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Calculating U.S. Treasury Futures Conversion Factors

Find out how U.S. Treasury futures are standardized with conversion factors

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Each cash note or bond eligible for delivery into a Treasury futures contract is assigned a conversion factor, which considers its coupon and the time remaining until maturity as of a specific delivery month. The conversion factor represents the estimated decimal price at which $1 par value of the security would trade if it had a yield to maturity of 6%.

The conversion factor serves a pragmatic role by standardizing the valuation of deliverable securities. It represents an estimated price at which the bond or note would trade, assuming a 6% yield to maturity. Throughout a specific delivery cycle, conversion factors remain consistent and act as a multiplier in determining the invoice prices for securities delivered within the futures contract.

In cases where the coupon exceeds 6%, the conversion factor is greater than 1, reflecting the higher relative value of the security. Conversely, if the coupon falls below 6%, the conversion factor is less than 1, indicating a comparatively lower value for the security.

Conversion factors for currently listed Treasury futures are listed are published in accordance with the Treasury's Tentative Auction Schedule.

The cheapest-to-deliver security can be found on the CME Group Treasury Analytics tool.

Exhibit 1: Deliverable grades for Treasury futures

FUTURES PRODUCT (CME GLOBEX PRODUCT CODE/ CLEARING CODE)	DELIVERABLE GRADE AND QUALITY	REMAINING TERM TO MATURITY ROUNDING CONVENTION	CBOT RULEBOOK CHAPTER
ULTRA U.S. TREASURY BOND FUTURES (UB/UBE)	U.S. Treasury bonds with remaining term to maturity of not less than 25 years from the first day of the futures contract delivery month.	Three-Month Increment	40
U.S. TREASURY BOND FUTURES (ZB/17)	U.S. Treasury bonds that have remaining term to maturity of at least 15 years and less than 25 years from the first day of the futures delivery month.	Three-Month Increment	18
20-YEAR U.S. TREASURY BOND FUTURES (TWE/ TWE)	U.S. Treasury bonds with not less than 19 years 2 months and not more than 19 years 11 months of remaining term to maturity from first day of futures delivery month.	Three-Month Increment	25
ULTRA 10-YEAR U.S. TREASURY NOTE (TN/TN)	Original issue 10-Year U.S. Treasury notes with not less than 9 years 5 months and not more than 10 years of remaining term to maturity from first day of futures delivery month.	Three-Month Increment	26
10-YEAR T-NOTE FUTURES (ZN/21)	U.S. Treasury notes with a remaining term to maturity of at least six and a half years, but less than eight years, from the first day of the delivery month.	Three-Month Increment	19
5-YEAR T-NOTE FUTURES (ZF/25)	U.S. Treasury notes with an original term to maturity of not more than five years and three months and a remaining term to maturity of not less than four years and two months as of the first day of the delivery month.	One-Month Increment	20
3-YEAR T-NOTE FUTURES (Z3N/3YR)	U.S. Treasury notes that have an original maturity of not more than 7 years and a remaining maturity of not less than 2 years and 9 months from the first day of the delivery month but not more than 3 years from the last day of the delivery month.	One-Month Increment	39
2-YEAR T-NOTE FUTURES (ZT/26)	U.S. Treasury notes with an original term to maturity of not more than five years and three months and a remaining term to maturity of not less than one year and nine months from the first day of the delivery month and a remaining term to maturity of not more than two years from the last day of the delivery month.	One-Month Increment	21

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The formula for calculating a conversion factor[1] is:

$$factor = a * \left[\left(\frac{coupon}{2}\right) + c + d\right] - b$$

where the factor is rounded to four decimal places. And:

coupon	is the bond or note's annual coupon in decimals rounded to the nearest one-eighth of one percent (rounded up in the case of ties).
n	is the number of whole years from the first day of the delivery month to the maturity (or call) date of the bond or note.
z	is the number of whole months between n and the maturity (or call) date rounded down to the nearest quarter for UB, ZB, TWE, TN and ZN, and to the nearest month for ZF, Z3N, and ZT

$$v = \begin{cases} z, & z < 7 \\ 3, & z \geq 7 (for \text{ UB, ZB, TWE, TN and ZN}) \\ (z-6), & z \geq 7 (for \text{ ZF, Z3N, and ZT}) \end{cases}$$

$$a = 1/1.03^{v/6}$$

$$b = \left(\frac{coupon}{2}\right) * (6 - v)/6$$

$$c = \begin{cases} 1/1.03^{2n}, & z < 7 \\ 1/1.03^{2n+1}, & otherwise \end{cases}$$

$$d = \left(\frac{coupon}{0.06}\right) * (1 - c)$$

The first step in calculating the conversion factor is to determine how many months there are until the first coupon payment, where *v* is used as a helper:

$$v = \begin{cases} z, & z < 7 \\ 3, & z \geq 7 (for \text{ UB, ZB, TWE, TN and ZN}) \\ (z-6), & z \geq 7 (for \text{ ZF, Z3N, and ZT}) \end{cases}$$

Coupons for Treasury notes and bonds are paid on a semiannual basis. For the contracts with a three-month rounding convention, z can equal 0, 3, 6, 9. If the value of z = 3 *or* 9, then there is 3 months until the next coupon payment. If the value of z = 0 *or* 6, then there is 6 months until the next coupon payment.

For contracts with a one-month rounding convention, z can equal any value from 0 to 11. If $z \geq 7$, then we subtract 6 to change *v* to a half year increment, which will assist in calculating the number of months until the next coupon payment in *b*.

Component *a* of the conversion factor formula is simply a present value formula:

$$PV = FV/(1+r)^n$$

$$a = 1/1.03^{v/6}$$

1 *The conversion factor for any note shall be the price at which it will yield six percent (rounded to four decimal places) based on the formula found in Standard Securities Calculation Methods published by the Securities Industry Association.*

The FV in the equation is the face value of the bond or note, $100 or 1, and r represents the assumed yield maturity of 6%, or 3% due to the semiannual coupon payments. v and a have an inverse relationship. As v increase, or gets further from the next coupon payment, the value of a decreases.

Component b discounts the coupon based on how many months there are until the next coupon payment. Since payments are semiannual, the coupon is divided by 2, and then it is discounted. If v=0, then there is 6 months until the next coupon, indicating a discount factor of 1, resulting in b=coupon/2. If v=6 then there are 0 months until the next coupon, so the discount factor is 0, resulting in b=0.

$$b = \left(\frac{coupon}{2}\right) * (6 - v)/6$$

Component c is also a present value formula like component a. Component c counts the number of semi-annual coupon payments there will be. If $z < 7$, then the first coupon payment of the year has not occurred yet, therefore the number of coupon payments is similar the number of years multiplied by 2. If $z \geq 7$, then the first coupon payments have already occurred for the current year, thus another coupon payments must be added to accommodate for second payments of the year.

$$c = \begin{cases} 1/1.03^{2n}, \; z < 7 \\ 1/1.03^{2n+1}, \; otherwise \end{cases}$$

Component d adjusts the magnitude of the coupon of the U.S. Treasury security. This is done to equalize the securities in a deliverable basket. If all conversion factors were set to 1, then the security with the lowest issued coupon would always the cheapest to deliver. To avoid this, Component d is scaled by component c to tune the impact of the coupons.

$$d = \left(\frac{coupon}{0.06}\right) * (1 - c)$$

2-Year U.S. Treasury Note futures contract (ZT/26)

Calculate the conversion factor for the 5s of September 30, 2025, (i.e., 91282CJB8) for the December 2023 expiry.

The first day of the December 2023 delivery month is Friday, December 1, 2023.

Remaining term to maturity of **1 year, 9 months** based upon an actual remaining maturity of 1 year 9 months and 29 days. Notice that the remaining term to maturity for ZT rounds down in one-month increments. Therefore:

$$n = 1 \; year$$

$$z = 9 \; months$$

$$coupon = 5\% \; or \; 0.05$$

Since this is the ZT contract and the value of z is greater than or equal to 7:

$$v = 9 - 6 = 3$$

$$a = 1/1.03^{3/6} = 0.9853293$$

$$b = \left(\frac{0.05}{2}\right) * \frac{6-3}{6} = 0.012500$$

Since z ≥ 7:

$$c = 1/1.03^{2(1)+1} = 0.9151417$$

$$d = \left(\frac{0.05}{0.06}\right) * (1 - 0.9151417) = 0.0707153$$

$$factor = 0.9853293 * \left[\left(\frac{0.05}{2}\right) + 0.9151417 + 0.0707153\right] - 0.0125 = 0.9835$$

3-Year U.S. Treasury Note futures contract (Z3N/3YR)

Calculate the conversion factor for the 4 5/8s of November 15, 2026, (i.e., 91282CJK8) for the December 2023 expiry.

The first day of the December 2023 delivery month is Friday, December 1, 2023.

Remaining term to maturity of **2 years, 11 months** based upon an actual remaining maturity of 2 year 11 months and 14 days. Notice that the remaining term to maturity for Z3N rounds down in 1-month increments. Therefore:

$$n = 2\ year$$

$$z = 11\ months$$

$$coupon = 4.625\%\ or\ 0.04625$$

Since this is the Z3N contract and the value of z is greater than or equal to 7:

$$v = 11 - 6 = 5$$

$$a = 1/1.03^{5/6} = 0.9756686$$

$$b = \left(\frac{0.04625}{2}\right) * \frac{6-5}{6} = 0.0038542$$

Since z ≥ 7:

$$c = 1/1.03^{2(2)+1} = 0.8626088$$

$$d = \left(\frac{0.04625}{0.06}\right) * (1 - 0.8626088) = 0.1059057$$

$$factor = 0.9756686 * \left[\left(\frac{0.04625}{2}\right) + 0.8626088 + 0.1059057\right] - 0.0038542 = 0.9637$$

5-Year U.S. Treasury Note futures contract (ZF/25)

Calculate the conversion factor for the 3 5/8s of May 31, 2028, (i.e., 91282CHE4) for the March 2024 expiry.

The first day of the March 2024 delivery month is Friday, March 1, 2024.

Remaining term to maturity of **4 years, 2 months** based upon an actual remaining maturity of 4 year 2 months and 30 days. Notice that the remaining term to maturity for ZF rounds down in 1-month increments. Therefore:

$$n = 4\ year$$

$$z = 2\ months$$

$$coupon = 3.625\%\ or\ 0.03625$$

Since the value of z is less than 7:

$$v = z = 2$$

$$a = 1/1.03^{2/6} = 0.9901954$$

$$b = \left(\frac{0.03625}{2}\right) * \frac{6-2}{6} = 0.0120833$$

Since z < 7:

$$c = 1/1.03^{2(4)} = 0.7894092$$

$$d = \left(\frac{0.03625}{0.06}\right) * (1 - 0.7894092) = 0.1272319$$

$$factor = 0.9901954 * \left[\left(\frac{0.03625}{2}\right) + 0.7894092 + 0.1272319\right] - 0.0120833 = 0.9135$$

10-Year U.S. Treasury Note futures contract (ZN/21)

Calculate the conversion factor for the 4 1/8s of August 31, 2030, (i.e., 91282CHW4) for the December 2023 expiry.

The first day of the December 2023 delivery month is Friday, December 1, 2023.

Remaining term to maturity of **6 years, 6 months** based upon an actual remaining maturity of 6 year 8 months and 30 days. Notice that the remaining term to maturity for ZN rounds down in 3-month increments. Therefore:

$$n = 6\ year$$

$$z = 6\ months$$

$$coupon = 4.125\%\ or\ 0.04125$$

Since the value of z is less than 7:

$$v = z = 6$$

$$a = 1/1.03^{6/6} = 0.9708738$$

$$b = \left(\frac{0.04125}{2}\right) * \frac{6-6}{6} = 0$$

Since z < 7:

$$c = 1/1.03^{2(6)} = 0.7013799$$

$$d = \left(\frac{0.04125}{0.06}\right) * (1 - 0.7013799) = 0.2053013$$

$$factor = 0.9708738 * \left[\left(\frac{0.04125}{2}\right) + 0.7013799 + 0.2053013\right] - 0 = 0.9003$$

10-Year "Ultra" U.S. Treasury Note futures contract (TN/TN)

Calculate the conversion factor for the 4 1/2s of November 15, 2033, (i.e., 91282CJJ1) for the December 2023 expiry.

The first day of the December 2023 delivery month is Friday, December 1, 2023.

Remaining term to maturity of **9 years, 9 months** based upon an actual remaining maturity of 9 years 11 months and 14 days. Notice that the remaining term to maturity for TN rounds down in 3-month increments. Therefore:

$$n = 9 \; year$$

$$z = 9 \; months$$

$$coupon = 4.5\% \; or \; 0.04500$$

Since this is the TN contract and the value of z is greater than or equal to 7:

$$v = 3$$

$$a = 1/1.03^{3/6} = 0.9853293$$

$$b = \left(\frac{0.04500}{2}\right) * \frac{6-3}{6} = 0.0112500$$

Since z ≥ 7:

$$c = 1/1.03^{2(9)+1} = 0.5702860$$

$$d = \left(\frac{0.04500}{0.06}\right) * (1 - 0.5702860) = 0.3222855$$

$$factor = 0.9853293 * \left[\left(\frac{0.04500}{2}\right) + 0.5702860 + 0.3222855\right] - 0.0112500 = 0.8904$$

20-Year U.S. Treasury Bond futures contract (TWE/TWE)

Calculate the conversion factor for the 4 3/8s of August 15, 2043, (i.e., 912810TU2) for the June 2024 expiry.

The first day of the June 2024 delivery month is Saturday, June 1, 2024.

Remaining term to maturity of **19 years** based upon an actual remaining maturity of 19 year 2 months and 14 days. Notice that the remaining term to maturity for TWE rounds down in 3-month increments. Therefore:

$$n = 19\ year$$

$$z = 0\ months$$

$$coupon = 4.375\%\ or\ 0.04375$$

Since the value of z is less than 7:

$$v = z = 0$$

$$a = 1/1.03^{0/6} = 1$$

$$b = \left(\frac{0.04375}{2}\right) * \frac{6-0}{6} = 0.021875$$

Since z < 7:

$$c = 1/1.03^{2(19)} = 0.3252262$$

$$d = \left(\frac{0.04375}{0.06}\right) * (1 - 0.3252262) = 0.4920226$$

$$factor = 1 * \left[\left(\frac{0.04375}{2}\right) + 0.3252262 + 0.4920226\right] - 0.021875 = 0.8172$$

U.S. Treasury Bond futures contract (ZB/17)

Calculate the conversion factor for the 4 1/2s of August 15, 2039, (i.e., 912810QC5) for the March 2024 expiry.

The first day of the March 2024 delivery month is Friday, March 1, 2024.

Remaining term to maturity of **15 years, 3 months** based upon an actual remaining maturity of 15 years 5 months and 14 days. Notice that the remaining term to maturity for ZB rounds down in 3-month increments. Therefore:

$$n = 15\ year$$

$$z = 3\ months$$

$$coupon = 4.5\%\ or\ 0.04500$$

Since the value of z is less than 7:

$$v = z = 3$$

$$a = 1/1.03^{3/6} = 0.9853293$$

$$b = \left(\frac{0.04500}{2}\right) * \frac{6-3}{6} = 0.0112500$$

Since z < 7:

$$c = 1/1.03^{2(15)} = 0.4119868$$

$$d = \left(\frac{0.04500}{0.06}\right) * (1 - 0.4119868) = 0.4410099$$

$$factor = 0.9853293 * \left[\left(\frac{0.04500}{2}\right) + 0.4119868 + 0.4410099\right] - 0.0112500 = 0.8514$$

Long-Term "Ultra" U.S. Treasury Bond futures contract (UB/UBE)

Calculate the conversion factor for the 2 3/8s of November 15, 2049, (i.e., 912810SK5) for the December 2023 expiry.

The first day of the December 2023 delivery month is Friday, December 1, 2023.

Remaining term to maturity of **25 years, 9 months** based upon an actual remaining maturity of 25 years 11 months and 14 days. Notice that the remaining term to maturity for UB rounds down in 3-month increments. Therefore:

$$n = 25\ year$$

$$z = 9\ months$$

$$coupon = 2.375\%\ or\ 0.02375$$

Since this is the UB contract and the value of z is greater than or equal to 7:

$$v = 3$$

$$a = 1/1.03^{3/6} = 0.9853293$$

$$b = \left(\frac{0.02375}{2}\right) * \frac{6-3}{6} = 0.0059375$$

Since z ≥ 7:

$$c = 1/1.03^{2(25)+1} = 0.2214632$$

$$d = \left(\frac{0.02375}{0.06}\right) * (1 - 0.2214632) = 0.3081708$$

$$factor = 0.9853293 * \left[\left(\frac{0.02375}{2}\right) + 0.2214632 + 0.3081708\right] - 0.0059375 = 0.5276$$

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