US Aggregate Negative 5 Duration Index

The Bloomberg Barclays US Aggregate Negative 5 Duration Index measures the return of the US Aggregate Index with its interest rate (duration) exposure hedged to negative 5 years using a short position in four on-the-run (OTR) US Treasury bellwether securities. The interest rate hedge is rebalanced on a monthly basis to achieve the target duration exposure. The US Aggregate is a Bloomberg Barclays flagship US fixed income index and is designed to measure the broad, investment grade taxable US dollar-denominated bond market. Full details of the methodology and rules of the US Aggregate Index can be found in a separate index factsheet.

US Aggregate Zero Duration: Index Calculation Methodology

The return of the US Aggregate Negative 5 Duration Index can be represented as the following:

$$US\ Aggregate\ Negative\ 5\ Duration_{Total\ Return} = US\ Aggregate_{Total\ Return} - US\ Aggregate_{Negative\ 5\ Duration\ Hedge} + Funding_{1-mo\ T-Bills}$$

Where:

$US\ Aggregate_{Total\ Return} = published\ return\ of\ the\ benchmark\ bond\ index, including\ a\ price, coupon\ and\ paydown\ return\ component$

$US\ Aggregate_{Negative\ 5\ Duration\ Hedge}$
$= the\ return\ of\ a\ portfolio\ of\ 2y, 5y, 10y\ and\ 30y\ OTR\ securities\ weighted\ to\ bring\ the\ duration\ of\ the\ US\ Aggregate\ Index\ to\ negative\ 5$
$years$

$Funding_{1-mo\ T-Bills} = the\ return\ of\ a\ basket\ of\ 1\ month\ T-Bills\ to\ make\ the\ total\ return\ a\ funded\ return$

Construction of Short Duration Hedged Position

Calculating the US Aggregate Negative 5 Duration Index returns requires the creation of a monthly rebalanced hedge portfolio of US Treasury cash bonds weighted to bring the interest rate duration of the flagship US Aggregate Index to negative 5 years. The hedge portfolio is constructed in four steps:

1. Bucketing of the Option Adjusted Duration (OAD) of the US Aggregate Index
2. Selection of on–the–run Treasury bellwethers for the hedge portfolio
3. Calculation of hedge portfolio weights
4. Calculation of hedge portfolio and funding returns

Step 1: OAD Bucketing of the US Aggregate Index

- The Negative 5 Duration hedge portfolio consists of OTR US Treasury securities in four different tenors: 2y, 5y, 10y, and 30y.
- The first step to constructing the hedge portfolio is to sort the underlying US Aggregate Index (Statistics Universe) into four non–overlapping duration buckets, and to identify the duration contribution to be hedged by each of these instruments in the hedge portfolio.
- The duration measure used is OAD, as computed and reported within the Bloomberg Barclays Indices.
- Contribution to OAD is calculated by multiplying the market value percent of each duration bucket as of the month–end index rebalancing date by the OAD of each bucket.

Step 2: Selecting OTR Instruments for Hedge Portfolio

- The selected securities for each monthly rebalance match the instruments that are used for Bloomberg Barclays US Treasury Bellwether Indices.
- OTR instruments for the portfolio are selected once a month on the last business day to include the most recently issued instrument for each tenor used in the hedge.

Example: US Aggregate Duration Weight by OAD Bucket for May 2017

OTR Bellwether	OAD Bucket	% of US Agg	Duration of Bucket	Contribution to OAD
2y	<3	22.19%	2.00	0.44
5y	3–7.5	58.13%	4.88	2.84
10y	7.5–15	10.90%	10.40	1.13
30y	15+	8.79%	17.61	1.55
Totals			5.96	5.96

Construction of Short Duration Hedged Position

Step 3: Calculating Negative 5 Duration Hedge portfolio weights

- To replicate the duration exposure from Step 1 with the four on–the–run US Treasuries selected in Step 2, an optimization technique is employed that minimizes the sum of squared differences of the contribution to duration of the index in each bucket vs. the contribution to duration of the OTR US Treasuries. Additionally, there is a 20% cap applied to the 30y US Treasury security.
- For example, the table shows that the optimization resulted in a weighted combination of securities that provided an overall duration of 10.96 years. When subtracted from the duration of the US Aggregate of 5.96 years, the final result is –5.00 year duration.

Example: Security Weights of Hedge Portfolio for May 2017

	Index Duration			Security Weight			
OAD Bucket	MV% of US Agg	OAD	OAD Contr	UST Hedge	OAD	Hedge Wght	Cont to OAD (UST)
<3	22.19%	2.00	0.44	2y	1.89	0.00%	0.00
3–7.5	58.13%	4.88	2.84	5y	4.79	3.46%	0.17
7.5–15	10.90%	10.40	1.13	10y	8.82	76.54%	6.75
15+	8.79%	17.61	1.55	30y	20.23	20.00%	4.05
Totals		5.96	5.96				10.96

Step 4: Calculating Total Return of the Negative 5 Duration Hedge portfolio

- To calculate the return of the negative 5 duration hedged position for May 2017, the weights assigned for each US Treasury security are multiplied by the total return of that security for the month.
- Continuing to work through the example for May 2017, the total return for the duration hedged position is as follows:

Example: Hedge Portfolio Returns for May 2017

Tsy Bellwether	Hedge Weight	MTD Total Return	Contribution to Return
US Treasury 2y	0.00%	0.09	0.00
US Treasury 5y	3.46%	0.43	0.01
US Treasury 10y	76.54%	0.87	0.67
US Treasury 30y	20.00%	2.05	0.41
		Total	1.09

Calculating US Aggregate Negative 5 Duration Index Returns

- Continuing with the example above, the return of the US Aggregate Negative 5 Duration Index for May 2017 is as follows:

$$US\ Aggregate\ Negative\ 5\ Duration_{Total\ Return} = US\ Aggregate_{Total\ Return} - Duration\ Hedge\ Portfolio_{Total\ Return} + Funding_{1-mo\ T-Bills}$$
$$= 0.77\% - 1.09\% + 0.06\% = -0.26\%$$

- The US Aggregate Index return and the duration hedged position return are both funded returns. Therefore, subtracting one from the other would result in an unfunded return. This is why a funding component is added back so that the final return reported for the US Aggregate Negative 5 Duration Index is a funded return.

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