

**S&P Daily Risk Control Put
Protection Index Series**
Methodology

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Introduction

Index Objective and Highlights

The S&P Daily Risk Control Put Protection Index Series consists of a hypothetical portfolio of a fixed number of synthetic put options on an underlying S&P Risk Control Index.

The index level for each index in the series can be expressed in two ways; by the performance of the synthetic put option overlay or by combining with the performance of the underlying S&P Daily Risk Control Index with the put overlay to create a composite index.

The parameters that define the put protection strategy for each index in the series are the underlying index, the daily risk control target volatility and the daily strike ratio.

Index Name	Index Type	Underlying S&P Daily Risk Control Index	Underlying Risk Control Target Volatility ¹	Daily Strike Ratio ²
S&P 500 10% Daily Risk Control 90% Put Protection Index (USD) NTR	Overlay Index	S&P 500 10% Daily Risk Control Index (NTR)	10%	90%
S&P 500 10% Daily Risk Control 90% Put Protection Composite Index (USD) NTR	Composite Index			
S&P 500 18% Daily Risk Control 90% Put Protection Index (USD) NTR	Overlay Index	S&P 500 18% Daily Risk Control Index (NTR)	18%	90%
S&P 500 18% Daily Risk Control 90% Put Protection Composite Index (USD) NTR	Composite Index			
S&P 500 10% Daily Risk Control 95% Put Protection Index (USD) NTR	Overlay Index	S&P 500 10% Daily Risk Control Index (NTR)	10%	95%
S&P 500 10% Daily Risk Control 95% Put Protection Composite Index (USD) NTR	Composite Index			
S&P 500 18% Daily Risk Control 95% Put Protection Index (USD) NTR	Overlay Index	S&P 500 18% Daily Risk Control Index (NTR)	18%	95%
S&P 500 18% Daily Risk Control 95% Put Protection Composite Index (USD) NTR	Composite Index			

For information on the underlying indices, please refer to their respective index methodologies available at www.spdji.com.

Please refer to Index Construction for details on the approach of each index and its calculation.

¹ Please refer to *S&P Dow Jones Indices' Index Mathematics Methodology* document for details on the index series' calculation.

² The daily strike ratio is used to determine the strike price of each synthetic put option on purchase date with respect to the prior day's value of the underlying S&P Daily Risk Control Index. For the avoidance of doubt, the daily strike ratio does not represent the absolute level of protection offered by the strategy. Market conditions, including interest rates and the trailing performance of the underlying index, will affect the level of protection offered by the strategy at any given point.

Supporting Documents

This methodology is meant to be read in conjunction with supporting documents providing greater detail with respect to the policies, procedures and calculations described herein. References throughout the methodology direct the reader to the relevant supporting document for further information on a specific topic. The list of the main supplemental documents for this methodology and the hyperlinks to those documents is as follows:

Supporting Document	URL
S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology	Equity Indices Policies & Practices
S&P Dow Jones Indices' Index Mathematics Methodology	Index Mathematics Methodology

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

Approach

Each index in the S&P Daily Risk Control Put Protection Index Series consists of a hypothetical portfolio containing a fixed number of synthetic put options on the underlying S&P Risk Control Index (see *Index Series Parameters* table for details). The expiration date of each synthetic option in the portfolio is staggered, so that on each day an existing option expires a new option is purchased.

The daily performance of the put protection index overlay is determined by the change in value of the non-expiring synthetic options held in the portfolio, plus the difference between the expired synthetic option's intrinsic value and the newly purchased synthetic option premium each day.

The strike level for each synthetic put option is determined by using a fixed percentage of the underlying Risk Control Index level (see *Index Series Parameters* table for details). The daily quantity of each individual synthetic put option is scaled on the purchase date in order to ensure that the aggregate portfolio collectively offers the intended level of protection. At any given point, this level of protection is therefore dependent on the trailing levels from the underlying S&P Daily Risk Control Index.³

Each synthetic option is priced using the standard Black-Scholes formula according to the present levels of the underlying Risk Control index. As the existing S&P Risk Control indices dynamically adjust exposure on a daily basis to an underlying index in an attempt to control the level of volatility, then each synthetic put option can be priced with an assumed implied volatility corresponding to the underlying's target level.⁴

Index Level Calculations

On any business day t when an index in the series is calculated, the index values are calculated using the following formulas:

$$\text{Composite Index}_t = \text{Composite Index}_{t-1} \times \left[1 + \left(\frac{\text{Overlay Index}_t}{\text{Overlay Index}_{t-1}} - 1 \right) + \left(\frac{\text{Underlying RCIndex}_t}{\text{Underlying RCIndex}_{t-1}} - 1 \right) \right]$$

$$\text{Composite Index}_{t=0} = 100$$

$$\text{Overlay Index}_t = \text{Overlay Index}_{t-1} + \Delta \text{Portfolio Option Value}_t + \text{Expiring Option Value}_t - \text{New Option Value}_t$$

where:

$$\text{Underlying RCIndex}_t = \text{Level of the S\&P Daily Risk Control Index using the underlying index and target volatility, } \sigma, \text{ at business day, } t$$

³ For the avoidance of doubt, the daily strike ratio does not represent the absolute level of protection offered by the strategy. Market conditions, including interest rates and the trailing performance of the underlying index, will affect the level of protection offered by the strategy at any given point.

⁴ With the exception of the additional transaction volatility cost applied only on each option purchase date. Transaction volatility cost refers to the increase in volatility used to calculate the daily synthetic option premium on purchase date only. See *Index Series Parameters* table for more information.

Hypothetical Portfolio Value and Option Quantity Calculations

On any business day t when an index in the series is calculated, the theoretical value of the synthetic options portfolio, expiring option value and new option value and quantity is calculated as follows:

$\Delta Portfolio Option Value_t$ = The change over the past business day in the theoretical value of the hypothetical option portfolio, at time t , is calculated as:

$$\Delta Portfolio Option Value_t = Portfolio Option Value_t - Portfolio Option Value_{t-1}$$

where:

$Portfolio Option Value_t$ = The sum of the theoretical values of all the unexpired options in the hypothetical option portfolio, at time t , and is calculated as:

$$Portfolio Option Value_t = \sum_{d=t-M-1}^t Q_d \times Price_t(Put Option_d)$$

where:

M = The number of unexpired synthetic put options in the portfolio at any given time (equivalent to the maturity of each new synthetic put option, expressed in index calculation days)

$Price_t(Put Option_d)$ = The theoretical price, on business day t , of the synthetic put option purchased on business day $d \leq t$

$Option Quantity, Q_d$ = The quantity of the synthetic put option purchased on business day d is calculated as:

$$Option Quantity, Q_d = \frac{Overlay Index_{d-1}}{M \times Underlying RCIndex_{d-1}}$$

$Expiring Option Value_t$ = The intrinsic value of the synthetic put option purchased on day d is calculated as:

$$Expiring Option Value_t = Q_{t-M} \times Maximum\{0, Strike_{t-M} - Underlying RCIndex_t\}$$

where:

$Strike_d$ = The strike price of the synthetic put option purchased on business day d , and is calculated as:

$$Strike_d = Daily Strike Ratio \times Underlying RCIndex_{d-1}$$

where:

Daily Strike Ratio = A fixed percentage (see *Index Series Parameters* table) used to determine the strike price of each synthetic put option

$New Option Value_t$ = The value of the synthetic option purchased on business day, t , is calculated as follows:

$$New Option Value_t = Q_t \times Price_t(Put Option_t)$$

Theoretical Option Pricing Calculations

On any business day t when an index in the series is calculated, the theoretical price of each unexpired synthetic put option purchased on their respective business day d is calculated using the standard Black-Scholes as follows:

$$Price_t(Put Option_d) = Strike_d \times e^{-r_t T_t(Put Option_d)} \times N(-d2_{t,d}) - Underlying RCIndex_t \times N(-d1_{t,d})$$

where:

$$d1_{t,d} = \frac{1}{\sigma \sqrt{T_t(Put Option_d)}} \left[\ln \left(\frac{Underlying RCIndex_t}{Strike_d} \right) + (r_t + \sigma^2/2) \times T_t(Put Option_d) \right]$$

$$d2_{t,d} = d1_{t,d} - \sigma \sqrt{T_t(Put Option_d)}$$

$N(x)$ = the cumulative distribution function for a standard normal distribution with mean 0 and standard deviation of 1 at x .

r_t = continuously compounded 12-month interest rate at business day, t

$$\sigma = \begin{cases} \text{underlying index risk control target volatility} + \text{transaction volatility cost}, & \text{if } t = d \\ \text{underlying index risk control target volatility}, & \text{if } t > d \end{cases}$$

$T_t(Put Option_d)$ = Time to maturity, expressed in years, for the synthetic put option purchased on business day, d , as of business day, t , is calculated as:

$$T_t(Put Option_d) = \frac{\text{Calendar days from and excluding business day, } t, \text{ to and including business day, } d + M}{\text{Calendar days in one year following business day, } t}$$

Index Series Parameters

The S&P Daily Risk Control Put Protection Index Series consists of the following indices with their corresponding parameters:

Index Name	Index Type	Underlying S&P Daily Risk Control Index	Underlying Risk Control Target Volatility, σ	Number of synthetic put options in portfolio, M	Daily Strike Ratio	12 Month Rate, r (for option pricing)	Transaction Volatility Cost ⁵
S&P 500 10% Daily Risk Control 90% Put Protection Index (USD) NTR	Overlay Index	S&P 500 10% Daily Risk Control Index (NTR)	10%	252	90%	12 month USD LIBOR	150bps
S&P 500 10% Daily Risk Control 90% Put Protection Composite Index (USD) NTR	Composite Index						
S&P 500 18% Daily Risk Control 90% Put Protection Index (USD) NTR	Overlay Index	S&P 500 18% Daily Risk Control Index (NTR)	18%	252	90%	12 month USD LIBOR	150bps
S&P 500 18% Daily Risk Control 90% Put Protection Composite Index (USD) NTR	Composite Index						
S&P 500 10% Daily Risk Control 95% Put Protection Index (USD) NTR	Overlay Index	S&P 500 10% Daily Risk Control Index (NTR)	10%	252	95%	12 month USD LIBOR	150 bps
S&P 500 10% Daily Risk Control 95% Put Protection Composite Index (USD) NTR	Composite Index						
S&P 500 18% Daily Risk Control 95% Put Protection Index (USD) NTR	Overlay Index	S&P 500 18% Daily Risk Control Index (NTR)	18%	252	95%	12 month USD LIBOR	150bps
S&P 500 18% Daily Risk Control 95% Put Protection Composite Index (USD) NTR	Composite Index						

⁵ Transaction volatility cost refers to an increase in the volatility input used to calculate the daily synthetic option premium on the purchase date only. Transaction volatility cost accounts for a hypothetical transaction cost that typically would be paid to execute such an over-the-counter option.

Index Maintenance

Rebalancing

The indices are rebalanced daily.

Currency, Currency Hedged, and Risk Control Indices

Additional currency, currency hedged, and risk control versions of the indices may be available. For a list of available currency, currency hedged, and risk control indices, please contact Client Services at index_services@spglobal.com.

For more information on currency, currency hedged, and risk control indices, please refer to S&P Dow Jones Indices' Index Mathematics Methodology.

Base Date and History Availability

Index history availability, base dates and base values are shown in the table below.

Index	Launch Date	First Value Date	Base Date	Base Value
S&P 500 10% Daily Risk Control 90% Put Protection Index (USD) NTR	11/20/2017	05/26/2000	05/26/2000	100
S&P 500 10% Daily Risk Control 90% Put Protection Composite Index (USD) NTR	11/20/2017	05/26/2000	05/26/2000	100
S&P 500 18% Daily Risk Control 90% Put Protection Index (USD) NTR	11/20/2017	05/26/2000	05/26/2000	100
S&P 500 18% Daily Risk Control 90% Put Protection Composite Index (USD) NTR	11/20/2017	05/26/2000	05/26/2000	100
S&P 500 10% Daily Risk Control 95% Put Protection Index (USD) NTR	11/20/2017	05/26/2000	05/26/2000	100
S&P 500 10% Daily Risk Control 95% Put Protection Composite Index (USD) NTR	11/20/2017	05/26/2000	05/26/2000	100
S&P 500 18% Daily Risk Control 95% Put Protection Index (USD) NTR	11/20/2017	05/26/2000	05/26/2000	100
S&P 500 18% Daily Risk Control 95% Put Protection Composite Index (USD) NTR	11/20/2017	05/26/2000	05/26/2000	100

Index Governance

Index Committee

S&P Dow Jones Indices' Global Benchmarks Index Committee maintains the index. The Committee meets regularly. At each meeting, the Committee reviews matters that may affect index constituents, statistics comparing the composition of the index to the market, and any significant market events. In addition, the Index Committee may revise index policy covering rules for selecting constituents, treatment of dividends, share counts 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.

S&P Dow Jones Indices' Index Committees reserve the right to make exceptions when applying the methodology if the need arises. In any scenario where the treatment differs from the general rules stated in this document or supplemental documents, clients will receive sufficient notice, whenever possible.

In addition to the daily governance of indices and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews the methodology to ensure the indices continue to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones Indices may publish a consultation inviting comments from external parties.

For information on Quality Assurance and Internal Reviews of Methodology, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document.

Index Policy

Holiday Schedule

The indices are calculated on all U.S. equity market business days.

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

Rebalancing

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.

Unexpected Exchange Closures

For information on Unexpected Exchange Closures, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document.

Recalculation Policy

For information on the recalculation policy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document.

For information on Calculations and Pricing Disruptions, Expert Judgment and Data Hierarchy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document I.

Contact Information

For questions regarding an index, please contact: index_services@spglobal.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

The table below lists headline indices covered by this document. All currency, currency hedged, risk control, and return type versions of the below indices that may exist are also covered by this document. Please contact index_services@spglobal.com for a complete list of indices covered by this document.

Index	Return Type	Bloomberg	Reuters
S&P 500 10% Daily Risk Control 90% Put Protection Index (USD) NTR	Net Total Return	SPRP1090	.SP10R90P
S&P 500 10% Daily Risk Control 90% Put Protection Composite Index (USD) NTR	Net Total Return	SPRC1090	.SP10RC90P
S&P 500 18% Daily Risk Control 90% Put Protection Index (USD) NTR	Net Total Return	SPRP1890	.SP18R90P
S&P 500 18% Daily Risk Control 90% Put Protection Composite Index (USD) NTR	Net Total Return	SPRC1890	.SP18RC90P
S&P 500 10% Daily Risk Control 95% Put Protection Index (USD) NTR	Net Total Return	SPRP1095	.SP10R95P
S&P 500 10% Daily Risk Control 95% Put Protection Composite Index (USD) NTR	Net Total Return	SPRC1095	.SP10RC95P
S&P 500 18% Daily Risk Control 95% Put Protection Index (USD) NTR	Net Total Return	SPRP1895	.SP18R95P
S&P 500 18% Daily Risk Control 95% Put Protection Composite Index (USD) NTR	Net Total Return	SPRC1895	.SP18RC95P

FTP

Daily stock level and index 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.

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