

Invoice Swap Spread Opportunities

Growing volumes, deep liquidity, and unparalleled capital efficiencies

Invoice Spreads provide exposure to the swap spread, using futures in place of cash securities

Invoice Spreads are trades between swaps and futures, that proxies the swap spread

- ✓ Invoice Spreads are packaged trades involving a CBOT Treasury Future and a matching interest rate swap, traded in opposite directions. An example trade would be as follows:

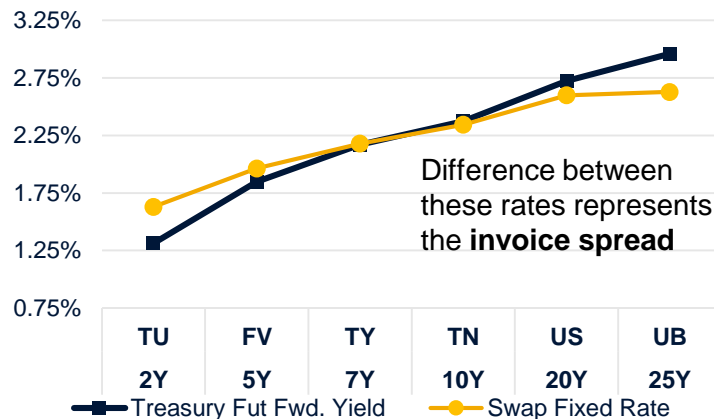
Receive Fixed (Long)	5-Year (FV) CBOT Treasury Future
Pay Fixed	5-Year Invoice Swap

- ✓ Terms of the swap are designed to match the attributes of the future, including a duration-neutral notional value, effective date matching the last delivery date of the future, and maturity date matching the cheapest-to-deliver security.
- ✓ This is a highly active market, daily volume exceeds \$14 billion notional (90,000 Futures contract equivalents). Invoice spreads can be traded in all tenor points along the yield curve, with the most activity at the 2Y, 5Y, and 7Y points.

Invoice Spreads have a variety of applications and diverse client base that trade actively

- In theory, the spread represents the credit differential between the U.S. Government and Inter-Bank Unsecured Borrowing (LIBOR).
- In practice, the spread is also strongly influenced by the supply & demand for Treasury securities relative to Interest Rate Swaps, including the storage costs of each instrument.
- Many participants use Invoice Spreads to switch exposure between these markets. One example is swap liquidity providers that use Treasury Futures to hedge market making activities, and then use Invoice Spreads to switch their hedge back to swap exposure.
- Other participants use Invoice Spreads for relative value trading, to take a view on how these spreads will change over time.
- Many global participants are active in the Invoice Spread market, including 75 buy-side firms (both Asset Managers and Hedge Funds) and more than 10 global swap dealers.

U.S. Treasury Futures Curve and U.S. Swap Curve



Taken on 3/31/2017

Invoice Spreads – Capital Efficiencies

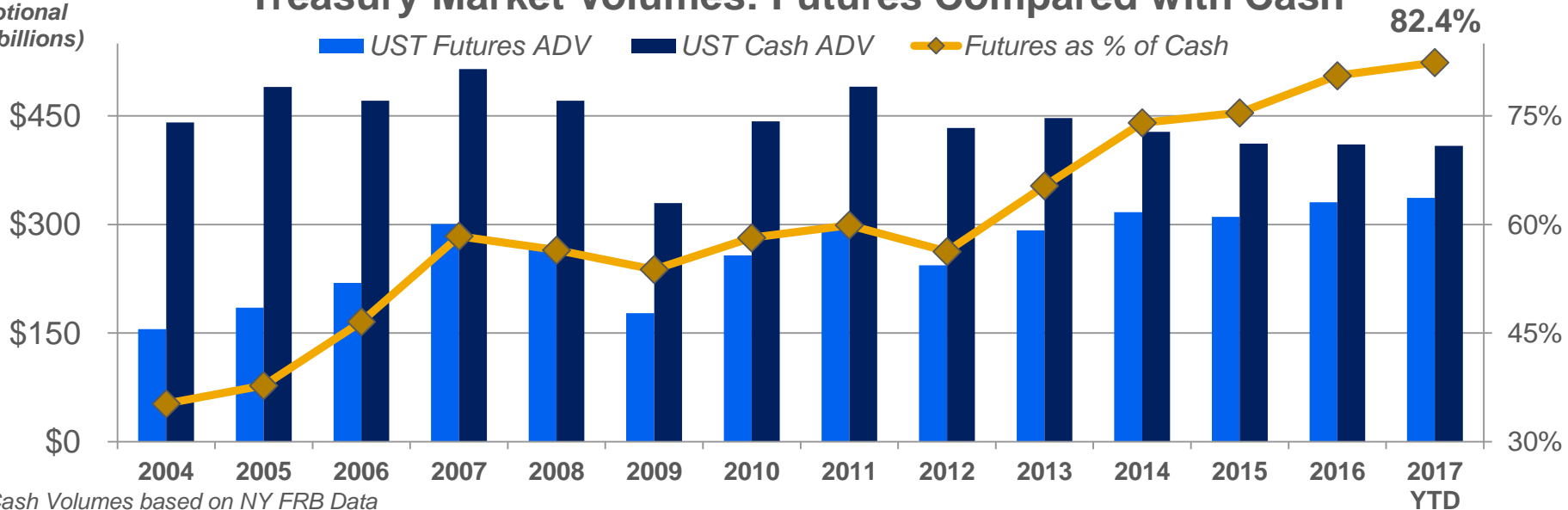
Invoice Spreads are a highly capital efficient trading mechanism

- ✓ Regulatory changes have increased demand for off-balance sheet unfunded products as a vehicle for exposure
 - Capital requirements create significant cost implications holding securities on balance sheet
 - Increased repo costs and securities margining increases further make futures a cost effective vehicle
- ✓ With invoice spreads, both the swap leg and the futures leg are off balance sheet, as opposed to swap spreads where the cash Treasury leg consumes balance sheet and increases cost to trade.
- ✓ Treasury Futures represent a highly robust and liquid marketplace with many participants trading across all time zones:
 - Open Interest reached 10.5 million contracts (**\$1.25 trillion notional**) in February 2017
 - Average Daily Volume of 3.5 million contracts (**\$384 billion notional**) in Q1-2017,
 - Futures notional volume is now **82.6%** of the underlying cash market volume, **up 5 percentage points** in the last 12 months (and with consistent growth over the past decade, as shown below)

Avg Daily Notional (\$billions)

Treasury Market Volumes: Futures Compared with Cash

■ UST Futures ADV ■ UST Cash ADV ◆ Futures as % of Cash



Recent Developments in Packaged Trades Between Futures and Swaps Provider Greater Efficiencies

Capital Efficiencies

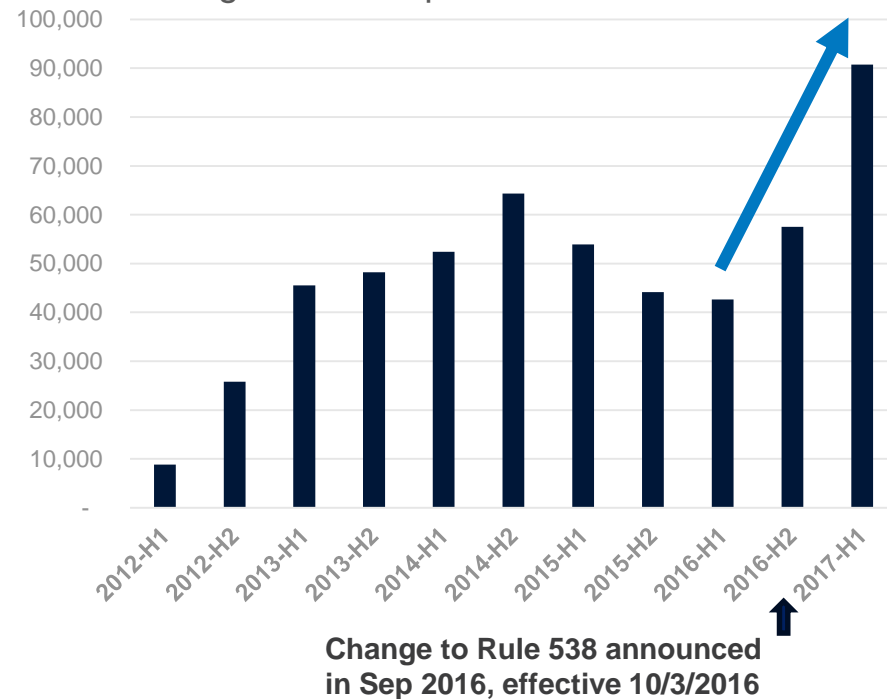
- **Portfolio Margining Expansion** – In October 2016, portfolio margining between futures and OTC Rates products was expanded to include Fed Fund Futures (ADV over 260k, O.I. over 1.6M) and Ultra 10-Year Futures (ADV over 100k, O.I. over 300k)

Execution Flexibility

- **Amendment to Rule 538** – Also In October 2016, CME amended Rule 538 to allow packages with multiple futures in different directions to be submitted as EFRs
- Most notably, this expanded the invoice spread calendar rolls and invoice spread tenor switches to be bilaterally negotiated off-exchange as a single package, and then submitted as EFRs

ADV in Treasury Futures EFRs

At a recent high in H1-2017, trading 90k ADV up 113% vs. H1-2016



Portfolio Margining IRS and CME Group Futures

Clearing both legs of an invoice swap trade at CME enables significant margin efficiencies

Background

- CME Group has administered a range of cross-margining programs for more than 20 years
- IRS Portfolio Margining for Clearing Members was launched in May 2012, and the solution became available to customers in November 2012

Broad Adoption From Market Participants

- **15 Clearing Members** are now live with IRS Portfolio Margining, and over **450 accounts** are benefitting from the solution
- Total Risk Reductions now account for over **\$3.0 billion in initial margin savings**

Scope of the Solution

- Achieve capital savings across a diverse portfolio of:
 - ✓ 19 cleared OTC IRS currencies and USD Swaptions
 - ✓ 6 CBOT Treasury Futures
 - ✓ CME Eurodollar Futures
 - ✓ MAC Swap Futures
 - ✓ Fed Fund Futures

Invoice Swap Examples

Invoice Spread Strategy <i>(\$1M DV01 each)</i>	Margin if Cleared Separately	CME Portfolio Margin	Margin Savings	Savings Percentage
2YR (TU) Treasury vs IRS	40,903,813	13,604,549	27,299,263	67%
5YR (FV) Treasury vs IRS	44,558,116	8,736,394	35,821,721	80%
10YR (TY) Treasury vs IRS	46,583,879	12,050,244	34,533,635	74%
Ultra 10YR (UXY) Treasury vs IRS	46,586,965	10,886,514	35,700,451	77%
Treasury Bond (US) vs IRS	53,595,599	19,608,733	33,986,866	63%
Ultra Treasury (WN) vs IRS	53,379,866	15,501,401	37,878,465	71%
30 Day Fed Funds (FF) vs OIS	16,688,286	3,848,458	12,839,828	77%

Flexible new execution methods will expand support for relationship-based trading

Rule 538 now enables packages of multiple invoice spreads to be bilaterally negotiated and then submitted as EFRs, in the exact same manner/workflow as EFRs are used for outright invoice spreads trade between participants.

Calendar Rolls between sequential months allows clients with an existing invoice spread position to roll it forward each quarter.

Example:

Receive Fixed (Long)	Jun 2017 5-Year CBOT Treasury Future
Pay Fixed	Jun 2017 5-Year Invoice Swap
Pay Fixed (Short)	Sep 2017 5-Year CBOT Treasury Future
Receive Fixed	Sep 2017 5-Year Invoice Swap

Tenor Switches between Treasury invoice spreads enable inter-commodity spreads, facilitating relative value trading between points on the curve.

Example:

Receive Fixed (Long)	Jun 2017 5-Year CBOT Treasury Future
Pay Fixed	Jun 2017 5-Year Invoice Swap
Pay Fixed (Short)	Jun 2017 30-Year CBOT Treasury Future
Receive Fixed	Jun 2017 30-Year Invoice Swap

CME Offers 4 Methods to Execute & Clear Invoice Spreads

In addition to EFR, exchange listed spreads provide an additional method of trading

- Today, the primary execution method is an off-exchange privately negotiated transaction with the futures submitted as EFR, and the swap leg processed independently.
- In addition, invoice spreads can be traded on the CBOT designated contract market as an intercommodity spread between the Treasury Future and a listed Interest Rate Swap. This design retains historical conventions (e.g. dates and notional)
- This offering also allows execution of the packages of invoice spreads (calendar rolls and tenor switches) to trade on CBOT

	Exchange for Risk (EFR)	CBOT-Listed Block	CBOT-Listed Globex Committed Cross	CBOT-Listed Globex CLOB
Negotiation	Bilateral	Bilateral	Bilateral pre-execution trade arrangement prior to cross order entry to Globex	Anonymous, competitive execution in the central limit order book
Minimum Trade Size	None	Yes	None	None
Credit Controls	Managed directly by FCM	Clearport RAV limits established by FCM	Accounts will be registered and positively permissioned by FCM to trade Globex Invoice Spreads	
Leg Price Assignments	Counterparties agree leg prices for swap and future	Counterparties agree leg prices for swap and future	Counterparties trade spread differential, CME Globex determines price for Treasury Future leg and related fixed rate for swap leg	
Submission Method	Future: CME FEC Swap: Middleware to clearinghouse	Submission of both legs to CME ClearPort for clearing	Globex automatically sends both legs to CME clearing	

Eurodollar Convexity Bias Margin Savings Analysis

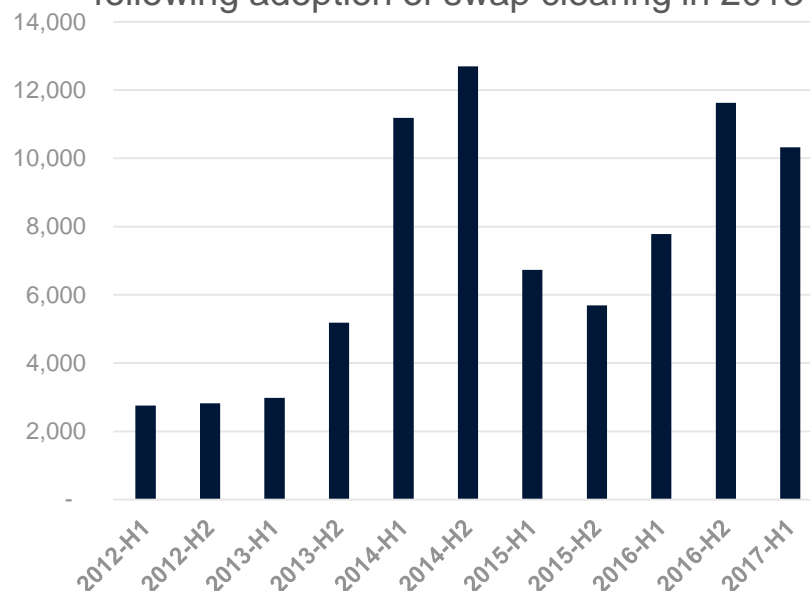
Unparalleled Margin Efficiencies for a Capital Constrained World

- Eurodollar Convexity Bias Strategies have grown in popularity as volatility has returned to the short end of the curve, and clients can capitalize on CME portfolio margining of IRS and Eurodollars
- Daily volume now averages \$10 billion notional per day, which is substantially greater than before CME launched interest rate swap clearing

Below are examples of popular Eurodollar Convexity Bias strategies with \$1 million DV01 in each strategy. Portfolio margining IRS with CME Eurodollars results in **indicative margin savings of 64%-89%**.

ADV in Eurodollar Futures EFRs

Substantial growth in convexity bias trades, following adoption of swap clearing in 2013



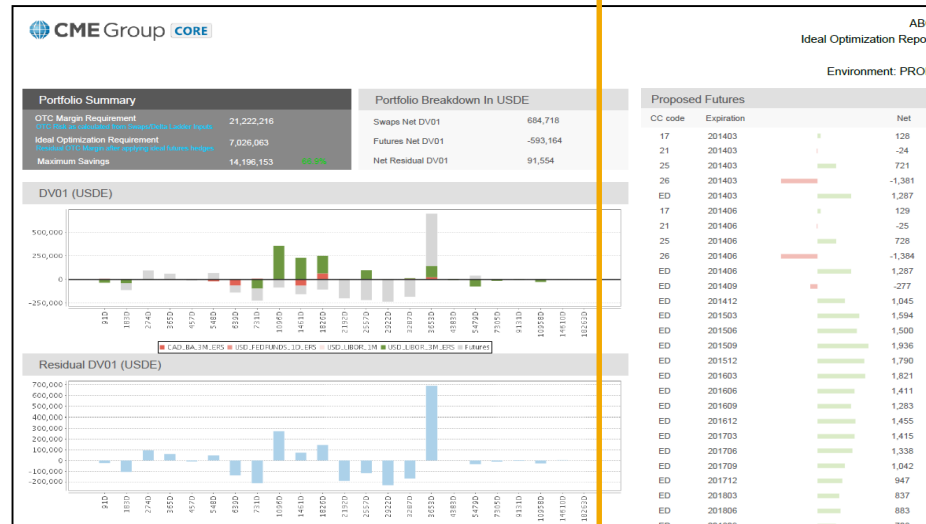
Eurodollar Convexity Bias Strategy	Margin if Cleared Separately	CME Portfolio Margin	Margin Savings	Savings Percentage
White (1st year) vs IRS	32,979,034	5,794,912	27,184,122	82%
Red (2nd year) vs IRS	43,959,455	6,940,247	37,019,208	84%
Green (3rd year) vs IRS	53,686,233	9,911,671	43,774,563	82%
Blue (4th year) vs IRS	57,736,710	13,300,279	44,436,432	77%
Gold (5th year) vs IRS	54,570,965	19,846,739	34,724,225	64%
Two Year vs IRS	36,818,766	5,383,207	31,435,559	85%
Three Year vs IRS	40,957,211	4,445,782	36,511,429	89%

Portfolio Margining Tools

CME CORE

- **CORE: Clearing Online Risk Engine**
- Ideal business user solution for Portfolio Margin Savings analysis
- Allows firms to calculate their margin for their portfolios
 - Can upload exact portfolio via a portfolio upload or enter trades manually
- Once run, CME CORE calculates the portfolio margin savings between OTC IRS and Interest Rate Futures
- Reports breakdown position transfers in PDF and CSV file format

- **Enhanced Margin Optimization:** Optimize portfolios using IRS trades in addition to Delta Ladders and Futures
- **Ideal Optimization Analysis:** Run new reports detailing which futures best hedge your OTC risk
- **Streamline Margin Calculations:** Upload and margin any combination of IRS trades, IRS delta ladder and futures



Margin Optimization Report

CC code	Expiration	Net
17	201403	128
21	201403	-24
25	201403	721
26	201403	-1,381
ED	201403	1,287
17	201406	129
21	201406	-25
25	201406	728
26	201406	-1,384
ED	201406	1,287
ED	201409	-277
ED	201412	1,045
ED	201503	1,594
ED	201506	1,500
ED	201509	1,936
ED	201512	1,790
ED	201603	1,821
ED	201606	1,411
ED	201609	1,283
ED	201612	1,455
ED	201703	1,415
ED	201706	1,338
ED	201709	1,042
ED	201712	947
ED	201803	837
ED	201806	883
ED	201809	728

CME Contacts

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