional value as of June 2010.[4]

Volume in CME Group Eurodollar products has grown on a strikingly parallel path along with over-the-counter swaps. This underscores the fact that Eurodollar futures are inextricably intertwined with the IRS market as a source for pricing and as a tool to hedge the risks associated with swaps. In particular, banks and broker-dealers making a market in over-the-counter (OTC) swaps represent primary Eurodollar market participants.

Eurodollars and Swap Growth



[4] As reported by the Bank of International Settlements (BIS) in its semi-annual survey of the over-the-counter (OTC) derivatives marketplace.

Pricing Swaps

Interest rate swaps are typically quoted (on an opening basis) by reference to the fixed rate of interest. That fixed rate is calculated as the rate that renders equivalent the present value of the anticipated periodic fixed rate payments (PV_{fixed}); with the present value of the anticipated periodic floating rate payments ($PV_{floating}$).

Those floating rate payments may be estimated by examining the shape of the yield curve, or more practically, by referencing the rates associated with Eurodollar futures prices that reflect the shape of the curve.

$$PV_{Fixed} = PV_{Floating}$$

When an IRS is transacted such that the present value of the estimated floating rate payments equals the present value of the fixed rate payments, no monetary consideration is passed on the basis of this initial transaction. This is also referred to as a "par swap." In other words, the "non-par payment" (NPP) is set at zero ($0).

$$NPP = 0 = PV_{Floating} - PV_{Fixed}$$

The fixed rate (R_{fixed}) associated with a swap may be calculated by reference to the following formula.

$$R_{fixed} = \frac{4 \times \sum_{i=1}^{n} \left[PV_i \times R_i \times \left(\frac{days_i}{360} \right) \right]}{\sum_{i=1}^{n} PV_i}$$

PV_i = present value discounting factor; R_i = rate associated with each successively deferred period; and $days_i$ = number of days in each successively deferred period. Note that those rates may be determined by reference to Eurodollar futures pricing.

E.g., find the value of a 2-year swap where the floating rate is determined by reference to the BBA 3-month Eurodollar time deposit rate. Assume it is December. Exhibit 2, found in the appendix below, provides inputs into the calculation. The fixed rate of interest associated with the swap may be calculated as 0.9079%.

The present value of the fixed and floating rate payments given a fixed rate of 0.9079% may be calculated as $180,271.20. The equivalent of these two cash flow streams may be established by reference to Exhibit 3 found in the appendix. As such, this is a par swap that may be transacted with no up-front monetary consideration.

$$\begin{aligned} R_{fixed} = 4 \times \Big(& \left[0.9992 \times 0.003125 \times \left(\frac{96}{360} \right) \right] \\ & + \left[0.9982 \times 0.003650 \times \left(\frac{98}{360} \right) \right] \\ & + \left[0.9970 \times 0.004550 \times \left(\frac{91}{360} \right) \right] \\ & + \left[0.9955 \times 0.006050 \times \left(\frac{91}{360} \right) \right] \\ & + \left[0.9934 \times 0.008450 \times \left(\frac{91}{360} \right) \right] \\ & + \left[0.9904 \times 0.011750 \times \left(\frac{91}{360} \right) \right] \\ & + \left[0.9866 \times 0.015350 \times \left(\frac{91}{360} \right) \right] \\ & + \left[0.9820 \times 0.01870 \times \left(\frac{91}{360} \right) \right] \Big) \\ & \div (0.9992 + 0.9982 + 0.9970 + 0.9955 \\ & + 0.9934 + 0.9904 + 0.9866 + 0.9820) \\ & = 0.9079\% \end{aligned}$$

Note that, once transacted, an IRS might be rather unique to the extent that there are a plethora of variables associated with the transaction. These include features such as the specific floating reference rate, the periodic reset dates, the date conventions, etc. Because there are a large number of variable features associated with an IRS, the market for swaps is fragmented amongst many outstanding swaps with divergent contract terms and conditions.

Because the swap market is rather fragmented, bi-lateral counterparties who wish to close or retire an outstanding swap transaction frequently must negotiate such a "close-out" or "tear-up" directly with the original counterparty. These closing transactions are typically quoted by reference to the non-par value of the swap at the time of such close-out.

E.g., interest rates may have advanced since the original transaction was concluded at a NPP = 0. As such, the fixed rate payer is advantaged while the floating rate payer is disadvantaged. Thus, the floating rate payer may be required to compensate the fixed rate payer with a NPP that reflects the difference between the $PV_{floating}$ and PV_{fixed} per current market conditions.

E.g., interest rates may have declined since the original transaction was concluded at a NPP = 0. As such, the fixed rate payer is disadvantaged while the floating rate payer is advantaged. Thus, the fixed rate payer may be required to compensate the floating rate payer with a NPP that reflects the difference between the $PV_{floating}$ and PV_{fixed} per current market conditions.

Hedging Swaps

Just as interest rate swaps may be priced by reference to Eurodollar futures values, they may also be hedged with Eurodollar futures positions. This is, of course, facilitated to the extent that the swap is structured to parallel the characteristics of Eurodollar futures contracts.

E.g., basis risk is reduced to the extent that the floating rate associated with the swap is based on the same BBA 3-month Eurodollar time deposit rate that is used to cash-settle the futures contract, a "BBA swap." Basis risk is further reduced to the extent that the swap is reset on dates corresponding to the quarterly expiration of the futures contracts.[5]

Fixed rate payers exposed to risk of falling rates	→	**Buy Eurodollar futures**
Fixed rate receivers exposed to risk of rising rates	→	**Sell Eurodollar futures**

As a general rule, the fixed rate payer is exposed to the risk of falling rates and rising prices. This suggests that fixed rate payers generally buy Eurodollar futures as a hedging strategy. Similarly, fixed rate receivers (floating rate payers) are exposed to the risk of rising rates and falling prices. Thus, fixed rate receivers may sell Eurodollar futures as a hedging strategy.

Just as we might identify the BPV of a loan instrument to assess the magnitude of risk, we might also calculate the BPV of a swap. Unfortunately, there is no simple, deterministic formula to reference in this regard. But we may nonetheless estimate the BPV of a swap by comparing its non-par value given yield levels spaced 1 basis point apart.

E.g., find the BPV of a 2-year IMM-dated swap with a $10 million notional amount, as discussed above. Note that the swap is originally transacted at par such that the $PV_{floating}$ = PV_{fixed} = $180,271.20. Thus, the original non-par payment, or difference between the present value of the fixed and floating payments, totaled zero (NPP = $0).

[5] Eurodollar futures expire on the 2nd business day prior to the 3rd Wednesday of the contract month. These dates are referred to as "IMM dates" with a nod to the International Monetary Market or the nomenclature that was once associated with the division of the Chicago Mercantile Exchange on which financial products were traded. The reference endures even though the Exchange no longer categorizes its products into an IMM division.

Assume that yields advance by 1 basis point (0.01%) at all points on the yield curve. Per this scenario and as detailed in Exhibit 4, found in the appendix, PV_{fixed} = \$181,164.10 while $PV_{floating}$ = \$183,416.46. Thus, the non-par value of the swap increases from \$0 to \$2,252.36 (= \$183,416.46 – \$181,164.10). I.e., the fixed rate payer profits by \$2,252.36 in the market or non-par value of the swap; the floating rate payer loses \$2,252.36 in value. As such, the swap has a BPV = \$2,252.36. This suggests that the swap may be hedged using 90 Eurodollar futures.

$$HR = \$2{,}252.36 \div \$25 = 90$$

But in which contract month should the hedge be placed? The short or floating rate payer might sell 90 futures in a nearby contract month if the yield curve were expected to flatten or invert. Or, one might sell 90 futures in a deferred month if the yield curve were expected to steepen. (The implications of a change in the shape of the yield curve are discussed in some detail above.)

But a more precise hedge may be achieved if one were to sell futures in Eurodollar months that match the swap reset dates and risk exposures. This may be accomplished by comparing the PV_{fixed} and $PV_{floating}$ cash streams at each reset date.

E.g., as shown in Exhibit 5 in the appendix, and in reference to the March 2012 payment date, $PV_{floating} - PV_{fixed}$ = \$15,224.33 – \$22,595.63 = –\$7,371.30. Assuming a 1 basis point advance in yield, the difference becomes $PV_{floating} - PV_{fixed}$ = \$15,521.70 – \$22,662.40 = –\$7,140.69. This suggests that the floating rate payer is exposed to a risk in March 2012 that may be quantified with a BPV = \$230.61 (= \$7,371.30 – \$7,140.69). This further suggests that the floating rate payer may hedge that particular reset date by selling 9 Dec-11 Eurodollar futures.

$$HR = \$230.61 \div \$25 = 9.2$$

Similarly, the floating rate payer might sell various amounts of Eurodollar futures in successively deferred months to hedge the risk of rising rates and falling prices as calculated in Exhibit 5 to the right.

Exhibit 5

Action
Sell 11 Jun-11 futures
Sell 9 Sep-11 futures
Sell 9 Dec-11 futures
Sell 10 Mar-12 futures
Sell 12 Jun-12 futures
Sell 16 Sep-12 futures
Sell 23 Dec-12 futures
Total 90 Contracts

This hedge is "self-liquidating" in the sense that every 3 months as the rate over the subsequent 3-month period is established, the Eurodollar futures sold to hedge that specific risk are cash-settled. However, this does not imply that the hedge requires no maintenance. The BPV associated with Eurodollar futures is unchanging at \$25/contract. However, like coupon bearing fixed income instruments, swaps experience "convexity," i.e., the responsiveness or BPV of the swap's value fluctuates as yields rise and fall. Convexity generally increases as a function of the tenor of the swap.

Thus, it is advisable periodically to quantify the swap structure and determine if the recommended hedge structure might have changed as a function of fluctuating rates and swap convexity.

Caps, Floors, Collars

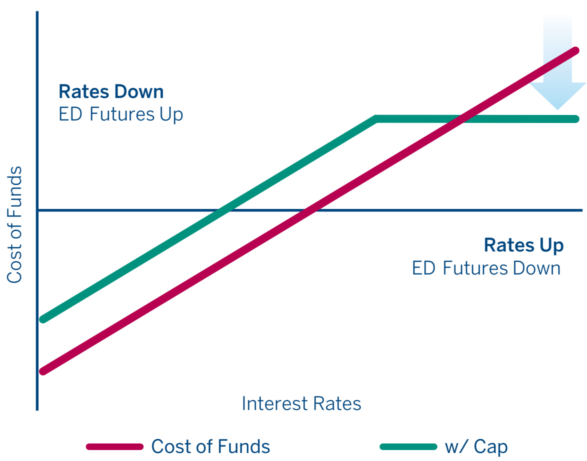
In addition to offering Eurodollar futures, CME Group also offers options on Eurodollar futures. This popular product is useful in restructuring risk in a variety of interesting and practical ways.

One may wish effectively restructure an asset or a liability by establishing a minimum rate, a maximum rate or possibly to limit the rate on both the upward and downward side. There is a variety of over-the-counter option instruments that are referred to as caps, floors and collars that accomplish these objectives. Or, one may readily utilize options on Eurodollar futures to accomplish the same purposes.

Cap

Assume that a corporation securing a floating rate loan is concerned that rates will advance over time, driving the cost of funds to untenable levels. But the corporation may wish to retain the benefits potentially associated with declining rates. By buying an over-the-counter (OTC) derivative known as a "cap," the corporation may accomplish its objectives.

Cap on Borrowing Rate



When buying a cap, the borrower pays a fee or premium to the cap provider up-front. Subsequently, the cap provider compensates the borrower if rates advance above an agreed-upon strike price over the term of the cap agreement. E.g., a cap is struck at 4% when the loan rate is at 3%. If rates advance above 4%, the cap buyer will be compensated for his increased borrowing costs. Thus, the borrower may fix the maximum loan rate while retaining the benefits of a possible rate decline. But this comes at the cost of paying the upfront fee or premium.

As an alternative, one might buy out-of-the-money put options exercisable for Eurodollar futures to create a synthetic long cap. Just like a long cap, the purchase of puts entails the payment of a negotiated premium. The puts advance in value as rates rise and Eurodollar futures decline.

Unlike a cap that may be available on an over-the-counter (OTC), privately negotiated basis, Eurodollar options are traded openly and competitively on the Exchange. Further, these options are processed through the Exchange's central counterparty (CCP) clearing and subject to the attendant financial sureties.

Buy out-of-the-money Eurodollar puts → **Provides a cap on cost of borrowing**

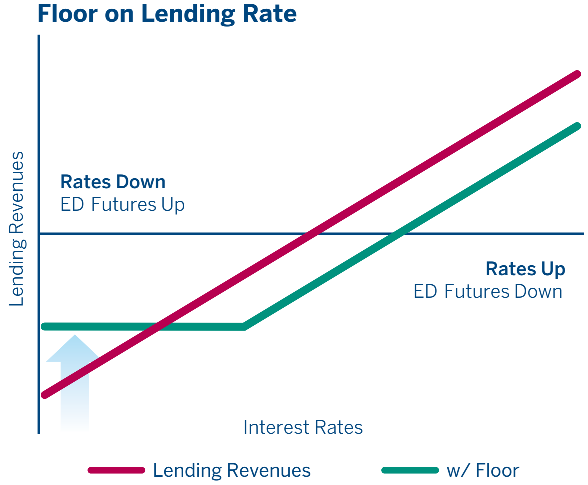
Creating an Investor Floor

Assume that an asset manager purchases a floating rate asset or loan but wants to lock-in a minimum return in the event that interest rates generally decline. The asset manager may buy another variety of OTC derivative known as a "floor" to accomplish this objective.

Buy out-of-the-money Eurodollar calls → **Provides a floor on lending revenues**

A floor means that the floor provider will compensate the floor buyer if the adjustable loan rate should decline below an agreed-upon strike price. E.g., a lender might purchase a floor at 2.5%. If rates fall to 2%, the floor provider is required to compensate the buyer for that 0.5% shortfall below the 2.5% strike price.

Floor on Lending Rate



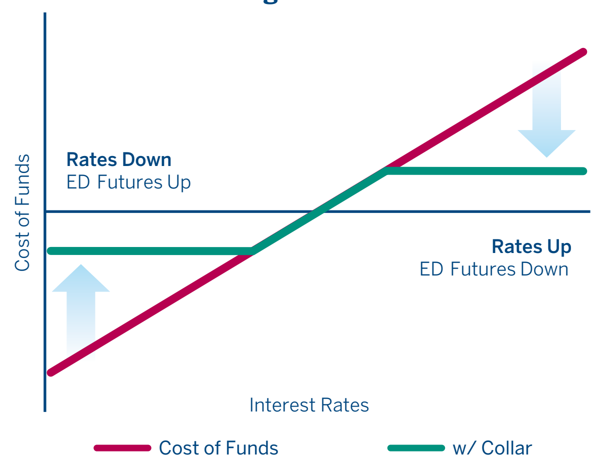
Or, one might buy out-of-the-money call options exercisable for Eurodollar futures to create a synthetic long floor. Just like the long floor, the purchase of calls entails the upfront payment of a negotiated premium. Calls will rise in value as rates decline and Eurodollar futures prices rise.

Creating a Collar

Assume that a borrower is interested in purchasing a cap but believes that the cap premium is too high. Thus, he may transact yet another variety of OTC derivative known as a "collar." A collar represents a combination of a floor and a cap that effectively limits both upside and downside rate changes.

Borrowers may purchase a cap and sell a floor to create a collar. The sale of the floor is used to fully or partially fund the purchase of the cap. These strategies allow the borrower to limit the negative impact of rate advances. But it comes at the cost of limiting the advantageous effects of rate declines.

Collar on Borrowing Rate



A collar may likewise be created by a borrower by buying out-of-the-money put options (analogous to buying a cap) and selling out-of-the-money call options (analogous to selling a floor).

Similarly, asset managers might purchase a floor and sell a cap. The sale of the cap by the lender is used to fully or partially fund the purchase of the floor. This allows the investor to limit the negative impact of rate declines. But it comes at the cost of limiting the advantageous effects of rate advances.

Buy out-of-the-money Eurodollar puts & sell out-of-the-money Eurodollar calls → **Provides a collar on cost of borrowing**

A collar may likewise be created by an asset manager by buying out-of-the-money call options (analogous to buying a floor) and selling out-of-the-money put options (analogous to selling a cap).

Buy out-of-the-money Eurodollar calls & sell out-of-the-money Eurodollar puts → **Provides a collar lending revenues**

Conclusion

CME Group is committed to finding effective and practical risk-management solutions for fixed-income asset managers in a dynamic economic environment.

While the recent financial crisis has sent shivers through the investment community, it is noteworthy that CME Group performed flawlessly throughout these trying times. Our products offer deep liquidity, unmatched financial integrity and innovative solutions to risk management issues.

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Appendix of Exhibits

Exhibit 1: Find Value of (Hypothetical) Strip
(As of Dec – 10)

Instrument	Day Span	Cumulative Term	Eurodollar Price	Rate (R)	Period Future Value	Compound Value	Strip Yield
3-Mth Investment	90	90	99.2000	0.800%	1.0020	1.0020	0.800%
Mar-11 Eurodollars	90	180	99.1000	0.900%	1.0022	1.0043	0.851%
Jun-11 Eurodollars	90	270	98.9600	1.040%	1.0026	1.0069	0.915%
Sep-11 Eurodollars	90	360	98.7000	1.300%	1.0032	1.0101	**1.014%**

Exhibit 2: Find Swap Value
(As of March 9, 2011)

Instrument	Expiration Date	Days	Day Span	Price	Rate (R)	Compound Value (CV)	Discount Factor (PV) (1/CV)
3-Mth LIBOR			96		0.3125	1.0008	0.9992
Jun-11 Eurodollars	6/13/11	96	98	99.6350	0.3650	1.0018	0.9982
Sep-11 Eurodollars	9/19/11	194	91	99.5450	0.4550	1.0030	0.9970
Dec-11 Eurodollars	12/19/11	285	91	99.3950	0.6050	1.0045	0.9955
Mar-12 Eurodollars	3/19/12	376	91	99.1550	0.8450	1.0067	0.9934
Jun-12 Eurodollars	6/18/12	467	91	98.8250	1.1750	1.0096	0.9904
Sep-12 Eurodollars	9/17/12	558	91	98.4650	1.5350	1.0136	0.9866
Dec-12 Eurodollars	12/17/12	649	91	98.1300	1.8700	1.0184	0.9820
	3/18/13	740					

Exhibit 3: Confirm Par Value
(As of March 9, 2011)

Payment Date	Fixed Payments	Discount Factor	PV of Fixed Payments	Floating Payments	Discount Factor	PV of Floating Payments
6/13/11	$22,697.63	0.9992	$22,678.73	$8,333.33	0.9992	$8,326.39
9/19/11	$22,697.63	0.9982	$22,656.22	$9,936.11	0.9982	$9,917.98
12/19/11	$22,697.63	0.9970	$22,630.19	$11,501.39	0.9970	$11,467.22
3/19/12	$22,697.63	0.9955	$22,595.63	$15,293.06	0.9955	$15,224.33
6/18/12	$22,697.63	0.9934	$22,547.47	$21,359.72	0.9934	$21,218.42
9/17/12	$22,697.63	0.9904	$22,480.70	$29,701.39	0.9904	$29,417.53
12/17/12	$22,697.63	0.9866	$22,393.81	$38,801.39	0.9866	$38,282.02
3/18/13	$22,697.63	0.9820	$22,288.45	$47,269.44	0.9820	$46,417.31
			$180,271.20			**$180,271.20**

Appendix of Exhibits (continued)

Exhibit 4: Find BPV of Swap
(As of March 9, 2011)

Payment Date	Fixed Payments	Discount Factor	PV of Fixed Payments	Floating Payments	Discount Factor	PV of Floating Payments
6/13/11	$22,697.63	0.9991	$22,678.12	$8,333.33	0.9991	$8,326.17
9/19/11	$22,697.63	0.9990	$22,674.48	$10,208.33	0.9990	$10,197.92
12/19/11	$22,697.63	0.9988	$22,670.98	$11,754.17	0.9988	$11,740.37
3/19/12	$22,697.63	0.9984	$22,662.40	$15,545.83	0.9984	$15,521.70
6/18/12	$22,697.63	0.9978	$22,648.68	$21,612.50	0.9978	$21,565.89
9/17/12	$22,697.63	0.9970	$22,629.84	$29,954.17	0.9970	$29,864.71
12/17/12	$22,697.63	0.9961	$22,609.33	$39,054.17	0.9961	$38,902.24
3/18/13	$22,697.63	0.9953	$22,590.27	$47,522.22	0.9953	$47,297.45
			$181,164.10			**$183,416.46**

Exhibit 5: Structuring Hedge
(As of March 9, 2011)

	Original Scenario			Rates Increase 1 Basis Point				
Payment Date	(1) PV of Fixed Payments	(2) PV of Floating Payments	(3) Fixed-Float (2-1)	(4) PV of Fixed Payments	(5) PV of Floating Payments	(6) Fixed-Float (5-4)	Difference in Cash Flows	Hedge Ratio (HR)
6/13/11	$22,678.73	$8,326.39	($14,352.33)	$22,678.12	$8,326.17	($14,351.95)	$0.38	0.0
9/19/11	$22,656.22	$9,917.98	($12,738.23)	$22,674.48	$10,197.92	($12,476.56)	$261.68	10.5
12/19/11	$22,630.19	$11,467.22	($11,162.97)	$22,670.98	$11,740.37	($10,930.61)	$232.36	9.3
3/19/12	$22,595.63	$15,224.33	($7,371.30)	$22,662.40	$15,521.70	($7,140.69)	$230.61	9.2
6/18/12	$22,547.47	$21,218.42	($1,329.05)	$22,648.68	$21,565.89	($1,082.79)	$246.27	9.9
9/17/12	$22,480.70	$29,417.53	$6,936.83	$22,629.84	$29,864.71	$7,234.87	$298.04	11.9
12/17/12	$22,393.81	$38,282.02	$15,888.21	$22,609.33	$38,902.24	$16,292.91	$404.70	16.2
3/18/13	$22,288.45	$46,417.31	$24,128.86	$22,590.27	$47,297.45	$24,707.18	$578.32	23.1
	$180,271.20	**$180,271.20**	**$0.00**	**$181,164.10**	**$183,416.46**	**$2,252.36**	**$2,252.36**	**90.1**

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