CME Group

INTEREST RATES

Treasury Futures Calendar Spreads

OCTOBER 2016

CALENDAR SPREADS AND THE ROLL

For any given futures product, a standard calendar spread is a transaction that combines the purchase of a futures contract for one delivery month and the sale of a futures contract for a different delivery month. Holders of open interest in Treasury futures[1] typically roll their open positions from one delivery month to the next as their open positions near expiration[2]. Known as the "quarterly roll," this process occurs within a brief interval around the start of each quarterly futures delivery month.

During this period, most open interest will migrate from the nearby delivery month to the next following ("deferred") delivery month. *For Treasury futures calendar spreads, buying/selling a spread means buying/selling the nearby delivery month and selling/buying the deferred delivery month.*

To maintain an established long exposure in Treasury futures, one would sell the calendar spread, simultaneously selling the nearby delivery month (to liquidate the existing long position) and buying the deferred delivery month (to re-establish the long exposure). Conversely, to maintain an established short position, one would buy the calendar spread.

WHY USE CALENDAR SPREADS?

The benefits of utilizing Treasury futures calendar spreads on the CME Globex electronic trading platform include:

1. Narrower bid/ask than in outright markets
2. Massive liquidity
3. Finer exit and entry pricing
4. Reduced numbers of transactions
5. Elimination of legging risk

CALENDAR SPREAD B/A VS OUTRIGHT B/A

The minimum bid-ask (B/A) spread in all Treasury calendar spreads is ¼ of 1/32nd of one futures price point. By contrast, the minimum B/A spread permitted in outright Treasury futures transactions varies from one futures product to another, and may be as wide as a full 1/32nd of a point. Without calendar spreads, the narrowest cumulative B/A spread one could cross when rolling a futures position would be twice the minimum price increment of the outright market.

To see this, consider rolling a position in the Ultra 10-Year Note ("TN") futures. The tightest possible B/A spread for rolling via the calendar spread is ¼ of 1/32nd point of one point, equal to $7.8125 per TN calendar spread. The narrowest possible B/A spread for rolling via outright markets is 1/32nd of one point, equal to $31.25 per TN calendar spread, equal to the sum of the minimum B/A spreads in the nearby contract outright and the deferred contract outright, both of which are ½ of 1/32nd of one point, or $15.625 per contract. Thus, by utilizing TN calendar spreads rather than by executing the legs separately in the TN outright markets, which is commonly referred to as legging the spread, the cost of crossing the B/A spread in the TN quarterly roll may be reduced by as much as 75%.

MASSIVE LIQUIDITY

Treasury calendar spreads boast deep liquidity, eclipsing even the robust liquidity of the associated outright contract markets. The abundant liquidity in Treasury calendar spreads helps to reduce or eliminate the market impact costs of rolling large positions. (See Appendix A for charts depicting the liquidity of the CME Globex order books for Treasury futures calendar spreads for 2-Year Note, 5-Year Note, 10-Year Note, Ultra 10-Year Note, Bond, and Ultra Bond futures during the first three roll periods of 2016.)

1 *"Treasury futures" comprise Long-Term US Treasury Bond ("Ultra Bond") futures, US Treasury Bond ("Bond") futures, 10-Year US Treasury Note ("Ultra 10-Year Note") futures, Long-Term US Treasury Note ("10-Year Note") futures, Medium-Term US Treasury Note ("5-Year Note") futures, 3-Year US Treasury Note ("3-Year Note") futures, and Short-Term US Treasury Note ("2-Year Note") futures. All rules and procedures for Treasury futures are established by the Board of Trade of the City of Chicago, Inc. ("CBOT" or "exchange"), one of four designated contract markets owned and operated by CME Group Inc., subject to regulation by the US Commodity Futures Trading Commission.*

2 *If there is a difference in the notional DV01s of the nearby and deferred delivery months, creating tails to manage, the practitioner should consider User-Defined Spreads for Treasury Calendar spreads on CME Globex http://www.cmegroup.com/tools-information/lookups/advisories/ser/SER-7436.pdf*

FINER EXIT AND ENTRY PRICING

Treasury calendar spreads feature price increments smaller than the cumulative minimum price increments of the associated outright markets, resulting in finer position exit and entry pricing. This can make a noticeable contribution to the portfolio manager's profit/loss, especially in low-volatility market conditions.

ONE TRANSACTION VS. TWO

Anyone who rolls a position using a Treasury calendar spread makes just one trade, and therefore crosses only one B/A spread. Anyone who opts instead to leg the roll is forced to make two trades — the outright purchase of one futures contract and the outright sale of another – and is therefore forced to cross two B/A spreads, significantly increasing the costs of the trade.

TRADING COSTS AND LIQUIDITY— A GENERAL FRAMEWORK

When rolling positions, investors are affected by and are required to manage two types of costs: explicit trading costs and implicit trading costs —

Explicit: Known before execution	**Implicit:** Fluctuates with market conditions
Commissions	**Market Impact[3] –** Potential adverse movement in price due to the liquidity demands of the order.
Fees	**Timing Risk –** Potential adverse movement in price due to the time it takes to execute the order.
Taxes	**Opportunity Cost –** Potential adverse impact arising from the inability to completely execute the entire order, typically due to insufficient liquidity or adverse price movement.
Bid-Ask	

Implicit trading costs have the potential to exert large impacts – in some circumstances overwhelming the entire set of explicit trading costs.

Highly liquid markets reduce the impact of implicit trading costs, helping to alleviate exposure to such trade cost impacts. Unsurprisingly, open interest holders, seeking to maintain positions by rolling them over, prize the cost efficiencies of highly liquid markets.

TRADING COSTS AND LIQUIDITY — EXAMPLE

On August 25, 2016, a portfolio manager (PM) holding a long position of 1,500 TN futures for September 2016 delivery – $150 million in notional face value terms – decides to maintain this exposure by rolling from the September 2016 delivery month ("TNU6") to the December 2016 delivery month ("TNZ6").

By selling 1,500 TNU6-TNZ6 calendar spreads[4] – ie, by simultaneously selling 1,500 TNU6 and buying 1,500 TNZ6 — the PM will simultaneously extinguish the long position of 1,500 TNU6 futures and establish a long position of 1,500 TNZ6 futures. As Exhibit 1 suggests, the CME Globex central limit order book typically has more than enough depth at the best bid price to accommodate this aggressor order in one transaction.

Exhibit 1 – Ultra 10-Year Note Futures Roll Example

PM Position (contracts)	Calendar Spread B/A (32nds)	Size on Best Bid (contracts)	Size on Best Ask (contracts)
1,500	0-16 / 0-16.25	2,116	3,069

(Average bid and offered price quotes and resting order sizes are for the TNU6-TNZ6 calendar spread and are calculated between 7am – 4pm Chicago Time on August 25, 2016, a day during the peak roll activity.)

3 Market impact and timing risk cost tend to be inversely related. The more one attempts to minimize market impact by spreading out an order over time, the higher Timing Risk may be, or vice-versa.

4 Students of Bloomberg symbology may recognize the TNU6-TNZ6 calendar spread as UXYU6-UXYZ6.

As Exhibit 2 attests, the deep liquidity of the TNU6-TNZ6 calendar spread enables the PM to execute the trade while limiting the impact of implicit trading costs, making the cost of the roll not only small, but reasonably predictable.

Exhibit 2 – Ultra 10-Year Note Futures Roll Example

Cost	Estimate	$ Impact	% of Notional
Commission and Fees	$3.12 / spread[5]	$4,680	0.0031%
B/A Spread	$7.8125 / contract	$11,718.75	0.0078%
Explicit Costs:		**$16,398.75**	**0.0109%**
Implicit Costs:		**$0**	**0**
TOTAL TRADING COSTS		**$16,398.75**	**0.0109%**

The abundant liquidity in the calendar spread market provides the PM with an easy trade-execution decision. The PM can execute the entire order at once, and at one price, immediately rolling $150 million notional face value of 10-year Treasury note exposure at a total trading cost of $16,398.75 (roughly 1.1 basis points position notional value). Implicit trading costs are zero, because the market B/A spread is the minimum ¼ of 1/32nd of a point, the entire order is executed at the best bid price, and the order size is absorbed by resting orders on the best bid, resulting in zero market impact.

For sizeable orders, not only can implicit trading costs potentially range into tens of millions of dollars, but volatility and uncertainty in the magnitudes of these execution costs can increase overall execution risk. Many open interest holders go to great lengths to execute large orders at once, at one price, giving them certainty of P/L and certainty of trading costs.

Appendix A displays average liquidity of Treasury Futures Calendar Spreads during 2016

Appendix B discusses two methods for the assignment of leg prices: Standard and SLEDS

HELPFUL LINKS

Treasury Futures Home page:
cmegroup.com/treasury

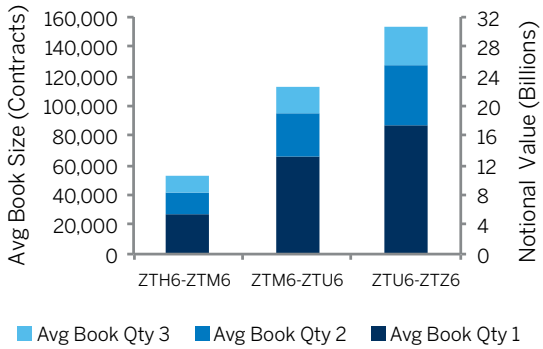
Treasury Pace of the Roll:
This analytical tool provides daily updates on the progress of the Treasury futures quarterly roll: cmegroup.com/ratesroll

5 Exchange trading and clearing fees and brokerage commission levels assumed here are hypothetical. Actual fees and commission rates may vary. Per-contract fees and commissions are charged on each leg of a calendar spread.

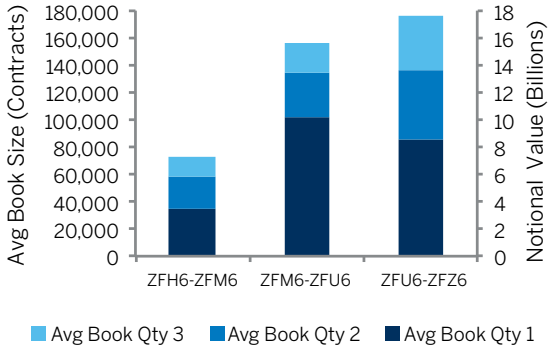
APPENDIX A — AVERAGE LIQUIDITY OF TREASURY FUTURES CALENDAR SPREAD MARKETS, 2016

Depicted here are time-weighted average sizes of resting orders on CME Globex at the best (Qty 1), next best (Qty 2), and third best (Qty 3) B/A price levels. For each Treasury futures product, the time-weighted averages reflect 7a.m. – 4p.m. Chicago Time for the March-June 2016 (H6-M6), June-September 2016 (M6-U6), and September-December 2016 (U6-Z6) quarterly roll periods. In each case, the roll period is defined to be the nine exchange trading days ending on, and including, the first business day of the nearby futures delivery month.

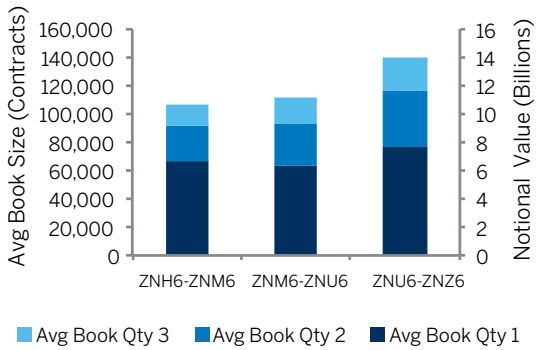
2-Year Treasury Futures Calendar Roll 2016 Roll Period



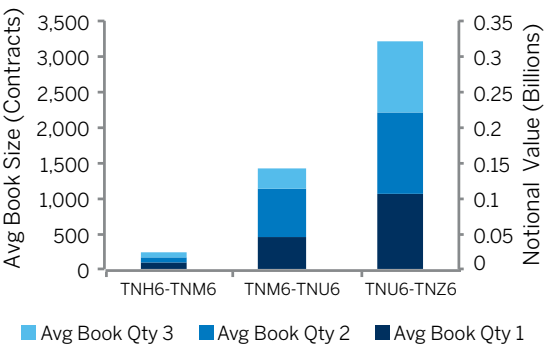
5-Year Treasury Futures Calendar Roll 2016 Roll Period



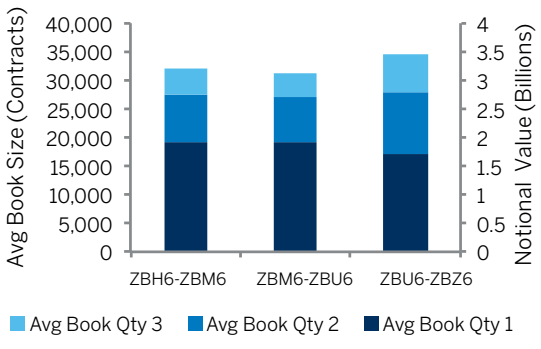
10-Year Treasury Futures Calendar Roll 2016 Roll Period



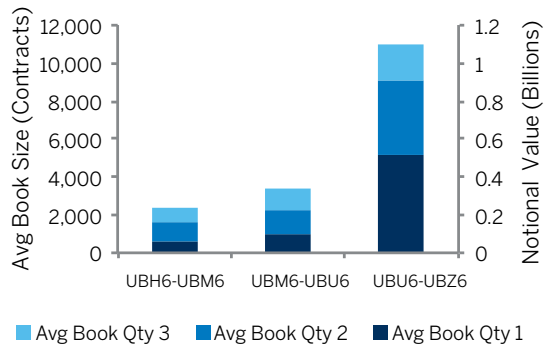
Ultra 10-Year Treasury Futures Calendar Roll 2016 Roll Period



Bond Treasury Futures Calendar Roll 2016 Roll Period



Ultra Bond Treasury Futures Calendar Roll 2016 Roll Period



APPENDIX B – CALENDAR SPREAD PRICING MECHANICS AND TWO METHODS FOR LEG PRICE ASSIGNMENTS

DECIPHERING CALENDAR SPREAD PRICES:

Buying the calendar spread entails buying the nearby month (eg, Sep-16) and selling the deferred month (eg, Dec-16). Conversely, selling the calendar spread entails selling the nearby month and buying the deferred month.

Bid Price: The bid price of the calendar spread is the difference between the bid price of the nearby month minus the ask price of the deferred month.

Ask Price: The ask price of the calendar spread is the difference between the ask price of the nearby month minus the bid price of the deferred month.

Treasury calendar spread trades offer two methods for assignment of leg prices: Standard and SLEDS. As illustrated below in Examples 1 and 2, respectively, these two methods produce the same profit/loss result, but through different channels, with the Standard method ascribing the P/L to one futures leg and the SLEDS method ascribing it to the other futures leg.

In each example, we return to the investor (PM) who holds a long position of 1,500 TNU6 futures, and who rolls out of this position and into a long position of 1,500 TNZ6 futures on August 25, 2016, using theTNU6-TNZ6 calendar spread.

In both examples assume market conditions on August 25, 2016, are as follows –

- C-Last price for TNU6 is 144-24[6]
- C-Last price for TNZ6 is 144-08
- TNU6-TNZ6 calendar spread market is 0-16 bid and 0-16.25 ask, with resting bid size of 2,116 contracts and resting offered size of 3,069 contracts.
- The PM sells 1,500 TNU6-TNZ6 calendar spreads at the bid, 0-16.

Assume that the exchange daily settlement price for TNZ6 is 144-08 (equal to the C-Last price at the time of the PM's trade), and that the exchange daily settlement price for TNU6 on the previous day, August 24, 2016, is 144-30.5.

Outright Markets vs. Calendar Spreads

Constructing Calendar Spread Prices From Outright Prices

	Bid	Ask
TNU6 Bid/Ask	144-24	144-24.5
TNZ6 Bid/Ask	144-08	144-08.5

Bid = (Sep-16 Bid – Dec-16 Ask); Ask = (Sep-16 Ask – Dec-16 Bid)

	Bid	Ask
TNU6 Bid/Ask	144-24	144-24.5
TNZ6 Ask/Bid	144-08.5	144-08
TNU6-TNZ6	0-15.5	0-16.5
Result	1 full 32nds B/A Spread	

Actual Calendar Spread Market Prices

	Bid	Ask
TNU6-TNZ6	0-16	0-16.25
Result	1/4 of 1/ 32 B/A Spread	

6 *Either the nearby or deferred contract can be the anchor in determining the prices of the spread legs. If the most recent C-Last price (defined below) at the time of the spread trade is determined to be in the nearby contract, then the deferred contract month price is assigned, as in this example: nearby month price – spread price. If the most recent C-Last price is determined to be in the deferred month, then the nearby month price is assigned by the deferred month price + spread price. If neither leg has the most recent C-last price (in the event of a tie), the C-Last price of the nearby contract is the anchor leg. If neither leg has a C-last price, the prior day's settlement price of the nearby contract is the anchor leg.*

The C-Last price for a Treasury futures contract is the contract's latest trade price, or actionable price indication, or settlement price. Specifically, the C-Last price is the most recent of: (i) the contract's latest CME Globex transaction price, or (ii) the CME Globex bid price that betters the bid side of the market, or (iii) the CME Globex asking price that betters the ask side of the market, or (iv) the contract's latest daily settlement price. In respect of items (ii) and (iii), a bid that betters the market is understood to be a bid to buy at a higher price than the incumbent C-Last price. Similarly, a better ask price is an offer to sell at a price below the preceding C-Last price.

EXAMPLE 1: STANDARD METHOD

TNU6 Exit Price (Leg 1)

Price assigned = 144-24 = TNU6 C-Last Price

TNU6 Mark-to-Market

= 144-24 minus (Previous Day Settlement Price 144-30.5)

= -$304,695 = (-6.5/32nds price points) * ($1000 per price point per contract) * (1500 contracts)

TNZ6 Entry Price (Leg 2)

Price assigned = 144-08 = (TNU6 C-Last Price 144-24) minus (calendar spread transaction price 0-16)

TNZ6 Mark-to-Market

Zero = (TNZ6 daily settlement price 144-08) minus 144-08

EXAMPLE 2: SLEDS[7] METHOD

TNU6 Exit Price (Leg 1)

Price assigned = 144-30.5 = TNU6 Previous Day Settlement Price

TNU6 Mark-to-Market

Zero = 144-30.5 minus (TNU6 daily settlement price 144-30.5)

TNZ6 Entry Price (Leg 2)

Price assigned

= 144-14.5

= (TNU6 Previous Day Settlement Price 144-30.5) minus (calendar spread transaction price 0-16)

TNZ6 Mark-to-Market

= (TNZ6 daily settlement price 144-08) minus 144-14.5

= -$304,695 = (-6.5/32nds price points) * ($1000 per price point per contract) * (1500 contracts)

The key feature of Examples 1 and 2 is that the combined daily marks-to-market on the calendar spread's component legs produce the same result: A loss of $304,695. The Standard method assigns calendar spread leg prices such that the loss is ascribed to the nearby TNU6 leg, whereas (in this example) the SLEDS method's reliance on previous-day settlement prices to facilitate leg price assignments has the effect of attributing the loss to the deferred TNZ6 leg

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7 Single Line Entry of Differential Spreads

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Data sources: CME Group unless otherwise noted

Futures trading is not suitable for all investors, and involves the risk of loss. Futures are a leveraged investment, and because only a percentage of a contract's value is required to trade, it is possible to lose more than the amount of money deposited for a futures position. Therefore, traders should only use funds that they can afford to lose without affecting their lifestyles. And only a portion of those funds should be devoted to any one trade because they cannot expect to profit on every trade. All references to options refer to options on futures.

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