

Replicating Mortgage Index (REMIC) Primer

August 24, 2021

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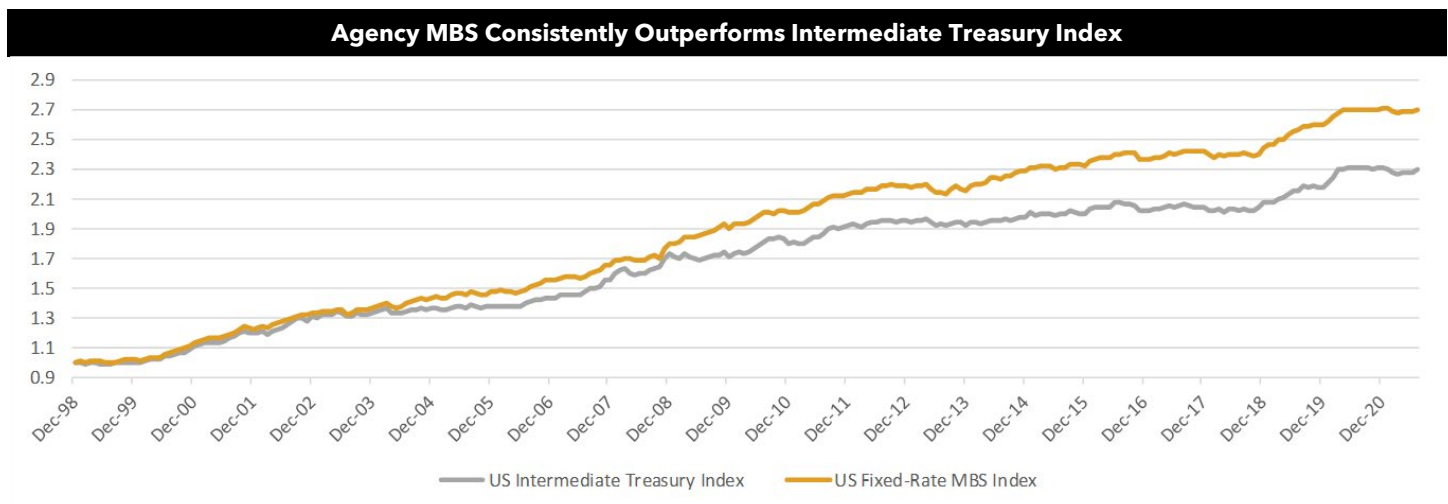
Overview

- REMIX is a portfolio of between 12 to 18 liquid To-Be-Announced (TBA) positions, rebalanced monthly, to track the performance of the US Agency Fixed-Rate MBS Index. REMIX contains TBAs that are "rolled" monthly.
- Clients have used REMIX to track the US MBS Index since September 2001 (239 months). Clients include non-US and US asset managers (Global Aggregate and US Aggregate benchmarks), official institutions, and hedge funds.
- REMIX is a "cashless" replication of MBS exposure that allows clients to deploy cash to strategies with greater alpha potential or to a liquidity reserve while still obtaining the benefits of MBS exposure.
- REMIX offers clients an opportunity to efficiently gain exposure to the MBS sector without the portfolio management and operations overhead of a full-fledged cash-settled MBS portfolio operation.
- Performance has closely tracked the MBS Index: the average monthly tracking error has been -0.1bp/m, with a monthly tracking error volatility of 8.3bp.

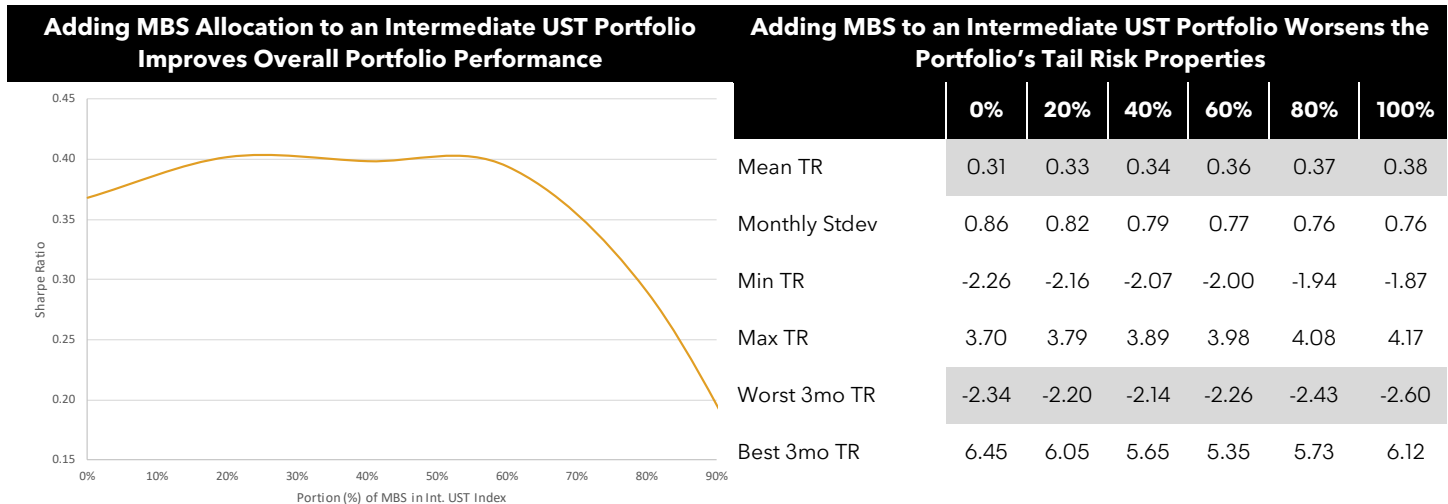
Features

- Customization: The REMIX methodology has also been used to track the US MBS GNMA Index.
- Execution: Clients receive a monthly spreadsheet detailing that month's REMIX portfolio. Clients simply resize the REMIX spreadsheet to their desired market value exposure and execute individual TBA transactions on their own.

Benefits of MBS Exposure: Effect of Adding Agency MBS to a US Treasury Portfolio



Source: Bloomberg



Note: Data from 12/98-7/19. Source: Bloomberg

Note: Data from 12/98-7/19. Source: Bloomberg

Obtaining MBS Exposure with TBA Replication

Replication with TBAs

- Avoids delivery and monthly handling of cash flows. Extremely liquid and deep market with low transaction costs.

Methodology

- We use the Bloomberg risk model to construct the REMIX portfolio to minimize TEV to the index while trying to match sector/ coupon exposure, constraining number of positions, and limiting turnover
- REMIX is rebalanced monthly, typically with positions rolled and occasionally sold and re-established in another TBA
- TBA positions are rolled to next PSA settlement month at month-end
- Cash is invested at 1m daily LIBOR
- Updated REMIX is sent to clients on the first business day of the month. Input field enables clients to specify desired MV exposure to resize individual TBA positions

REMIX Portfolio for Fixed-Rate MBS Index, as of 7/31/2021 (UST 10y @ 1.22%)

07/30/2021

Bloomberg REMIX Portfolio for Fixed-Rate MBS Index

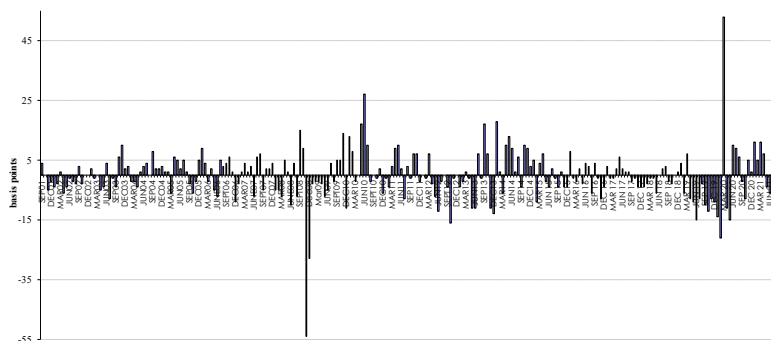
UST 10-yr @ 1.22%

| TBA issue | Notes | FICC - SEP TBAs | PSA Settle Date | par (OF) | OAD | PSA price | MV% | MV | MV | par |
|---|-------|-----------------|-----------------|-------------|------|-----------|--------|-------------|-------------|--------------|
| UMBS30 1.5% | | 01F01269 | 09/14/2021 | 77,974 | 6.99 | 98.807 | 3.26% | \$77,086 | 14,657,605 | \$14,834,537 |
| UMBS30 2% | | 01F02069 | 09/14/2021 | 341,887 | 5.72 | 101.759 | 14.71% | \$348,147 | 66,198,767 | \$65,054,459 |
| UMBS30 2.5% | | 01F02269 | 09/14/2021 | 221,165 | 4.37 | 103.928 | 9.72% | \$230,052 | 43,743,427 | \$42,090,127 |
| UMBS30 3% | | 01F03069 | 09/14/2021 | 339,642 | 2.52 | 104.596 | 15.03% | \$355,620 | 67,619,589 | \$64,648,351 |
| UMBS30 3.5% | | 01F03269 | 09/14/2021 | 201,194 | 2.32 | 105.777 | 9.00% | \$213,071 | 40,514,564 | \$38,301,865 |
| UMBS30 4% | | 01F04069 | 09/14/2021 | 104,799 | 2.15 | 106.911 | 4.74% | \$112,193 | 21,333,028 | \$19,954,006 |
| UMBS30 4.5% | | 01F04269 | 09/14/2021 | 61,544 | 2.55 | 107.904 | 2.81% | \$66,509 | 12,646,381 | \$11,720,029 |
| UMBS15 2% | | 01F02049 | 09/16/2021 | 168,328 | 2.88 | 103.639 | 7.38% | \$174,594 | 33,198,281 | \$32,032,614 |
| UMBS15 2.5% | | 01F02249 | 09/16/2021 | 89,837 | 1.84 | 104.691 | 3.98% | \$94,145 | 17,901,272 | \$17,099,151 |
| UMBS15 3% | | 01F03049 | 09/16/2021 | 63,943 | 1.58 | 105.271 | 2.85% | \$67,394 | 12,814,668 | \$12,173,028 |
| GNB 2% | | 21H02069 | 09/21/2021 | 144,574 | 4.59 | 102.235 | 6.25% | \$147,966 | 28,135,137 | \$27,520,063 |
| GNB 2.5% | | 21H02269 | 09/21/2021 | 128,596 | 3.35 | 103.746 | 5.64% | \$133,592 | 25,401,880 | \$24,484,684 |
| GNB 3% | | 21H03069 | 09/21/2021 | 205,377 | 2.25 | 104.443 | 9.08% | \$214,844 | 40,851,690 | \$39,113,862 |
| GNB 3.5% | | 21H03269 | 09/21/2021 | 29,047 | 2.22 | 105.028 | 1.29% | \$30,564 | 5,811,695 | \$5,533,472 |
| GNB 4% | | 21H04069 | 09/21/2021 | 95,064 | 2.77 | 105.841 | 4.26% | \$100,828 | 19,172,017 | \$18,113,980 |
| | | | | 15 | | | | | | |
| Fixed-Rate MBS AUGUST 21 Statistics Index | | | | \$2,272,971 | 3.41 | | 100.0% | \$2,366,604 | 450,000,000 | |
| | | | | | 3.86 | | | | | |

REMIX Performance

- REMIX has a live client track record since September 2001
- Over the past 239 months, REMIX has experienced a realized monthly TEV of 8.3bp, with a monthly mean excess return over the MBS Index of -0.1bp.
- Tracking error of REMIX is relatively stable over time, irrespective of market environment - except Nov/Dec 2008.

Realized Tracking Error between REMIX and MBS Index



A Note on REMIX Nov/Dec 2008 Performance*

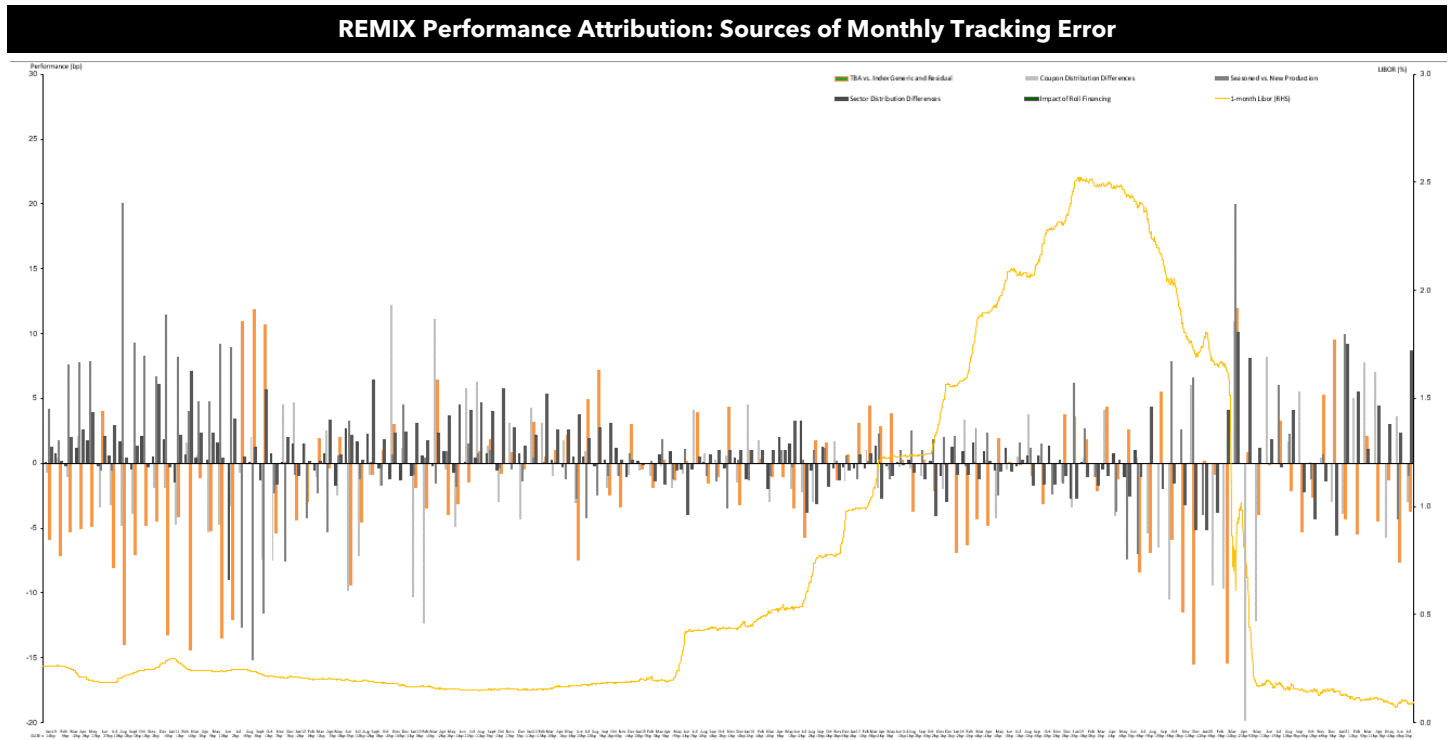
REMIX experienced large negative tracking errors in Nov/Dec 2008 owing to three factors:

- **Exogenous Events/ Government Intervention:** Government programs to buy mortgages outright caused large relative performance differences across coupons. As a precaution, we now more closely match program/ coupon distributions.
- **TBA Roll Cost of Financing:** TBA positions became very expensive to roll when funding became scarce.
- **Differences in TBA/ Index Pricing Conventions:** REMIX vs. MBS Index performance is exposed to large changes in 1m Libor.

Source: Bloomberg

Performance Attribution: REMIX's Tracking Error Performance

Each month, we provide detailed analysis of REMIX's monthly tracking error performance:



Source: Bloomberg

Typical Reasons for Monthly Tracking Errors

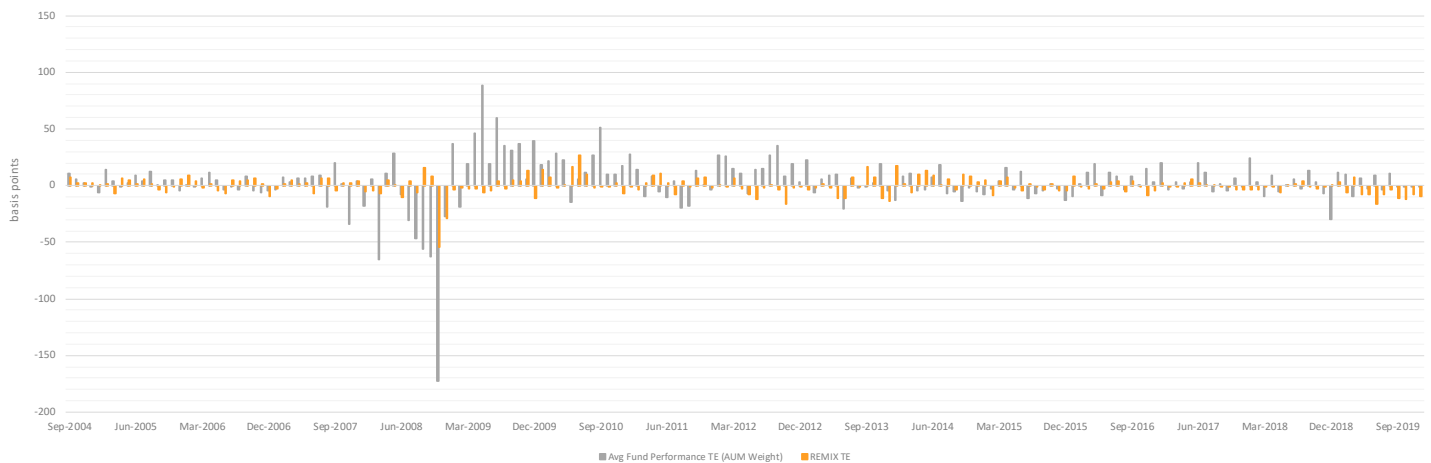
- New production (i.e., TBA) under/ outperforms seasoned mortgages which have a large weight in the MBS Index
- Differences in coupon/ program market value distribution - REMIX holds many fewer positions than the index
- REMIX generally more negatively convex than index - exposed to realized volatility during the month
- Occasional roll advantage (positive TE) or disadvantage (negative TE)
- Pricing convention differences between REMIX (PSA Settle) and MBS Index (same-day settle)
- Exogenous events affecting MBS market (e.g., government programs and agency buyout programs)

REMIX versus the Average Fund Manager Performance

| REMIX vs. Average MBS Fund Manager Performance (42 Funds, \$330bn AUM) | | |
|--|----------------------|---|
| Period | Realized Monthly TEV | Monthly Mean Excess Return over MBS Index |
| Sep01 - Jul19 | | |
| REMIX Portfolio | 7.3bp | -0.1bp |
| Average Fund Manager | 22.6bp | 3.3bp |

REMIX offers an efficient way to obtain exposure to the mortgage market with excellent liquidity

Realized MBS Index Tracking Errors for REMIX and the Average MBS Fund Manager



*AUM data as of June 2019. Source: Bloomberg and eVestment

Other Replication Strategies to Obtain MBS Index Beta

Large-Pool Replication (for investors who cannot hold TBAs)

- Holding large pools minimizes idiosyncratic pool risk and permits portfolio to have exposure to seasoned MBS.
- Number of pools can be limited with good monthly tracking error (~22bps).
- Using pools removes counterparty, liquidity (i.e., roll), and pricing convention risks
- Tracking error performance of Large-Pool replication improves over time as portfolio composition closely mimics index

TBA-5 Proxy

- From time to time, clients express interest in a TBA Proxy Portfolio with even fewer TBA positions than the REMIX. With an inception date of December 2007, this portfolio contains only five TBAs with a monthly TEV = 14.5bp and a mean excess return over the US MBS Index = +0.01bp/m. Used for aggressive basis trading.

GNMA TBA Proxy

- With an inception date of January 2011, this portfolio tracks the performance of the US MBS GNMA Index using eight GNMA TBAs. Monthly TEV is 8.0bp, and mean excess return over US MBS GNMA Index is 0.2bp/m.

REMIX Daily Performance Transparency¹

- REMIX can be accessed on the Bloomberg Terminal® via ticker I21254US (and GNMA TBA Proxy via ticker I26794US)
- Monthly and daily return data is available

¹ Please see the Bloomberg Fixed Income Index Methodology (available on the [Bloomberg Terminal](#) or on <https://www.bloomberg.com/professional/product/indices/bloomberg-fixed-income-indices/#/>) for additional information on index determination and governance and oversight arrangements.

| I21254US 182.4134 +.1530 Ret MTD -.07 Ret 3M +.53 | | | | | | | | | |
|---|------------|--------------|-------------|--------------------------|--------------|---------------------------------|------------|---------------------|------|
| As of 08/24/21 YTW N.A. OAS N.A. | | | | | | | | | |
| I21254US Index | | Export | | Settings | | Page 1/6 Historical Price Table | | | |
| Bloomberg REMIX Portfolio TBA Proxy Total Return Index Unhedged USD High 182.8698 on 02/09/21 | | | | | | | | | |
| Range 08/24/2020 - 08/23/2021 | | Period Daily | | Low 180.5990 on 03/19/21 | | | | | |
| Market Last Price | | Indx OAD to | | Currency USD | | Average 181.8515 | | Net Chg .4192 0.23% | |
| View Price Table | | | | | | | | | |
| Date | Last Price | Indx OAD ... | Date | Last Price | Indx OAD ... | Date | Last Price | Indx OAD ... | Date |
| Fr 08/27/21 | | | Fr 08/06/21 | 182.0877 | | Fr 07/16/21 | 181.8507 | | |
| Th 08/26/21 | | | Th 08/05/21 | 182.3976 | | Th 07/15/21 | 181.9805 | | |
| We 08/25/21 | | | We 08/04/21 | 182.6248 | | We 07/14/21 | 181.8068 | | |
| Tu 08/24/21 | | | Tu 08/03/21 | 182.6508 | | Tu 07/13/21 | 181.5012 | | |
| Mo 08/23/21 | 182.4134 | | Mo 08/02/21 | 182.7036 | | Mo 07/12/21 | 181.6720 | | |
| Fr 08/20/21 | 182.2604 | | Fr 07/30/21 | 182.5342 | | Fr 07/09/21 | 181.6362 | | |
| Th 08/19/21 | 182.3547 | | Th 07/29/21 | 182.4205 | | Th 07/08/21 | 181.8999 | | |
| We 08/18/21 | 182.2672 | | We 07/28/21 | 182.4849 | | We 07/07/21 | 181.7608 | | |
| Tu 08/17/21 | 182.2413 | | Tu 07/27/21 | 182.3453 | | Tu 07/06/21 | 181.6838 | | |
| Mo 08/16/21 | 182.4117 | | Mo 07/26/21 | 182.1713 | | Mo 07/05/21 | 181.4468 | | |
| Fr 08/13/21 | 182.3499 | | Fr 07/23/21 | 182.2353 | | Fr 07/02/21 | 181.4453 | | |
| Th 08/12/21 | 182.1891 | | Th 07/22/21 | 182.2018 | | Th 07/01/21 | 181.3054 | | |
| We 08/11/21 | 182.2125 | | We 07/21/21 | 181.9202 | | We 06/30/21 | 181.3763 | | |
| Tu 08/10/21 | 181.9275 | | Tu 07/20/21 | 182.2518 | | Tu 06/29/21 | 181.3819 | | |
| Mo 08/09/21 | 182.0113 | | Mo 07/19/21 | 182.1660 | | Mo 06/28/21 | 181.3628 | | |

| I26794US 132.4271 +.0995 Ret MTD -.05 Ret 3M +.21 | | | | | | | | | |
|--|------------|--------------|-------------|--------------------------|--------------|---------------------------------|------------|---------------------|------|
| As of 08/24/21 YTW N.A. OAS N.A. | | | | | | | | | |
| I26794US Index | | Export | | Settings | | Page 1/6 Historical Price Table | | | |
| Bloomberg REMIX GNMA Portfolio TBA Proxy TR Index Unhedged USD High 132.9384 on 02/09/21 | | | | | | | | | |
| Range 08/24/2020 - 08/23/2021 | | Period Daily | | Low 131.7015 on 03/19/21 | | | | | |
| Market Last Price | | Indx OAD to | | Currency USD | | Average 132.3451 | | Net Chg .0802 0.06% | |
| View Price Table | | | | | | | | | |
| Date | Last Price | Indx OAD ... | Date | Last Price | Indx OAD ... | Date | Last Price | Indx OAD ... | Date |
| Fr 08/27/21 | | | Fr 08/06/21 | 132.1542 | | Fr 07/16/21 | 132.2195 | | |
| Th 08/26/21 | | | Th 08/05/21 | 132.3615 | | Th 07/15/21 | 132.2876 | | |
| We 08/25/21 | | | We 08/04/21 | 132.5450 | | We 07/14/21 | 132.2107 | | |
| Tu 08/24/21 | | | Tu 08/03/21 | 132.5610 | | Tu 07/13/21 | 131.9918 | | |
| Mo 08/23/21 | 132.4271 | | Mo 08/02/21 | 132.5929 | | Mo 07/12/21 | 132.0720 | | |
| Fr 08/20/21 | 132.3276 | | Fr 07/30/21 | 132.4963 | | Fr 07/09/21 | 132.0449 | | |
| Th 08/19/21 | 132.3481 | | Th 07/29/21 | 132.3763 | | Th 07/08/21 | 132.2294 | | |
| We 08/18/21 | 132.2869 | | We 07/28/21 | 132.3897 | | We 07/07/21 | 132.1365 | | |
| Tu 08/17/21 | 132.2806 | | Tu 07/27/21 | 132.3159 | | Tu 07/06/21 | 132.1505 | | |
| Mo 08/16/21 | 132.3973 | | Mo 07/26/21 | 132.2346 | | Mo 07/05/21 | 132.0137 | | |
| Fr 08/13/21 | 132.3401 | | Fr 07/23/21 | 132.2773 | | Fr 07/02/21 | 132.0126 | | |
| Th 08/12/21 | 132.2888 | | Th 07/22/21 | 132.2607 | | Th 07/01/21 | 131.9253 | | |
| We 08/11/21 | 132.3198 | | We 07/21/21 | 132.1027 | | We 06/30/21 | 132.0266 | | |
| Tu 08/10/21 | 132.0980 | | Tu 07/20/21 | 132.3872 | | Tu 06/29/21 | 132.0563 | | |
| Mo 08/09/21 | 132.1373 | | Mo 07/19/21 | 132.3947 | | Mo 06/28/21 | 132.0695 | | |

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