S&P Dow Jones Indices

A Division of S&P Global

S&P 500 VIX Futures Long/Short Strategy Index Series

Methodology

May 2017

Table of Contents

Introduction

The S&P 500® VIX® Futures Long/Short Strategy Index Series has six indices:

- The S&P 500 VIX Futures Tail Risk Index – Short Term
- The S&P 500 VIX Futures Tail Risk Index – Mid Term
- The S&P 500 VIX Futures Variable Long/Short Index –Short Term
- The S&P 500 VIX Futures Variable Long/Short Index –Mid Term
- The S&P 500 VIX Futures Short Volatility Hedged Index – Short Term
- The S&P 500 VIX Futures Short Volatility Hedged Index – Mid Term

Each index seeks to gain exposure to a specific volatility strategy by taking advantage of the convex return profile of a series which is rebalanced daily. This convex profile, combined with the negative mean and positive skew of VIX Futures returns, enables a payoff profile with risk return characteristics that can be tailored to specific investor needs. This is accomplished by pairing both long and short positions (each rebalanced daily) in VIX Futures. The target ratio of long and short exposure is different for each index and is rebalanced to target weights on a quarterly basis. In order to reduce the path-dependent nature of such an exposure, the index tracks 13 sub-portfolios, each of which allocates between a leveraged and inverse exposure to VIX futures indices. Each sub-portfolio is rebalanced back to its target weight independently and quarterly, with rebalancing dates spread evenly in a quarter on a weekly basis. Each strategy then simulates the return of owning the 13 sub-portfolios on an equally weighted basis, with a quarterly rebalancing back to equal weight.

S&P Dow Jones Indices thanks VelocityShares for its significant contribution to the development of the S&P 500 VIX Futures Long/Short Strategy Index family.

Highlights

Historically, VIX[1] has a negative correlation to the S&P 500 and is considered a useful tool to hedge against the potential downside of the broad equity market. The S&P 500 VIX Short-Term and S&P 500 VIX Mid-Term Futures Indices model the outcome of holding a long position in multiple VIX futures contracts and give investors access to directional exposure to the S&P 500's implied volatility. The cost of holding VIX futures contracts comes from the continuous daily roll from shorter term VIX futures to longer term VIX futures when the VIX futures curve is in contango.

All of the Indices are constructed so that each sub-portfolio has a 2x leveraged position, rebalanced daily, in the S&P 500 VIX Short-Term or S&P 500 VIX Mid-Term Futures Index, and a daily rebalanced inverse position in the S&P 500 VIX Short-Term Futures Index. Due to the nature of the daily rebalancing, if the underlying VIX futures trend up, the exposure in the leveraged position increases more than linearly and the exposure in the inverse position decreases more than linearly, resulting in a net increase in long exposure. If the underlying futures trend down, the opposite is true and the result is a net increase in short exposure. This dynamic leads the net exposure to be increasing when the VIX futures are moving up and decreasing when the underlying futures are moving down. Ignoring any intentional directional weighting, the expected payoff of this profile is similar to a long gamma position; however it derives solely from the convexity of products which are rebalanced daily. Again, ignoring any intentional directional tilt, the expected cost of such a position is the decay of leveraged products.

[1] The VIX® methodology is the property of the Chicago Board Options Exchange ("CBOE"). CBOE has granted Standard & Poor's Financial Services LLC ("S&P"), a license to use the VIX methodology to create the S&P VIX Futures Strategy Indices.

The S&P 500 VIX Futures Variable Long/Short Index – Short Term and the S&P 500 VIX Futures Variable Long/Short Index – Mid Term are constructed so that each sub-portfolio has a variable volatility profile on the quarterly rebalancing day. The goal of each index is to provide an opportunity to achieve a positive expected return from either the negative carry in VIX futures or a large spike in VIX futures.

The S&P 500 VIX Futures Tail Risk Index – Short Term and the S&P 500 VIX Futures Tail Risk Index – Mid Term are constructed so that each sub-portfolio has a long volatility profile on the quarterly rebalancing day. The goal of each index is to provide a long volatility exposure whose cost is partially or completely mitigated (due to negative roll yield) via a rebalanced short exposure.

The S&P 500 VIX Futures Short Volatility Hedged Index – Short Term and the S&P 500 VIX Futures Short Volatility Hedged Index – Mid Term are constructed so that each sub-portfolio has a short volatility profile on the quarterly rebalancing day. The goal of each index is to provide an opportunity to achieve a positive expected return from the negative carry in VIX futures, while providing a hedge against a large spike in VIX futures.

To further reduce the path dependency associated with the choice of rebalancing days, at the last business day of every quarter each index is equally invested in 13 sub-portfolios, P_1, P_2,…, P_{13}, with the rebalancing days of P_{i+1} being one week later than that of P_i . Each individual portfolio has a leveraged leg and an inverse leg, rebalanced every 13 weeks to its target weights as listed below.

Underlying Index and Weights

Index Name	Leveraged Leg		Inverse Leg	
	Underlying Index	Weight (W_L)	Underlying Index	Weight (W_I)
S&P 500 VIX Futures Tail Risk Index – Short Term	2x S&P 500 VIX Short-Term Futures Index	45%	Inverse S&P 500 VIX Short-Term Futures Index	55%
S&P 500 VIX Futures Tail Risk Index – Mid Term	2x S&P 500 VIX Mid-Term Futures Index	60%	Inverse S&P 500 VIX Short-Term Futures Index	40%
S&P 500 VIX Futures Variable Long/Short Index – Short Term	2x S&P 500 VIX Short-Term Futures Index	33.33%	Inverse S&P 500 VIX Short-Term Futures Index	66.67%
S&P 500 VIX Futures Variable Long/Short Index – Mid Term	2x S&P 500 VIX Mid-Term Futures Index	45%	Inverse S&P 500 VIX Short-Term Futures Index	55%
S&P 500 VIX Futures Short Volatility Hedged Index – Short Term	2x S&P 500 VIX Short-Term Futures Index	10%	Inverse S&P 500 VIX Short-Term Futures Index	90%
S&P 500 VIX Futures Short Volatility Hedged Index – Mid Term	2x S&P 500 VIX Mid-Term Futures Index	30%	Inverse S&P 500 VIX Short-Term Futures Index	70%

Family

The indices belong to the S&P 500 VIX Futures Long/Short Strategy Index family.

This methodology was created by S&P Dow Jones Indices to achieve the aforementioned objective of measuring the underlying interest of each index governed by this methodology document. Any changes to or deviations from this methodology are made in the sole judgment and discretion of S&P Dow Jones Indices so that the index continues to achieve its objective.

Index Construction

Approaches

The S&P 500 VIX Futures Long/Short Strategy Index family has six indices:

- The S&P 500 VIX Futures Tail Risk Index – Short Term
- The S&P 500 VIX Futures Tail Risk Index – Mid Term
- The S&P 500 VIX Futures Variable Long/Short Index – Short Term
- The S&P 500 VIX Futures Variable Long/Short Index – Mid Term
- The S&P 500 VIX Futures Short Volatility Hedged Index – Short Term
- The S&P 500 VIX Futures Short Volatility Hedged Index – Mid Term

Each index is equally invested in 13 sub-portfolios, P_1, P_2,…, P_{13}. The indices are rebalanced quarterly.

Each sub-portfolio has a leveraged leg and an inverse leg, both rebalanced daily. They are also rebalanced every 13 weeks to their target weights.

Index Calculations

Step 1: Calculating the Leveraged and Inverse Underlying Indices

The underlying indices of the leveraged and inverse legs are calculated based on the excess return of the S&P 500 VIX Short-Term Futures and Mid-Term Futures indices. The return and the index value are calculated as follows:

$$LER_t = 2*\left(\frac{LVF_t}{LVF_{t-1}}-1\right) \qquad (1)$$

$$IER_t = -1*\left(\frac{IVF_t}{IVF_{t-1}}-1\right)$$

$$L_t = (1+LER_t)*L_{t-1}$$

$$I_t = (1+IER_t)*I_{t-1}$$

where:

LER_t = Daily excess return of the leveraged leg on business day *t*.

IER_t = Daily excess return of the inverse leg on business day *t*.

LVF_t = Excess return of the base index in the leveraged leg on business day *t*. The underlying index is specified in Table 1.

IVF_t = Excess return of the base index in the inverse leg on business day *t*. The underlying index is specified in Table 1.

L_t = Daily leveraged excess return index value on business day *t*.

I_t = Daily inverse excess return index value on business day *t*.

Step 2: Calculating the Sub Portfolio Values

Each sub-portfolio is rebalanced every 13 weeks to its target weight. The portfolio value is calculated based on the return of the two legs since the last rebalancing day as follows:

$$PER_{i,t} = w_L * \left(\frac{L_t}{L_{i,lr}} - 1 \right) + w_I * \left(\frac{I_t}{I_{i,lr}} - 1 \right) \tag{2}$$

$$P_{i,t} = (1 + PER_{i,t}) * P_{i,lr}$$

where:

PER*$_{i,t}$* = Excess return of portfolio *i* since the last rebalancing day on business day *t*.
w*$_L$* = Target weight of the leveraged leg.
L*$_t$* = Leveraged excess return index value on business day *t*.
L*$_{i,lr}$* = Leveraged excess return index value on the last rebalancing day of portfolio *i*.
w*$_I$* = 1- ***w****$_L$* = Target weight of the inverse leg.
I*$_t$* = Inverse excess return index value on business day *t*.
I*$_{i,lr}$* = Inverse excess return index value on the last rebalancing day of portfolio *i*.
P*$_{i,t}$* = Value of portfolio *i* on business day *t*.
P*$_{i,lr}$* = Value of portfolio *i* on its last rebalancing day.

Step 3: Calculating the Excess Return Indices

Each index holds 13 portfolios, P_1, P_2,…, P_{13}. It is rebalanced quarterly to equal weight. The excess return index value is calculated based on the return of the portfolios since the last rebalancing day as follows:

$$ER_t = \frac{1}{13} * \sum_{i=1}^{13} \left(\frac{P_{i,t}}{P_{i,lR}} - 1 \right)$$

$$IndexER_t = (1 + ER_t) * IndexER_{lR} \tag{3}$$

where:

ER*$_t$* = Index excess return since last rebalancing day on business day, *t*.
P*$_{i,t}$* = Value of portfolio *i* on business day *t*.
P*$_{i,lR}$* = Value of portfolio *i* on the last rebalancing day of The Excess Return Index.
IndexER*$_t$* = The Excess Return Index value on business day *t*.
IndexER*$_{lR}$* = The Excess Return Index value on its last rebalancing day.

Step 4: Calculating the Total Return Indices

The total return index value includes interest based on the three-month U.S. Treasury rate:

$$IndexTR_t = (1 + DER_t + TBR_t) * IndexTR_{t-1}$$

$$DER_t = \frac{IndexER_t}{IndexER_{t-1}} - 1 \tag{4}$$

$$TBR_t = \left[\frac{1}{1 - \frac{91}{360} * TBAR_{t-1}}\right]^{\frac{Delta_t}{91}} - 1$$

where:

IndexTR$_t$ = The Total Return Index value on business day *t*.

DER$_t$ = Index daily excess return on business day *t*.

TBR$_t$ = Treasury bill return on business day *t*.

Delta$_t$ = The number of calendar days between the current and previous business days.

TBAR$_{t-1}$ = The most recent weekly high discount rate for 91-day US Treasury bills effective on the preceding business day. Generally the rates are announced by the US Treasury on each Monday. On Mondays that are bank holidays, Friday's rates will apply.

Index Maintenance

Rebalancing

The Indices are rebalanced on the last business day of every quarter. The index positions are rebalanced to an equal weight holding of each of the 13 sub-portfolios.

The 13 sub-portfolios are rebalanced on Wednesdays. Each sub-portfolio is rebalanced every 13 weeks. If that date is not a business day, the roll date is the next business date. The positions are rebalanced to the target weights specified in Table 1.

The index committee may change the date of a given rebalancing for reasons including market holidays occurring on or around the scheduled rebalancing date. Any such change will be announced with proper advance notice where possible.

Base Date

The indices' base dates are December 20, 2005 with base values of 100.

Index Governance

Index Committee

The Commodities Index Committee maintains the S&P 500 VIX Futures Long/Short Strategy Indices. All members of the Committee are full-time professionals at S&P Dow Jones Indices. The Committee meets quarterly. At each meeting, the Committee reviews any significant market events. In addition, the Committee may revise index policy for timing of rebalancing or other matters.

S&P Dow Jones Indices considers information about changes to its indices and related matters to be potentially market moving and material. Therefore, all Index Committee discussions are confidential.

For information on Quality Assurance and Internal Reviews of Methodology, please refer to S&P Dow Jones Indices' Commodities Indices Policies & Practices document located on our Web site, www.spdji.com.

Index Policy

Announcements

Announcements of the daily index values are made after the equity and futures market close each day.

Holiday Schedule

The indices are calculated daily from 3 AM EST to 4:25 PM EST, excluding holidays and weekends.

A complete holiday schedule for the year is available at *www.spdji.com*.

Unscheduled Market Closures

For information on Unexpected Exchange Closures, please refer to S&P Dow Jones Indices' Commodities Indices Policies & Practices document located on our Web site, *www.spdji.com*.

For information on Calculations and Pricing Disruptions, Expert Judgment, Data Hierarchy and Error Corrections, please refer to S&P Dow Jones Indices' Commodities Indices Policies & Practices document located on our Web site, www.spdji.com.

Index Dissemination

Index levels are available through S&P Dow Jones Indices' Web site at *www.spdji.com*, major quote vendors (see codes below), numerous investment-oriented Web sites, and various print and electronic media.

Tickers

Index	Bloomberg
S&P 500 VIX Futures Tail Risk Index ER– Short Term	SPVXTRSP
S&P 500 VIX Futures Tail Risk Index TR – Short Term	SPVXTRST
S&P 500 VIX Futures Tail Risk Index ER – Mid Term	SPVXTRMP
S&P 500 VIX Futures Tail Risk Index TR – Mid Term	SPVXTRMT
S&P 500 VIX Futures Variable Long/Short Index ER – Short Term	SPVXVSP
S&P 500 VIX Futures Variable Long/Short Index TR – Short Term	SPVXVST
S&P 500 VIX Futures Variable Long/Short Index ER – Mid Term	SPVXVMP
S&P 500 VIX Futures Variable Long/Short Index TR – Mid Term	SPVXVMT
S&P 500 VIX Futures Short Volatility Hedged Index ER – Short Term	SPVXVHSP
S&P 500 VIX Futures Short Volatility Hedged Index TR – Short Term	SPVXVHST
S&P 500 VIX Futures Short Volatility Hedged Index ER – Mid Term	SPVXVHMP
S&P 500 VIX Futures Short Volatility Hedged Index TR – Mid Term	SPVXVHMT

FTP

Index returns and data are available via FTP subscription.

For product information, please contact S&P Dow Jones Indices, www.spdji.com/contact-us.

Web site

For further information, please refer to S&P Dow Jones Indices' Web site at www.spdji.com.

S&P Dow Jones Indices' Contact Information

Index Management

David M. Blitzer, Ph.D. – Managing Director & Chairman of the Index Committee
david.blitzer@spglobal.com +1.212.438.3907

Product Management

Vinit Srivastava – Managing Director
vinit.srivastava@spglobal.com +1.212.438.4168

Media Relations

Soogyung Jordan – Communications
soogyung.jordan@spglobal.com +1.212.438.2297

Client Services

index_services@spglobal.com

Disclaimer

It is not possible to invest directly in an index. Exposure to an asset class represented by an index is available through investable instruments based on that index. S&P Dow Jones Indices does not sponsor, endorse, sell, promote or manage any investment fund or other investment vehicle that is offered by third parties and that seeks to provide an investment return based on the performance of any index. S&P Dow Jones Indices makes no assurance that investment products based on the index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor, and S&P Dow Jones Indices makes no representation regarding the advisability of investing in any such investment fund or other investment vehicle. A decision to invest in any such investment fund or other investment vehicle should not be made in reliance on any of the statements set forth in this document. Prospective investors are advised to make an investment in any such fund or other vehicle only after carefully considering the risks associated with investing in such funds, as detailed in an offering memorandum or similar document that is prepared by or on behalf of the issuer of the investment fund or other investment product or vehicle. S&P Dow Jones Indices LLC is not a tax advisor. A tax advisor should be consulted to evaluate the impact of any tax-exempt securities on portfolios and the tax consequences of making any particular investment decision. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

These materials have been prepared solely for informational purposes based upon information generally available to the public and from sources believed to be reliable. No content contained in these materials (including index data, ratings, credit-related analyses and data, research, valuations, model, software or other application or output therefrom) or any part thereof ("Content") may be modified, reverse-engineered, reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of S&P Dow Jones Indices. The Content shall not be used for any unlawful or unauthorized purposes. S&P Dow Jones Indices and its third-party data providers and licensors (collectively "S&P Dow Jones Indices Parties") do not guarantee the accuracy, completeness, timeliness or availability of the Content. S&P Dow Jones Indices Parties are not responsible for any errors or omissions, regardless of the cause, for the results obtained from the use of the Content. THE CONTENT IS PROVIDED ON AN "AS IS" BASIS. S&P DOW JONES INDICES PARTIES DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT'S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY