

# Creating Treasury Rate Locks with On-The-Run U.S. Treasury Futures

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***Futures contracts that cash settle at expiration to mid-market, benchmark Treasury yields provide excellent tools to create Treasury rate locks***

## **New Tools in the Toolkit**

On-The-Run Treasury futures (OTR futures) cash settle at expiration with reference to mid-market yields of the on-the-run (most recently auctioned) 2-year, 5-year, and 10-year Treasury notes. The contract design enables users to achieve capital-efficient and precise exposure to the most liquid, benchmark maturity yields on the Treasury yield curve, with the benefit of the CME Clearing guarantee. Because they directly reference *the benchmark Treasury yields*, they permit the creation of new investment strategies in futures form, such as Treasury rate locks, synthetic on-the-run exposures, yield curve spreads, and swap spreads.

The listing and expiration schedule for OTR futures mirrors the auction schedule of the underlying on-the-run Treasury notes, enabling intuitive trade construction similar to that of using on-the-run Treasury securities, but with the leverage of repo financing already built into the contract. For more information, including a historical illustration of contract final settlement yields, please visit [www.cmegroup.com/otr](http://www.cmegroup.com/otr).

## **Balance Sheet Management, Initial Margin, and Mark-to-Market**

Like all CME Group exchanges' futures, to establish a long or short position in OTR Treasury futures requires a deposit of collateral for initial margin. Once established, open positions are "marked-to-market" each day based on that day's settlement price, creating positive or negative cash flows for each open position.

The amount of initial margin required to open a position in OTR futures is economical compared to the notional value of the contracts (i.e., usually less than 2% of notional)<sup>1</sup>. The initial/maintenance margin levels are carefully calibrated to account for one-day's worth of severe price risk. Futures positions are marked-to-market daily through the variation margin process, which effectively *realizes* the gains or losses on all open positions and brings them back in line with the market each day.

Using futures in lieu of cash or OTC derivative positions can increase the efficiency of balance sheet capital and virtually eliminate counterparty credit risk with the CME Clearing guarantee. The corporation gains access not only to OTR futures, but likely all of CME Group exchanges' extensive product offerings with a single set of standardized futures account documents with its futures clearing firm (FCM), precluding the need for separate ISDA or MRA documentation with each potential counterparty. Also, depending on the transaction size, one can often access additional liquidity for block trades through their FCM.

Please visit [www.cmegroup.com/clearing](http://www.cmegroup.com/clearing) for up to date information on current CME Group margin requirements and a list of acceptable collateral and collateral management programs<sup>2</sup>.

1. Margin requirements are subject to change. Notional contract values are \$100,000 for each OTR Treasury futures contract.
2. FCMs may expand the list of collateral they accept from customers. If they provide this service, they hold the customer collateral and post different collateral to CME Clearing (as may be acceptable to CME Clearing) on behalf of the customer account.

## Creating a Treasury Rate Lock with OTR Treasury Futures

On January 14<sup>th</sup> a hypothetical corporation, BIG Corp, announces that it is preparing to issue \$500 million of 10-year debt with semi-annual interest payments. BIG Corp bonds generally price at 175 basis points over the prevailing 10-year Treasury yield at time of issuance. Since there is usually a three week interval between announcement date and issuance date, BIG Corp is exposed to the risk of interest rates rising during this time. On January 14<sup>th</sup>, the 10-year Treasury yield is 3.33%. If it is still 3.33% in three weeks, when BIG Corp's new bonds actually issue, then their coupon should reflect interest cost of 5.08%.

### Exhibit 1 – BIG Corp Issuance Plan, January 14<sup>th</sup>

Issuance Amount	Term to Maturity	Projected BIG Corp		Modified Duration	DV01 (per \$1m)	Total DV01 (per \$500m issue)
		Current 10-year Treasury Yield	Bond Coupon (10Y yield + 175 bps)			
\$500m	10-years	3.33%	5.08%	7.765	\$776.52	\$388,260
10Y OTR Treasury Futures		3.35%			\$87.063 (per contract)	

The modified duration of the planned issue at the prevailing yield of 5.08% is 7.765, which indexes the interest rate sensitivity of the planned debt issue. For example, BIG Corp will incur \$388,260 loss of value for each 1 basis point rise in yield. See Exhibit 2.

### Exhibit 2 -- Interest Rate Sensitivity of Planned Debt Issue

Yield Change (in bps)	10-year Treasury Yield	Projected BIG Corp 10-Year Yield	Modified Duration	Issue DV01 (per \$500m)	Gain/Loss to Present Value from Yield Change*
+100	4.33%	6.08%	7.411	\$370,565	+\$ 37.1 million
+50	3.83%	5.58%	7.585	\$379,262	+\$ 19.0 million
0	3.33%	5.08%	7.765	\$388,260	0
-50	2.83%	4.58%	7.951	\$397,573	-\$ 19.9 million
-100	2.33%	4.08%	8.144	\$407,212	-\$ 40.7 million

\* Yield Change x Issue DV01 (convexity path from zero to +/- 100 bps change not taken into account, actual results may vary)

To neutralize the risk that the 10-year Treasury note yield may rise over the interval between announcement date and the bond issue date, BIG Corp decides to use 10-Year OTR futures to establish a Treasury rate lock by selling 10-Year OTR Treasury futures.

## Trade Construction

BIG Corp will use 10-Year OTR Treasury futures to create a DV01-weighted hedge for 100 percent of the planned \$500 million bond issue. Hedging 100% of the issue is a strategic decision, as some issuers might prefer a different strategy by establishing a hedge that accounts for less than 100% of the planned issue or may choose to “scale” into a 100% hedge depending whether certain interest rate levels are reached.

On January 14<sup>th</sup>, announcement day for BIG Corp's new debt issue, 10-Year OTR futures have a price of 105 and 15.5/32nds (105.484375) with an implied forward Treasury contract yield of 3.35% (for notional forward settlement on February 10<sup>th</sup>). At this price level, the dollar value of a one-basis point change in the contract forward yield (the “DV01”) of the OTR futures contract is \$87.063. (Among the important advantages of the OTR futures contract design is that it standardizes the relationship between contract price and contract DV01. For a simple but complete explanation, see the Appendix -- **What is the DV01 of an OTR Treasury futures contract.**

### Hedge Ratio: How many OTR futures does BIG Corp need to short to create the rate lock?

To set the hedge ratio, BIG Corp's corporate treasury manager simply divides DV01 of the \$500 million issue by the DV01 of a 10-Year OTR Treasury futures contract.

$$\text{Hedge Ratio} = \text{DV01}_{\text{bond issue}} / \text{DV01}_{\text{futures}}$$

$$\text{Hedge Ratio} = \frac{\$388,260}{\$87.063} = \mathbf{4,460 \text{ 10-Year OTR Treasury futures}}$$
 (rounded to nearest whole contract)

Accordingly, BIG Corp sells 4,460 10-Year OTR Treasury futures for Feb11 expiry, at a price of 105 and 15.5/32nds. See Exhibit 3. This short position will profit if the 10-year Treasury yield increases and will create a loss if the 10-year Treasury yield decreases. Either way, the objective of the hedge is to offset any financial impact to BIG Corp caused by a shift in the 10-Year Treasury yield from its announcement day value of 3.33%.

**Exhibit 3 -- 10-Year OTR Treasury Futures Rate Lock, Position Entry, January 14, 2011**

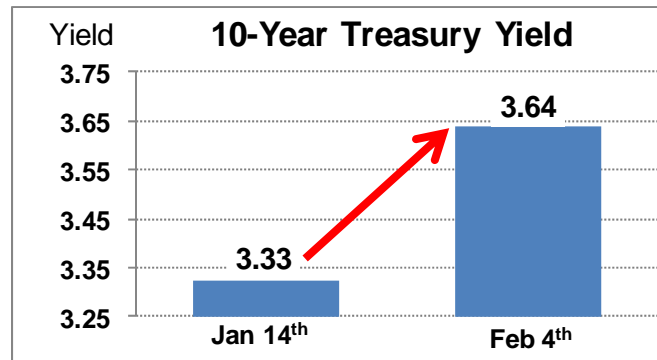
Futures Contract	Price*	Implied Forward Yield (Pct)	Contract DV01 (\$ per bp)	Number of Contracts Long (+) or Short (-)	Futures Position DV01 (\$ per bp)
10-Year OTR Feb11 expiry	105 and 15.5/32nds	3.35%	\$87.063	-4,460	\$388,301

Initial margin requirement is \$6,623,100 = 4,460 contracts X \$1,485 initial margin per contract

\* Actual market prices (last price)

### Issue Corporate Debt & Remove Hedge

Three weeks later on February 4<sup>th</sup>, BIG Corp issues \$500 million of 10-year debt at a coupon rate of 5.39%. This is 31 basis points higher (and more costly) than the 5.08% prevailing on the bond issue's announcement day, signifying approximately \$12.04 million loss of value (31 bps X \$388,260.52 debt issue DV01). See Exhibit 4.



**Exhibit 4 – Yields Rise, Creating a Loss of Value at Issuance Date**

Jan 14 <sup>th</sup> Treasury yield	Jan 14 <sup>th</sup> Projected Debt Coupon	Feb 4 <sup>th</sup> Treasury yield	Feb 4 <sup>th</sup> Actual Debt Coupon	(A) Yield/Coupon Change	(B) DV01 Debt Total (per \$500m)	(A X B) Estimated Loss from Rise in Yield
3.33%	5.08%	3.64%	5.39%	+31 bps	\$388,260	- \$12,036,076

Given this outcome, how did BIG Corp's futures hedge perform? Over the same interval, the 10-Year OTR futures contract's *forward* yield increased by 30 basis points to 3.65% from 3.35%, resulting in a gain of nearly \$11.50 million on the short hedge. See Exhibit 5.

**Exhibit 5 -- 10-Year OTR Treasury Futures Rate Lock, Profit/Loss, February 4, 2011**

Jan 14, Entry Price*	Jan 14, Implied Yield	Feb 4, Exit Price*	Feb 4, Implied Yield	Price Change Per Contract	Number of Contracts Long (+) or Short (-)	Profit (+) / Loss (-) (\$)
105-155	3.35%	102-290	3.65%	-(02 and 18.5/32nds) = \$2,578.13	-4,460	+ \$11,498,504*
Loss in Value of Debt Issue						- \$12,036,076
Net Profit/Loss from Debt Issuance and Hedging Activities						- \$537,622
Hedge Effectiveness						96%

\* Actual prices (last price). Daily position mark-to-market involves rounding to nearest penny, see Exhibit 6

Without the OTR Treasury futures hedge, the rise in the 10-year yield between announcement and issue dates would have cost BIG Corp an incremental \$12 million. By hedging with OTR Treasury futures, BIG Corp neutralized all but \$537,622 of the \$12 million, or 96% of the loss in value.

Important to note is that this example depicts a hedge position that is established at the onset and then removed three weeks later, without any intervening adjustment to the hedge ratio along the way. This approach clearly makes for easy hedge position management, but at the cost of less accuracy. As yields rise or fall, the ratio between the debt issue's total DV01 and the OTR Treasury futures DV01 is apt to change. To achieve yet finer hedge effectiveness, BIG Corp's treasurer would have monitored changes in market yield and price levels, and would have made periodic adjustments to the hedge ratio to keep the futures position in line with the impending bond issue.

**Mark-to-Market (MTM) Cash Flows**

10-Year Treasury futures contract requires \$1,485 of initial margin per contract (long or short). To establish and hold a short position of -4,460 contracts would require \$6,623,100 of initial margin.

In addition, the futures position would generate daily cash flows through the MTM process. Exhibit 6 illustrates the MTM cash flows that the position in this example incurred based on the actual settlement prices of the 10-Year OTR Treasury futures, to arrive at the \$11,498,504 of total profit when BIG Corp exited the position on February 4<sup>th</sup>.

**Exhibit 6 -- Daily Cash Flows from Mark-to-Market**

Date	10Y OTR Futures Daily Settle Price	# Contracts +L or -S	MTM Daily Cash Flows
1/14	105.484375	-4,460	
1/18	105.171875	-4,460	\$ 1,393,750
1/19	105.421875	-4,460	\$ (1,115,000)
1/20	104.375000	-4,460	\$ 4,669,085
1/21	104.781250	-4,460	\$ (1,811,875)
1/24	104.859375	-4,460	\$ (348,460)
1/25	105.593750	-4,460	\$ (3,275,335)
1/26	104.703125	-4,460	\$ 3,972,210
1/27	105.078125	-4,460	\$ (1,672,500)
1/28	105.593750	-4,460	\$ (2,299,710)
1/31	105.171875	-4,460	\$ 1,881,585
2/1	104.640625	-4,460	\$ 2,369,375
2/2	104.218750	-4,460	\$ 1,881,585
2/3	103.796875	-4,460	\$ 1,881,585
2/4	102.906250	-4,460	\$ 3,972,210
			<b>\$ 11,498,504</b>

## Conclusion and Additional Resources

### Position Management

10-Year OTR Treasury futures employ a quarterly listing and expiration schedule, with contract expirations in February, May, August, and November. Because 2-Year and 5-Year OTR Treasury futures employ a monthly listing and expiration schedule, maintaining a position in these contracts for any extended period will require position management to replace expiring contracts with successive nearby contracts. A participant would accomplish this by simply rolling the contracts that are nearing expiration into the first deferred contracts, much the same as a participant would perform a dollar roll in the Treasury cash market to maintain position exposure in whatever issue is the current on-the-run. Also, as noted earlier, if the price of the OTR Treasury futures position moves substantially, the embedded convexity will cause the contract DV01 to change as well, potentially requiring a position adjustment to keep the DV01 of the futures hedge in balance with the DV01 of the corporate debt instrument.

### Basis Considerations

Municipal issuers may also find OTR Treasury futures attractive as hedging vehicles for tax exempt issues that have a strong basis relationship with Treasury yields. Hedging municipals with Treasuries have two elements of basis risk:

1. Changes in the AAA rated municipal yield curve relative to the Treasury yield curve and
2. Changes in issuer's credit risk premium relative to the AAA municipal curve.

This is somewhat similar to corporate issuers who have to assess and monitor changes in the shape of corporate yield curve relative to Treasuries and changes in the credit risk of the corporate issuer relative to the broad corporate yield curve. As part of any hedging strategy, corporate and municipal issuers should monitor basis risk. A stable corporate or municipal to Treasury yield curve relationship and a stable credit spread should produce a hedge that is highly correlated. Both of these elements of basis risk may either benefit or detrimentally impact the futures Treasury rate lock strategy.

### Capital Efficiencies

With OTR Treasury futures, market participants can implement many new futures hedging strategies, thereby benefitting from the protections afforded by the CME Clearing House guarantee, while precluding the need for onerous cash-market or OTC derivative documentation. For firms seeking synthetic alternatives to potentially cumbersome cash-market exposures, futures offer the natural advantages of embedded leverage, combined with the safety of CME Clearing's daily mark-to-market and margining processes.

### Additional Resources

OTR Treasury Futures Web Page

[www.cmegroup.com/otr](http://www.cmegroup.com/otr)

CME Group Yield Center

[www.cmegroup.com/yield](http://www.cmegroup.com/yield)

Intercommodity Treasury and Swaps Spreads

[www.cmegroup.com/ics](http://www.cmegroup.com/ics)

CME Group Interest Rate Products Page

[www.cmegroup.com/ir](http://www.cmegroup.com/ir)

## **APPENDIX: What is the DV01 of an OTR Treasury futures contract?**

**Hedging strategies using OTR Treasury futures are intuitive to construct and maintain.** The simplicity of the contract design ensures that the performance of a hedge constructed with OTR Treasury futures should be easy to monitor in terms of both futures price and implied futures contract yield. It also ensures the price/yield action of an OTR Treasury futures implied contract yield closely tracks the dynamics of the cash market yield.

**OTR Treasury futures employ direct Price-Yield-DV01-Convexity relationships, similar to that of Treasury securities.** OTR Treasury futures contracts are designed so as to remove the guesswork from DV01-weighting. For any given OTR Treasury futures contract price level, there is one and only one implied forward-starting, on-the-run Treasury contract yield, which is based on notional forward settlement on the business day following contract expiration. Calculating the forward yield requires the spot price and term repo rate of the underlying note. The same one-to-one property applies to relationships between OTR Treasury futures contract prices and key characteristics of contract price behavior, including:

*interest rate sensitivity* of contract price (i.e., the futures contract's DV01), and

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

Moreover, these standardized relationships apply to all contract delivery months. The values of the OTR Treasury futures contract's forward-starting Treasury yield, DV01, and price convexity that are implied by the futures contract price remain the same, regardless of whether the contract is listed for expiration a day from now or three months from now. Utilizing the spot yield at expiration to determine the final expiration price ensures the forward contract yield converges to the underlying spot yield upon expiration.

### **Exhibit 7 -- Sample Slice: 10-Year OTR Treasury futures Prices, Implied Yields, Implied DV01s, \$ Convexity**

<b>10-Year OTR Futures Price</b>	<b>Handle (Points)</b>	<b>Tail (32nds)</b>	<b>Implied Contract Yield (Pct per Annum)</b>	<b>DV01 (\$ per Basis Point per Contract)</b>	<b>Dollar Convexity*</b>
105.437500	<b>105</b>	<b>14</b>	3.3554	87.018	4.220
105.453125	<b>105</b>	<b>14 1/2</b>	3.3536	87.033	4.221
105.468750	<b>105</b>	<b>15</b>	3.3518	87.048	4.222
105.484375	<b>105</b>	<b>15 1/2</b>	3.3501	87.063	4.222
105.500000	<b>105</b>	<b>16</b>	3.3482	87.079	4.223
105.515625	<b>105</b>	<b>16 1/2</b>	3.3465	87.094	4.224
105.531250	<b>105</b>	<b>17</b>	3.3447	87.109	4.225

\* \$ per 100 contracts per basis point

[www.cmegroup.com/otr](http://www.cmegroup.com/otr) includes many useful links, including the full Excel arrays of OTR Treasury futures prices, implied contract yields, implied DV01s, and implied convexities at [OTR Treasury Futures Price-Yield-DV01Tables](#), as well as the product *Reference Guide*, detailing contract design and fair value calculations at [www.cmegroup.com/trading/interest-rates/files/OTR-Treasury-Futures-Ref\\_Guide.pdf](http://www.cmegroup.com/trading/interest-rates/files/OTR-Treasury-Futures-Ref_Guide.pdf).

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