CME Group

A CME/Chicago Board of Trade/NYMEX Company

INTEREST RATE PRODUCTS

Interest Rate Swap Futures Reference Guide

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INTRODUCTION

Interest Rate Swap futures fill a vital need for exchange-traded derivatives that reference intermediate- and long-term plain vanilla swap rates.

Because they are guaranteed by CME Clearing, they virtually eliminate counterparty credit risk. Combined with their standardization, low operational cost, and flexibility, this makes them ideal for managing swap rate exposures under a wide range of circumstances.

- *Institutional money managers* who oversee spread product portfolios (e.g., corporate bonds, mortgage backed securities or tax-exempt bonds) can use Swap futures to manage duration exposure and to securitize cash.
- *Bank treasurers* will find them useful for asset-liability management.
- For *proprietary traders*, they are an analytically clean and standardized tool for spreading generic swap rates against cash market holdings.
- *Leveraged investors and hedge funds* can use them to create synthetic swap rate exposures without the administrative costs of over-the-counter (OTC) alternatives. Swap futures also enable users to transact swap rate exposure in smaller denominations than are either customary or cost-effective in the OTC market.
- *Corporate or tax-exempt bond issuers* can use Swap futures to protect against adverse moves in market yields during periods leading up to new debt issuances.
- For those who *manage books of plain vanilla OTC interest rate swaps*, Swap futures offer a capital-efficient means to control residual risks.

This reference guide summarizes the terms and conditions of Swap futures, explains the mechanics of contract pricing, and discusses their hedge effectiveness.

CONTRACT FEATURES

The trading unit for any Swap futures contract is the notional price of the fixed-rate side of a plain vanilla U.S. dollar interest rate swap. "Plain vanilla" denotes a standard fixed-to-floating interest rate swap that exchanges:

- semiannual interest payments at a fixed rate of 4 percent per annum, accruing on a 30/360 day count, for
- quarterly floating interest payments based on 3-Month LIBOR, accruing on the standard actual/360 day count, with spot reset dates.

In these respects, and in all others, the swap rate that serves as the underlying reference for each Swap futures contract is assumed to meet the terms that ISDA, the International Swaps and Derivatives Association, Inc., prescribes for setting daily Benchmark Rates for U.S. dollar interest rate swaps.[1]

The notional size of each Swap futures contract is $100,000. Swap futures trade in price terms, with a par price of 100 points per contract. Contract prices are quoted in points (at $1,000 per point) and halves of 32nds of points (equal to $15.625).

Appendix 1 summarizes these and other key features of contract terms and conditions.

[1] ISDA® is a registered trademark, and ISDAFIX℠ is a registered service mark, of the International Swaps and Derivatives Association, Inc. ISDA Benchmark mid-market par swap rates are collected at 11:00 a.m. New York time by Reuters Limited and ICAP plc and published on Reuters page ISDAFIX3 and Bloomberg page ISDAFIX1. Source: Reuters Limited.

WHAT HAPPENS AT EXPIRATION

Swap futures expire by cash settlement. The final settlement price of each contract is the value of the contract's notional cash flows – a coupon payment of approximately $2,000 each semester through maturity, plus payment of $100,000 principal at maturity – discounted to present at a yield equal to the corresponding ISDA Benchmark rate set on the morning of the contract's last day of trading.

ISDA Benchmark Swap Rates[2]

ISDA established ISDAFIX in 1998 in cooperation with Reuters Ltd (now Thomson Reuters) and Intercapital Brokers (now ICAP plc). Each day ISDAFIX establishes average mid-market rates for interest rate swaps (and, for the U.S. dollar market, swap spreads) at key terms to maturity for seven major currencies.

ISDA Benchmark swap rates are based on a rigorously organized daily poll. For each currency, an ICAP or Reuters representative canvasses a panel of dealers for their par swap rate quotes as of a specified local mid-day time (and, in some currencies, also as of end of day). For the U.S. dollar swap market, polling occurs at 11:00 a.m. New York time, either by telephone or by electronic interface, for 13 swap tenors: 1 year through 10 years, inclusive, plus 15, 20, and 30 years.

The dealers in the canvass are selected and impaneled by ISDA, ICAP, and Reuters on the basis of each contributor's reputation among dealers, credit standing, scale of activity in the relevant swap market, and perceived expertise in the currency concerned. Contributor panelists who consistently fail to provide rates, or who provide rates that appear to be consistently off the market, may be replaced at ISDA's discretion. For the U.S. dollar swap market, the contributor panel currently[3] comprises 14 institutions:

- BNP Paribas
- Bank of America
- Barclays Bank
- Citigroup
- Credit Suisse
- Deutsche Bank
- Goldman Sachs
- HSBC
- JP Morgan Chase
- Mizuho
- Morgan Stanley
- UBS AG
- Royal Bank of Scotland
- Wells Fargo

For any given swap term to maturity, the rate provided by the contributing dealer to the ICAP or Reuters surveyor is the midpoint of where that dealer would itself offer and bid a swap for a notional equivalent amount of 50 million U.S. dollars (or whatever amount is deemed market size in that currency, for that term to maturity, to an acknowledged dealer of good credit in the swap market). The contributing dealer's survey response is the midpoint of its own bid/offer spread. (It is not, e.g., where the dealer sees mid-market rates being quoted or dealt away from itself.)

[2] The following passage draws upon the ISDFIX FAQ at http://www.isda.org

[3] As of August 2009.

Contributor panelists may submit their mid-market rate quotes up to five decimal places of precision. The ISDAFIX Benchmarks, however, are computed to just three decimal places.

The Benchmark rate for any given swap tenor is determined as a trimmed mean. For major currencies, including U.S. dollar, the Benchmark rate is calculated by (1) eliminating the four highest and the four lowest of the rates that have been submitted by the contributor panelists, and then (2) taking the simple average of the mid-market quotes that remain after the sample has been trimmed.

ISDAFIX Benchmark rates are posted on Reuters and Bloomberg as soon as possible after polling is completed. Reuters also provides secondary screens, each day, that display the rates reported that day by each individual contributor panelist.

Swap Futures Final Settlement Prices

The Exchange establishes the final settlement price for an expiring Swap futures contract as soon as possible after the pertinent ISDAFIX Benchmark rate has been published on the contract's last trading day.

Contract final settlement values (measured in price points) are determined as follows:

5-Year: $100 * [4/r_5 + (1 - 4/r_5)*(1 + r_5/200)^{-10}]$
7-Year: $100 * [4/r_7 + (1 - 4/r_7)*(1 + r_7/200)^{-14}]$
10-Year: $100 * [4/r_{10} + (1 - 4/r_{10})*(1 + r_{10}/200)^{-20}]$
30-Year: $100 * [4/r_{30} + (1 - 4/r_{30})*(1 + r_{30}/200)^{-60}]$

Here, r_5 represents the ISDA Benchmark rate for a 5-year interest rate swap on the contract's last day of trading, expressed in percent terms. That is, if the ISDA Benchmark Rate were six and three quarters percent, then r_5 would be 6.750. r_7 , r_{10} , and r_{30} are similarly defined.

Contract final expiration prices are these final settlement values rounded to the nearest one-quarter of one 32nd of one price point. If the final settlement value occurs at the midpoint between adjacent quarters of a 32nd, the final settlement price is obtained by rounding up.

Example:

Consider a hypothetical 10-Year Swap futures expiry. With rare exceptions, the contract's expiration day and last day of trading occur on IMM Monday, the Monday before the third Wednesday of the contract expiration month. As required by Exchange regulations, the expiring contract ceases trading at 11:00 a.m. New York time.

Around 11:30 a.m. New York time, that day's ISDA Benchmark rates are published. For this example, assume that the 10-Year ISDA Benchmark rate is 3.142 percent. This spot swap rate is transformed by the Exchange into a contract final settlement value according to the formula given above:

$$107.31405 \text{ points} = 100 \times [\, 4/3.142 + (1 - 4/3.142)*(1 + 3.142/200)^{-20} \,]$$

In terms of 32nds of price points, this is approximately 107 and 10.05/32nds. The Exchange then rounds the final settlement value to the nearest quarter of a 32nd to obtain the final settlement price of 107 and 10/32nds.

FUTURES FAIR VALUE

Prior to expiration, the futures contract's theoretical fair value is, to a good approximation, its final settlement price formula evaluated at the rate for an interest rate swap for forward settlement on the third Wednesday (i.e., IMM Wednesday) of the contract's expiry month.

For relative-value traders taking views on cash-to-futures spreads, and more generally for anyone concerned with futures contract fair value, a useful discipline is to compare the forward-starting swap rates implied by Swap futures prices against either OTC market quotes for the corresponding forward-starting IMM date swaps, or with the corresponding forward-starting swap rates implied in the term structure of OTC market quotes for London Interbank Offered Rates and spot-starting swap rates.

As Exhibit 1 indicates, nearby 5-year and 7-year Swap futures tend to be priced slightly rich, with median contract rates 0.3 to 0.5 basis points below the corresponding forward-starting OTC swap rates. 10-Year Swap futures prices routinely reside in the neighborhood of fair value. Nearby 30-Year Swap futures tend to be priced slightly cheap, with the median contract rate 0.3 basis points above its OTC counterpart. Nearby 5-Year and 10-Year Swap futures contract rates run approximately 1.3 basis points above the corresponding forward-starting OTC swap rates. For nearby 30-Year Swap futures, rates implied by contract prices reside around 1.8 basis points above their OTC counterparts.

Exhibit 1:
The Distribution of Futures Divergence from Theoretical Fair Value:
Swap Futures Contract Rates minus OTC Forward-Starting Swap Rates (Basis Points)

Swap Futures Contract	25th Percentile	Median	75th Percentile
5-Year	-1.0	-0.3	0.2
7-Year	-1.2	-0.5	0.3
10-Year	-0.3	0.1	0.5
30-Year	-1.1	0.3	1.6

Notes: Divergence of the nearby Swap futures price from theoretical fair value is measured each day as (a) the forward-starting swap rate implied by the futures price as of 11:00 a.m. New York time minus (b) the corresponding forward-starting swap rate implied jointly by London Interbank Offered Rates and ISDAFIX Benchmark values for the same day. For 5-Year and 10-Year Swap futures the sample interval is July 2007 through June 2009. For 7-Year and 30-Year Swap futures the sample interval is October 2008 through June 2009. Data sources: CME Group, ICAP Information Services, IHS Global Insight.

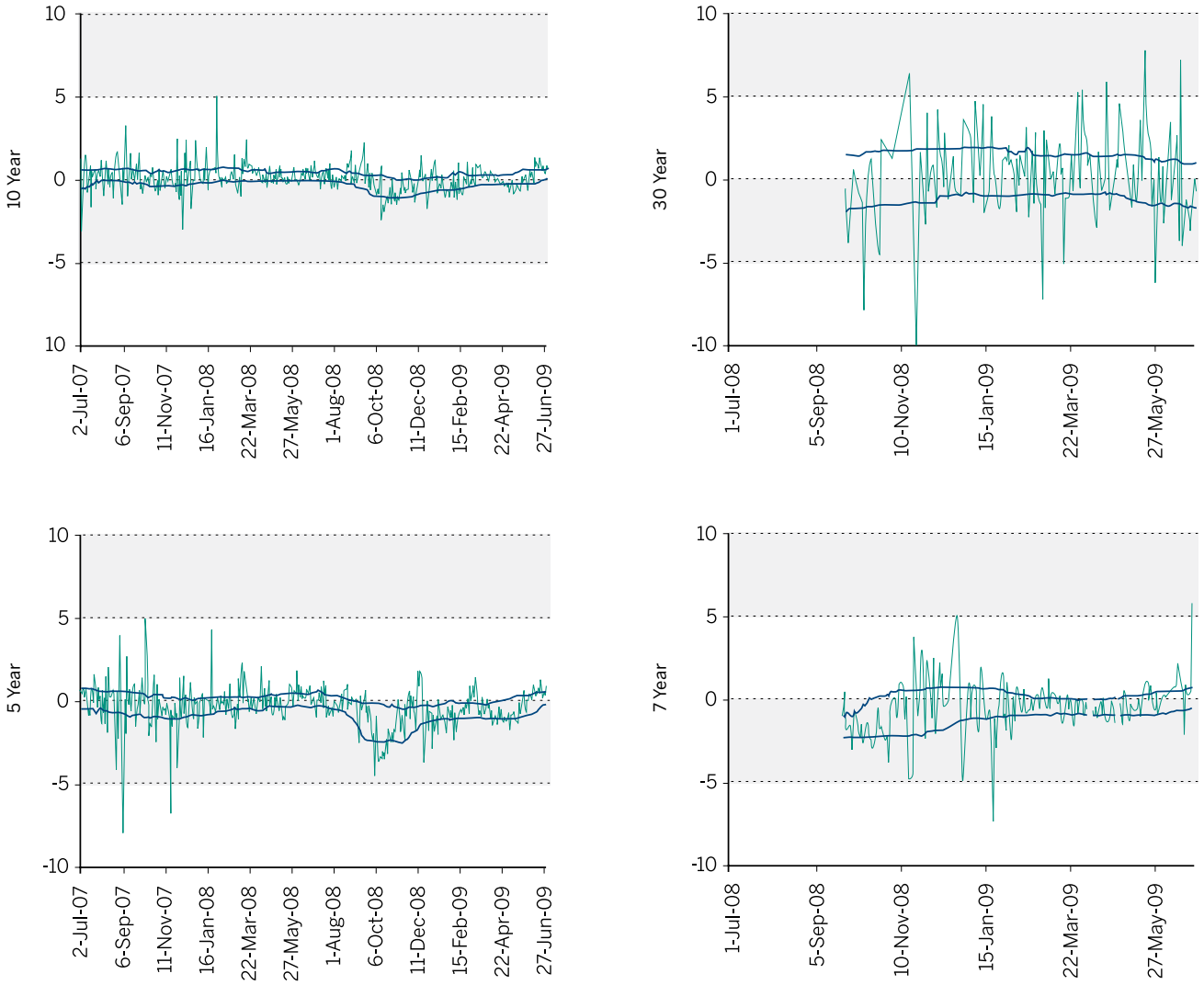
The plots in Exhibit 2 depict the recent historical record of divergences between rates implied by nearby Swap futures prices and the forward-starting swap rates implied by the term structure ISDAFIX Benchmark Rates. The point of comparison is around 11:00 a.m. New York time.

They reveal at least two features of cash-futures spreads that are important for contract users. First, for practical purposes, departures in futures prices from fair value are bounded. For 5-Year, 10-Year, and 30-Year Swap futures, for example, deviations from theoretical fair value rarely stray, if at all, beyond plus/minus 5 basis points. Second, excursions from fair value tend to be short-lived.

On one hand, this combination of features should be reassuring for those wishing to employ Swap futures for strategic hedging and risk control. On the other hand, departures from fair value that might be large enough to signify worthwhile trading opportunities crop up with sufficient frequency, and with sufficiently prompt reversion to fair value, to make these contracts enticing to tactical relative-value traders.

Exhibit 2:

The Historical Distribution of Futures Divergence from Fair Value:
Swap Futures Contract Rates minus OTC Forward-Starting Swap Rates (Basis Points)



Notes: Divergence of the nearby Swap futures price from fair value is measured each day as (a) the forward-starting swap rate implied by the futures price as of 11:00 a.m. New York time minus (b) the corresponding forward-starting swap rate implied jointly by London Interbank Offered Rates and ISDA Benchmark Rates for the same day. The variability of divergence from fair value is depicted as the centered moving interquartile range (the spread between the 25th percentile and the 75th percentile) computed over a moving 63-business-day window. For 5-Year and 10-Year Swap futures the sample interval is July 2007 through June 2009. For 7-Year and 30-Year Swap futures the sample interval is October 2008 through June 2009. Data sources: CME Group, ICAP Information Services, IHS Global Insight.

STANDARDIZING SWAP RATE EXPOSURE

The Swap futures contract uses an elementary internal rate of return formula to re-express a par swap rate as an index number. Although this index loosely mimics the price of a 4 percent per annum semiannual coupon note, it is not strictly speaking a bond price.

Indeed, the coupon rate that facilitates the transformation from swap rate to contract price is entirely arbitrary. Its role is not to create a futures contract that replicates the price dynamics of a notional 4 percent coupon debenture.

Rather, it serves to standardize and to simplify the relationships between par swap rates and futures contract prices and price dynamics. By creating such standardization, Swap futures make a remarkably clear and flexible device for market participants to use in shifting intermediate- and long-dated swap rate exposure and for gauging the relative effectiveness of alternative positions and strategies.

For any given Swap futures contract price level, there is one and only one implied forward-starting par swap rate. The same one-to-one property applies to the relationships between futures contract prices and key characteristics of contract price behavior. These include:

- interest rate sensitivity of contract price (i.e., the contract's DV01, the dollar value of a one basis point change in the underlying forward swap rate), and

- convexity of contract price with respect to changes in the underlying forward swap rate (i.e., the rate at which the magnitude of the contract DV01 shrinks or expands in response to changes in the underlying forward swap rate).

Worth emphasizing is that these standardized relationships apply to all contract expiries. The values of the forward-starting swap rate, the contract DV01, and the contract price convexity that are implied by a given futures contract price are the same, regardless of whether the contract expires a day from now or a year from now.

Exhibit 3 illustrates this for 30-Year Swap futures. The left-hand panel shows the mapping between futures prices and the forward-starting 30-year par swap rates implied by each contract price level. Consider some examples:

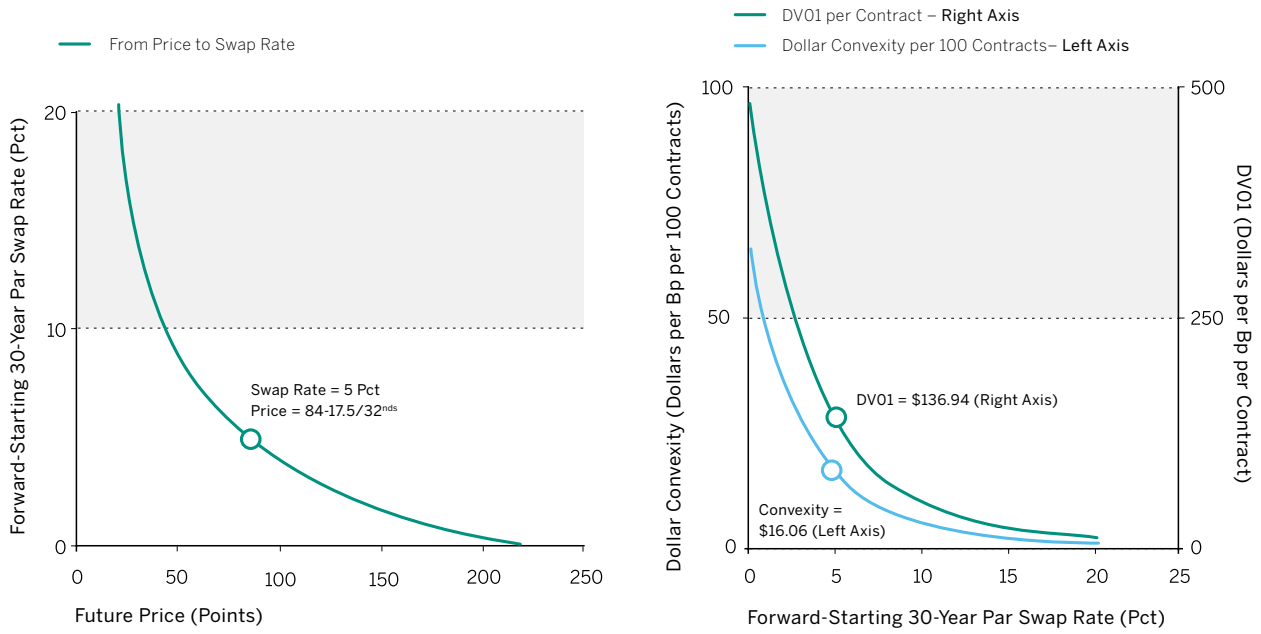
- A futures price of 84 and 17.5/32nds implies a swap rate 5 percent (to be more exact, 4.9999 percent), and vice versa.

- At a price of 100 points the contract's implied swap rate is 4 percent, and vice versa. (By design, this must be so. A futures price of par should beget an implied swap rate equal to the standardizing coupon, and vice versa.)

- At a price of 220 points the contract implied swap rate is zero, and vice versa. (This too must be so: 220 price points is simply the value of the futures contract's notional cash flows – 100 points for the par amount, plus 120 points representing 30 years' interest at 4 percent per annum – discounted to present at a rate of zero percent per annum.)

Exhibit 3:

How Swap Futures Standardize 30-Year Par Swap Rates: Futures Prices, DV01s, and Convexity



The right-hand panel indicates how futures prices – or, what amounts to the same thing, the forward-starting par swap rates implied by those prices – map to various measures of contract price sensitivity.

For example, a forward-starting swap rate of 5 percent (equivalently, a price of 84 and 17.5/32nds) implies a DV01 around $136.94 (or 4.38/32nds) per contract per basis point. It also implies that dollar price convexity is around 16 cents per contract (ie, $16.06 per 100 contracts) per basis point squared.

10-Year, 7-Year, and 5-Year Swap futures contracts feature similarly standardized one-to-one mappings between their contract prices, their respective implied forward-starting swap rates, and their price characteristics.

These relationships are neatly summarized in lookup tables furnished by the Exchange. These lookup tables give, for every contract price level, the values of the implied forward-starting swap rate, the DV01 per contract, and the dollar convexity of contract price per 100 contracts. (Visit www.cmegroup.com/ircenter.)

Appendix 2 summarizes how contract DV01 and contract dollar convexity fit together for the purpose of approximating the sensitivity of futures price to volatility in the underlying reference swap rate.

HEDGE EFFECTIVENESS FOR SPOT SWAPS

The price dynamics of Swap futures closely track the dynamics of spot swap rates. Exhibit 4 demonstrates with correlations between daily changes in mid-market spot swap rates and daily changes in Swap futures contract rates.

Exhibit 4:
Correlations of Daily Changes in Swap Futures Contract Rates with Daily Changes in OTC Spot Swap Rates

Swap Futures Contract	Correlation with OTC Par Swap Rates
5-Year	0.978
7-Year	0.971
10-Year	0.983
30-Year	0.982

Notes: Correlations of (a) daily changes in forward-starting swap rates implied by prices of nearby Swap futures prices as of 11:45 a.m. New York time with (b) daily changes in corresponding mid-market swap rates as of 4:45 p.m. London time. For 5-Year and 10-Year Swap futures, the sample interval is July 2007 through June 2009. For 7-Year and 30-Year Swap futures the sample interval is October 2008 through June 2009. Data sources: CME Group, IHS Global Insight.

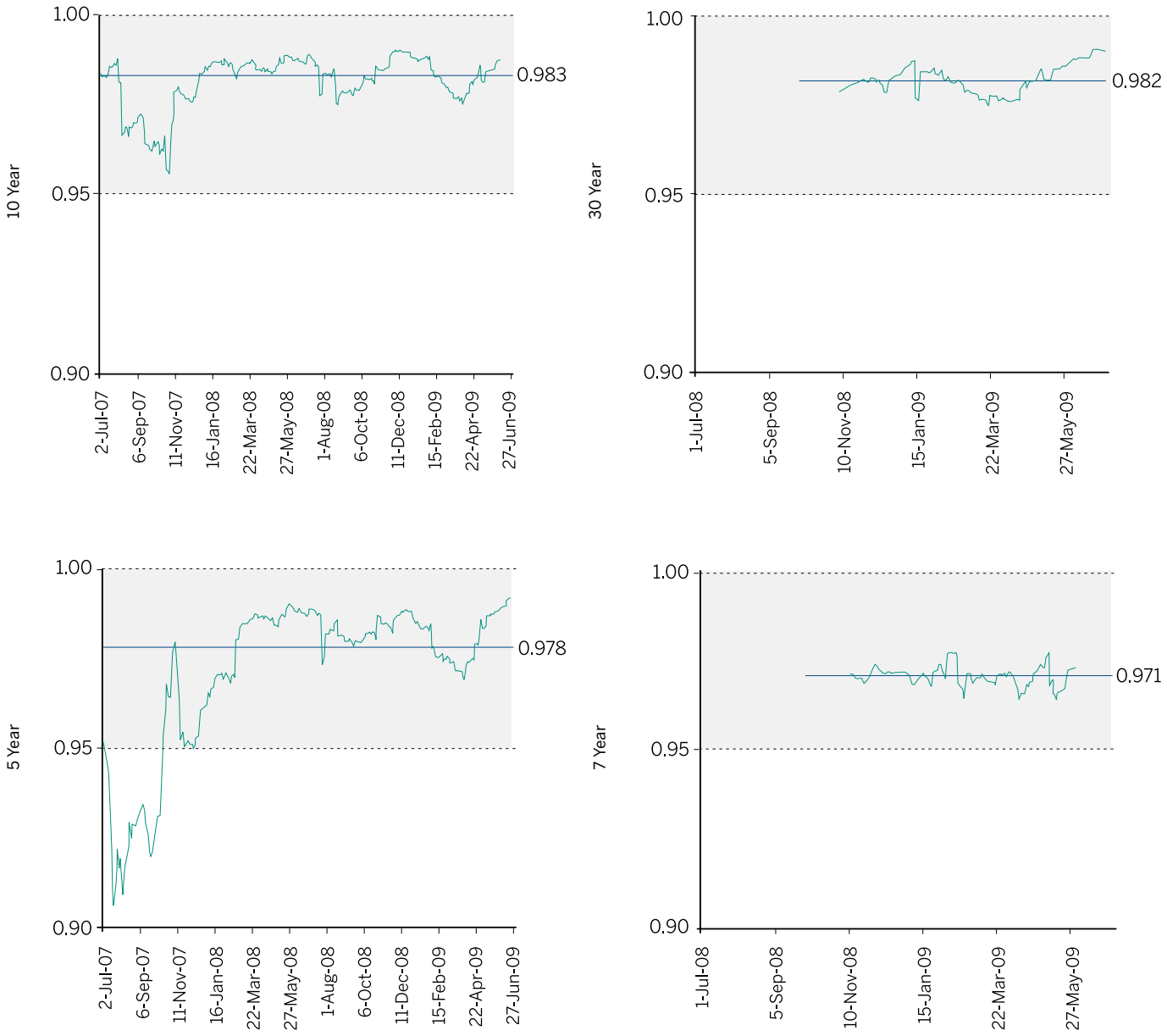
As a rule, correlations between Swap futures contract rates and the corresponding spot swap rates are tight as long as the stub rate – the London interbank offered rate that applies to the interval between the spot settlement date and the forward IMM start date implied in the Swap futures contract – is either (a) nonvolatile, or (b) highly correlated with the futures contract's implied forward-starting swap rate, or (c) both.

Exhibit 5 suggests moreover that these close correlative relationships are robust, in the sense that correlations for short-run intervals seldom stray far from the long-run correlation values shown in Exhibit 4. This is a remarkable result, given that concerns over bank creditworthiness have led to periodically severe disruptions in both the London interbank placement market (eg, in the second half of 2007) and in the interest rate swap market itself (in the second half of 2008).

A fair surmise is that Swap futures make an effective exchange-listed hedge for spot-starting swaps, and for swap-related asset exposure, in both placid and turbulent times. An important corollary is that they permit straightforward demonstrations of hedge effectiveness for the purpose of establishing compliance with guidelines prescribed by the Financial Accounting Standards Board.

Exhibit 5:

Long Run and Short Run (Moving Quarterly) Correlations of Daily Changes in Swap Futures Contract Rates with Daily Changes in OTC Spot Swap Rates



Notes: Correlations of (a) daily changes in forward-starting swap rates implied by prices of nearby Swap futures prices as of 11:45 a.m. New York time with (b) daily changes in corresponding mid-market swap rates as of 4:45 p.m .London time. For 5-Year and 10-Year Swap futures, the sample interval is July 2007 through June 2009. For 7-Year and 30-Year Swap futures the sample interval is October 2008 through June 2009. Moving quarterly correlations are computed with a centered moving 63-business-day sample window. Data Sources: CME Group, IHS Global Insight.

KEY BENEFITS

CME Clearing Guarantee

The CME Clearing guarantee makes Swap futures comparable to the strongest credits in the OTC market. This effectively removes the need for establishing and maintaining bilateral collateralization agreements, or for levying counterparty credit surcharges, or for entering into auxiliary OTC credit default swaps to insure against counterparty failure.

Capital Efficiency

Besides virtually eliminating credit risk, the CME Clearing guarantee obviates the need for Swap futures users to reserve significant amounts of capital against the risk of adverse market moves. By using Swap futures, market participants who manage bank or corporate balance sheets are able to substitute (inexpensive) risk management for (expensive) capital.

A related benefit is that Swap futures users who hold counter-positions in correlated CME Group contracts – Treasury futures or Eurodollar futures, for example – may enjoy potentially substantial reductions in their performance bond postings.

Administrative Convenience and Low Operational Cost

Swap futures entail none of the administrative costs (accounting, manpower, record-keeping) needed for maintaining a book of OTC swaps. Moreover, expiry by cash settlement means that all contractual obligations expire with the futures contract, after the final mark to market on the last day of trading.

Position Scalability

The standardization described above permits Swap futures users to create synthetic exposure, long or short, to generic swap rates without having to own swaps. Unlike OTC swap contracts, positions in Swap futures can be entered or liquidated, scaled up or scaled down, without extensive contractual documentation and without leaving behind a trail of non-nettable or non-offsetting bilateral swap agreements.

Trade Scalability

Market participants can use Swap futures to transact generic swap rate exposure in a wider range of denominations than is either customary or cost effective in the OTC swap market. Because Swap futures are traded competitively on a regulated exchange, all participants are treated equitably, regardless of scale of activity. A mid-size bank treasurer or a small proprietary trading firm wanting to hedge $25 million notional of swap exposure (equivalent to 250 Swap futures contracts) enjoys the same access to market price exposure as a large institution wanting to move a swap exposure of $1 billion notional (10,000 contracts).

Transparency

Futures markets allow participants with differing information sets and outlooks to discover the equilibrium price of the moment. By making price information available for all to see, Swap futures provide a reference point, and a daily mark to market, with unmatched transparency.

Off-Exchange Transactions

Under certain conditions, Swap futures also are eligible for a variety of bilaterally negotiated off-exchange transactions. These include:

- Exchange for Related Position (EFRP) trades in which a buyer acquires Swap futures from a seller, bilaterally, at a mutually agreeable price. At the same time the futures buyer sells (and the futures seller buys) an equivalent amount of cash-market securities, or OTC interest rate swaps, or other OTC interest rate derivatives for which the price dynamics are reasonably correlated with the price dynamics of the Swap futures.

- Block transactions in which a buyer and seller can trade contracts bilaterally at a mutually agreeable price, as long as the scale of the transaction is large enough to qualify. The minimum admissible block size for all Swap futures is 2,000 contracts, or $200 million notional value. Note: Block minimums are subject to change – visit www.cmegroup.com/blocks for current block thresholds.

For information on EFRP trades consult “Rule 538. Exchange for Related Positions.” For details on block transactions see “Rule 526. Block Trades.” Both rules are found in Chapter 5 of the CBOT Rulebook.

APPENDIX 1

Interest Rate Swap Futures: Contract Specifications

Trading Unit	The notional price of the fixed-rate side of an interest rate swap with $100,000 notional principal, that exchanges semiannual interest payments at a 4 percent per annum fixed rate for quarterly floating interest payments based on 3-month LIBOR
Price Basis	Notional principal value of $100,000. Par is on the basis of 100 points. One point equals $1,000 per contract
Price Increments	One half of one thirty-second of one point ($15.625 per contract)
Expiry Months	Typically the first four consecutive months in the March quarterly cycle
Last Trading Day	The second London business day before the third Wednesday of the expiration month. Trading in expiring contracts ceases at 11:00 a.m. New York time on the last trading day
Delivery Standard	The notional price of the trading unit on the last day of trading, based upon the ISDA Benchmark Rate for a U.S. dollar interest rate swap on the last day of trading
Delivery Method	Cash settlement. The final settlement value, measured in price basis points, is determined as: 5-Year $100 * [4/r_5 + (1 - 4/r_5)*(1 + r_5/200)^{-10}]$ 7-Year $100 * [4/r_7 + (1 - 4/r_7)*(1 + r_7/200)^{-14}]$ 10-Year $100 * [4/r_{10} + (1 - 4/r_{10})*(1 + r_{10}/200)^{-20}]$ 30-Year $100 * [4/r_{30} + (1 - 4/r_{30})*(1 + r_{30}/200)^{-60}]$ r_5, r_7, r_{10}, and r_{30} represent, respectively, ISDA Benchmark Rates for 5-year, 7-year, 10-year, and 30-year U.S. dollar interest rate swaps on the last day of trading, expressed in percent terms. (E.g., if the ISDA Benchmark Rate were five and a quarter percent, then r would be 5.25.) Contract expiration price will be the final settlement value rounded to the nearest one quarter of one thirty-second of one point
Trading Hours	Open outcry: 7:20 a.m. to 2:00 p.m. Chicago time, Monday through Friday CME Globex: 5:00 p.m. to 4:00 p.m. Chicago time, Sunday through Friday 5-Year, 10-Year, and 30-Year futures trade on CME Globex and in open outcry. 7-Year futures trade on CME Globex only
Position Limits and Reportable Positions	No position limits. Reportable position threshold for 5-Year, 10-Year, and 30-Year futures: 500 contracts. Reportable position threshold for 7-Year futures: 25 contracts
Margins	For information on margin requirements, please see "Performance Bonds/Margins" at www.cmegroup.com/clearing
Ticker Symbols	5-Year CME Globex: SA Open outcry: NG 7-Year CME Globex: 7I n/a 10-Year CME Globex: SR Open outcry: NI 30-Year CME Globex: I3 Open outcry: NZ
Exchange Rules	These contracts are listed at and subject to the rules and regulations of the CBOT

APPENDIX 2

How Futures Prices, DV01s, and Dollar Convexities Fit Together

This appendix sketches the framework in which to use the DV01 and Dollar Convexity values in the Exchange's Interest Rate Swap Futures price-to-yield lookup tables (available at www.cmegroup.com/ircenter) to approximate futures contract price movements.

Notation: In what follows…

r0	is the current value of the Swap futures contract's forward-starting swap rate.
r1	is some prospective value of the forward-starting swap rate (eg, r0 minus 100 bps, or r0 plus 50 bps).
P(r0)	is the Swap futures price at the current forward-starting swap rate.
DV01(r0)	is the DV01 (per contract) at the current forward-starting swap rate.
C(r0)	is Dollar Convexity (per 100 contracts) at the current forward-starting swap rate.
P(r1)	is the futures price at the prospective swap rate.
DV01(r1)	is the DV01 (per contract) at the prospective swap rate.
C(r1)	is Dollar Convexity (per 100 contracts) at the prospective swap rate.

Using DV01s and Dollar Convexity to Approximate Futures Price Changes

The framework is based on a second-order Taylor series expansion of futures contract price, as a function of the contract's forward-starting swap rate.

$$P(r1) - P(r0) \approx 100 \times (-DV01(r0) \times (r1-r0) + C(r0) \times (r1 - r0)^2)$$

APPENDIX 2 CONTINUED

Example: 30-Year Interest Rate Swap Futures

Assume the pertinent forward-starting 30-year swap, r0, is 5 percent per annum. Then:

P(r0)	is 84 and 17.5/32nds, or $84,546.875 in dollar terms.
DV01(r0)	is $136.942 per contract.
C(r0)	is $16.063 per 100 contracts.

Suppose that the prospective value of the forward starting 30-year swap rate, r1, is 5.5 percent. If so, then the prospective change in the swap rate (r1-r0) is 0.5 percent, and the prospective squared rate change, $(r1 - r0)^2$, is 0.25 $percent^2$.

How well does the approximation work? Putting numerical values in their appropriate places, we find:

$$P(5.5) - P(5.0) \approx 100 \times (-DV01(5.0) \times (5.5 - 5.0) + C(5.0) \times (5.5 - 5.0)^2)$$

$$-6{,}445.525 \approx 100 \times (-136.942 \times 0.5 + 16.03 \times 0.25)$$

In dollar terms, the approximation implies that a 50 bps rise in the forward-starting 30-year par swap rate, from 5 percent to 5.5 percent, will result in a decline in futures contract price of $6,445.525.

In turn, this implies that the futures price evaluated at a swap rate of 5.5 percent, P(5.5), will be approximately $78,101.350, equal to $84,546.875 minus $6,445.525. In terms of price points, this is approximately 78 and 3.25/32nds, equal to 84 and 17.5/32nds minus 6 and 14.25/32nds. (In practice, because the futures contract trades in price increments of one half of one 32nd, P(5.5) must be either 78 and 3/32nds or 78 and 3.5/32nds.)

In this particular case, we can use the Exchange's price-to-yield lookup tables to check the goodness of approximation. The implied swap rate value that comes closest to 5.5 percent is 5.5004 percent, corresponding to a futures price level of 78 and 2.5/32nds.

This means that the exact price change would be a decline of 6 and 15/32nds (equal to 78 and 2.5/32nds minus 84 and 17.5/32nds).

Comparing this to the approximated value of the price change (6 and 14.25/32nds), we conclude that the approximation is good to within three quarters of a 32nd (ie, one third of one percent of the magnitude of the price move).

For more information on Interest Rate Swap futures products, visit **www.cmegroup.com/interestrates.**

A CME/Chicago Board of Trade/NYMEX Company

CME GROUP HEADQUARTERS

20 South Wacker Drive
Chicago, Illinois 60606
cmegroup.com

info@cmegroup.com
800 331 3332
312 930 1000

CME GROUP REGIONAL OFFICES

New York	212 299 2000	**Houston**	713 658 9292	**Washington D.C.**	202 638 3838
London	+44 20 7796 7100	**Singapore**	+65 6322 8595	**Tokyo**	+81 3 5403 4828
São Paulo	+55 11 2565 5999				

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