
Morningstar Target Volatility Methodology Paper

Morningstar Indexes

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Overview

The objective of the Morningstar Target Volatility methodology is to provide variable exposure to a given Base Index so as to maintain a certain volatility target. The balance of exposure to the Base Index compared to a cash investment is adjusted as the volatility of the Base Index changes according to the rules outlined in the rest of the document. The methodology may be applied to any Base Index, and the various parameters such as the volatility target, maximum exposure and volatility tolerance can all be customized.

Two scenarios may occur in attempting to maintain the given volatility target. An unleveraged position arises when the measured volatility of the Base Index is higher than the volatility target. In this case, the volatility control mechanism reduces the percentage of the Base Index held in the Target Volatility Index and increases the percentage of cash. Conversely, a leveraged position arises when the measured volatility of the Base Index is lower than the volatility target. When this occurs, the volatility control mechanism decreases or removes altogether the amount of cash held in the Target Volatility Index. At the same time, the Target Volatility Index will increase its exposure to the Base Index up to the maximum exposure limit, usually 150%. All constituents are levered proportionally in the Base Index.

Inception Date

The inception date of the Target Volatility Index is 60 business days after the inception date of the Base Index. Daily index levels are available from this date forward. The index level at inception is 1,000.

Calculation and Dissemination of Index Values

Index values for the Target Volatility Index are currently calculated and disseminated daily at close of trade.

Index Calculation

Overview

The Target Volatility Index holds variable exposure to the Base Index. When the exposure is less than 100% of the Target Volatility Index, the remaining percentage up to 100% is comprised of a cash investment. When the exposure is greater than 100%, the Target Volatility Index is in a leveraged position in regards to the Base Index. In this situation, there is no cash investment.

Total Return Calculation

The total return of the Target Volatility Index is comprised of two sources of return – the return on the Base Index, and the return on the cash investment. To calculate the return on the Base Index, we compare today's closing value to the previous day's close. To calculate the return on the cash investment, Morningstar uses the daily Fed Funds effective rate as an approximation of the interest gain on the cash investment.

When the Target Volatility Index is in a leveraged position, there will be no cash investment. However, because the exposure to the Base Index is over 100%, it is essentially borrowing money to invest in the Base Index. Morningstar uses the 3-month LIBOR in USD to calculate the borrowing cost associated with the leveraged position.

The total return index calculation equation is shown below.

If $W_{t-1} \leq 100\%$ then

$$TR_t = TR_{t-1} \times \left[w_{t-1} \cdot \left(\frac{B_t}{B_{t-1}} \right) + (1 - w_{t-1}) \cdot \left(\frac{FFE_t}{FFE_{t-1}} \right) \right]$$

Else

$$TR_t = TR_{t-1} \times \left[w_{t-1} \cdot \left(\frac{B_t}{B_{t-1}} \right) + (1 - w_{t-1}) \cdot \left(\frac{L3M_t}{L3M_{t-1}} \right) \right]$$

Where:

- TR_t = Total Return Index Level on date t, rounded to two decimal places
- w_{t-1} = Realized exposure of the Index on date t-1
- B_t = Base Index Level on date t
- FFE_t = Index capitalizing at the Fed Funds effective rate on date t with an initial value of 1, calculated daily using value from date t-1, on an (actual/360) day count basis
- $L3M_t$ = Index capitalizing at the 3-month LIBOR rate in USD on date t with an initial value of 1, calculated daily using value from date t-3, on an (actual/360) day count basis

Excess Return Calculation

The excess return of the Target Volatility Index is equal to the total return minus the cash borrowing cost associated with holding the Base Index. The simplest way to explain this is to view it as an opportunity cost of investing in the Base Index instead of a cash investment. Thus, the total return of the Target Volatility Index is “dragged” by the cash borrowing rate to arrive at the return in excess of the expected return of a pure cash investment. Morningstar uses the 3-month LIBOR in USD as the cash borrowing rate.

The excess return index calculation equation is shown below.

If $W_{t-1} \leq 100\%$ then

$$ER_t = ER_{t-1} \times \left[2 - \left(\frac{L3M_t}{L3M_{t-1}} \right) \right] \times \left[w_{t-1} \cdot \left(\frac{B_t}{B_{t-1}} \right) + (1 - w_{t-1}) \cdot \left(\frac{FFE_t}{FFE_{t-1}} \right) \right]$$

Else

$$ER_t = ER_{t-1} \times \left[2 - \left(\frac{L3M_t}{L3M_{t-1}} \right) \right] \times \left[w_{t-1} \cdot \left(\frac{B_t}{B_{t-1}} \right) + (1 - w_{t-1}) \cdot \left(\frac{L3M_t}{L3M_{t-1}} \right) \right]$$

Where:

ER_t = Excess Return Index Level on date t, rounded to two decimal places

w_{t-1} = Realized exposure of the Index on date t-1

B_t = Base Index Level on date t

FFE_t = Index capitalizing at the Fed Funds effective rate on date t with a base value of 1 on the inception date of the Base Index, calculated daily using value from date t-1, on an (actual/360) day count basis

$L3M_t$ = Index capitalizing at the 3-month LIBOR rate on date t with a base value of 1 on the inception date of the Base Index, calculated daily using value from date t-3, on an (actual/360) day count basis

Measuring Volatility

The measured volatility of the Base Index is taken as either the trailing 20 business day historic volatility or the trailing 60 business day historic volatility, whichever is greater.

Measured volatility = $\text{Max}(\text{Vol}20_t, \text{Vol}60_t)$

Where:

$$\text{Vol } 20_t = \sqrt{252 \times \frac{20}{19} \times \left[\frac{1}{20} \sum_{k=1}^{20} \text{Ln}^2 \left(\frac{B_{t-k}}{B_{t-k-1}} \right) - \left(\left(\frac{1}{20} \sum_{k=1}^{20} \text{Ln} \left(\frac{B_{t-k}}{B_{t-k-1}} \right) \right)^2 \right) \right]}$$

And

$$\text{Vol } 60_t = \sqrt{252 \times \frac{60}{59} \times \left[\frac{1}{60} \sum_{k=1}^{60} \text{Ln}^2 \left(\frac{B_{t-k}}{B_{t-k-1}} \right) - \left(\left(\frac{1}{60} \sum_{k=1}^{60} \text{Ln} \left(\frac{B_{t-k}}{B_{t-k-1}} \right) \right)^2 \right) \right]}$$

Determining the Target Exposure

The target exposure of the Target Volatility Index to the Base Index is determined in accordance with the formula below, with the aim of maintaining the target volatility. It is based on the ratio between the target volatility and the measured historic volatility of the Base Index, and will vary between zero and the maximum allowable exposure.

$$W_{Target(t)} = \min \left(\text{max exposure}, \frac{\text{target volatility}}{\text{measured volatility}} \right)$$

Rebalancing and Volatility Tolerance

The historical volatility and the target volatility are calculated daily at end-of-day. If the historical volatility is higher than the target volatility, then the exposure to the Base Index will be reduced and the cash investment will be increased in order to lower the volatility. If instead the historical volatility is lower than the target volatility, then the exposure to the Base Index will be increased and the cash investment will be reduced in order to increase the volatility of the Target Volatility Index.

To discourage daily rebalancing of the Target Volatility Index, the target exposure is updated only when there is a change that greater than the exposure tolerance percentage. The current exposure of the Index on the inception date shall be equal to the target exposure on the inception date.

$$w_0 = w_{Target(0)}$$

On any subsequent date t, the current exposure shall be determined as follows

$$w_t = \begin{cases} w_{Target(t)} & \text{if } w_{t-1} > (1 + \text{tolerance}) \cdot w_{Target(t)} \\ w_{Target(t)} & \text{if } w_{t-1} < (1 - \text{tolerance}) \cdot w_{Target(t)} \\ w_{t-1} & \text{otherwise} \end{cases}$$

Where:

tolerance = 10%

w_t = Realized exposure of the index on date t

$w_{Target(t)}$ = Target exposure of the index on date t

Trading Cost Adjustment Factor (TCAF)

To account for higher transaction and portfolio management costs associated with the target volatility strategy, an adjustment factor may be applied to the calculated index level to arrive at the final, published index level.

On any index business day, the final adjusted Index level I_t , shall be calculated as follows

$$I_t = I_{t-1} \times \left(\frac{ER_t}{ER_{t-1}} \right) \times \left[1 - TCAF \times \left(\frac{n}{360} \right) \right]$$

Where:

ER_t = Unadjusted Index level on day t

n = No. of days between t and (t-1)

Index Maintenance

The Target Volatility Index contains variable exposure to the Base Index. This exposure is assessed daily, and therefore theoretically, the Index may be rebalanced daily as well.

However, daily rebalancing is rare, and will only occur during the most turbulent markets. On average, we expect the Index to be rebalanced every one to two weeks.

Data Correction and Precision

Intraday Index Data Corrections

Commercially reasonable efforts are made to ensure the accuracy of data used in real-time index calculations. If incorrect price or corporate action data affects index daily highs or lows, it is corrected retroactively as soon as is feasible.

Index-Related Data and Divisor Corrections

Incorrect pricing and corporate action data for individual issues in the database will be corrected upon detection. In addition, an incorrect divisor of an index, if discovered within five days of its occurrence, will always be fixed retroactively on the day it is discovered to prevent an error from being carried forward. Commercially reasonable efforts are made to correct an older error subject to its significance and feasibility.

Computational and Reporting Precision

All calculated and adjusted data are stored in real numbers. For reporting purposes, index values are rounded to two decimal places and divisors are rounded to appropriate decimal places. The actual number of shares is used to determine the number of shares outstanding for the free float weighting.

About Morningstar® Inc.

Morningstar, Inc. is a leading provider of independent investment research in North America, Europe, Australia, and Asia. Morningstar offers an extensive line of products and services for individual investors, financial advisors, asset managers, and retirement plan providers and sponsors. Morningstar provides data on approximately 500,000 investment offerings, including stocks, mutual funds, and similar vehicles, along with real-time global market data on more than 15 million equities, indexes, futures, options, commodities, and precious metals, in addition to foreign exchange and Treasury markets. Morningstar also offers investment management services through its investment advisory subsidiaries.

About Morningstar Indexes

Morningstar® Indexes combine the science and art of indexing to give investors a clearer view into the world's financial markets. Our indexes are based on transparent, rules-based methodologies that are thoroughly back-tested and supported by original research. Covering all major asset classes, our indexes originate from the Morningstar Investment Research Ecosystem—our network of accomplished analysts and researchers working to interpret and improve the investment landscape. Clients such as exchange-traded fund providers and other asset management firms work with our team of experts to create distinct, investor-focused products based on our indexes. Morningstar Indexes also serve as a precise benchmarking resource.

Morningstar Index Committee

The Morningstar Index Committee consists of the following index group leaders: the head of the indexes business unit, the research director, and the head of product development. The committee seeks to create indexes of the highest quality that meet the recognized qualities of a good benchmark.

For More Information

For any queries reach out to us via our [communication page](#).



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