

## Limiting Risk Exposure with S&P Risk Control Indices

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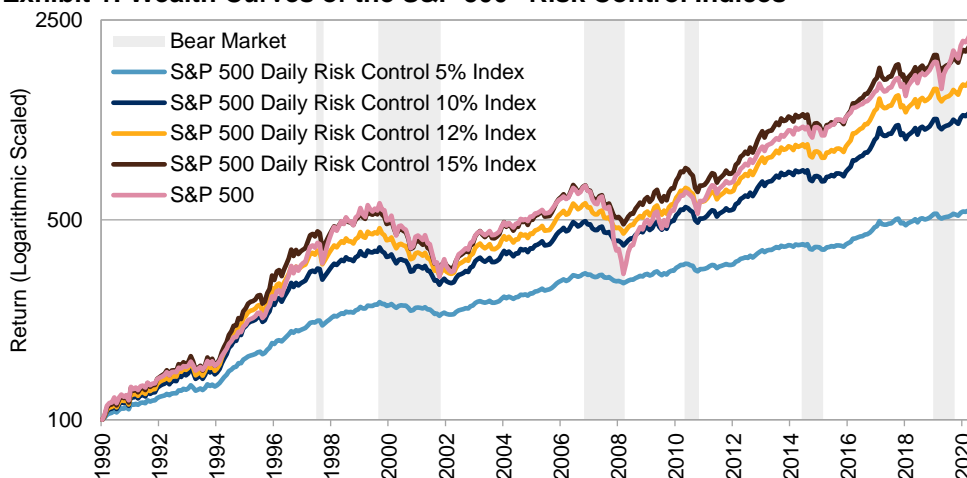
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### INTRODUCTION

The volatility seen during the Global Financial Crisis (GFC) in 2008 broke the calm that was present in financial markets from 2004 to early 2007. Most asset classes experienced significant pullbacks, markets became volatile, and the correlation between asset classes increased significantly. Portfolio construction based on the backward-looking correlation model failed, as the expected diversification benefit was eliminated precisely when it was needed the most.

In the aftermath of the GFC, institutional market participants with long-term investment horizons have responded with aversion to this volatility by considering a number of risk control strategies. The risk control strategies adjust market exposure in inverse relation to risk to target a stable level of volatility in all market environments. For institutional market participants with long-standing liabilities, which can range from defined benefit plans to variable annuities offered at insurance companies, a risk control strategy may provide a smoother path of asset returns (see Exhibit 1) and could more closely align the performance of the institution's assets to the characteristics of its liabilities.

**Exhibit 1: Wealth Curves of the S&P 500® Risk Control Indices**



Source: S&P Dow Jones Indices LLC. Data as of June 30, 2021. Index levels set to 100 on Dec. 31, 1990. Index performance based on total return in USD. Parameters for the S&P 500 RC Indices: maximum leverage: 150%; interest rate: overnight USD LIBOR; exponentially weighted volatility. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information about the inherent limitations associated with back-tested performance.

S&P Dow Jones Indices has developed a risk control framework through a series of risk control indices, which seek to measure various underlying equity- or futures-based indices at set risk levels. S&P Dow Jones Indices' risk control indices feature:

- Globally accepted, independent underlying indices like the [S&P 500](#), [S&P 500 Low Volatility](#), and [S&P 500 Dividend Aristocrats®](#);
- Transparent methodology based on the underlying index's historical volatility;
- Measurements of risk, based on volatility, to help market participants control risk at a predefined level; and
- Utilization of the same constituents as the underlying index.

*In the aftermath of the GFC, institutional market participants with long-term investment horizons have responded with aversion to volatility by considering a number of risk control strategies.*

S&P Dow Jones Indices has created a suite of risk control indices based on a large number of equity and thematic indices, along with the [S&P GSCI®](#) and the other commodity indices in its series (see the Appendix for a complete list).

## WHY CONTROL RISK WHEN YOU CAN AVOID IT?

Maintaining risk at certain levels has a couple of advantages. First, it starts from broad market exposure, at a level that is dynamically scaled up or down. This is different from volatility response strategies such as low volatility and minimum variance, which prune the securities from an underlying basket in order to isolate the risk factor. As a result, those strategies tend to be more concentrated in certain sectors or stocks.

Second, risk control indices give market participants the option to choose a desired volatility target level to match their appetite for risk. For example, a volatility target level of 10% would provide more room for upside potential, while a 5% volatility level would cater to a lower risk appetite.

Third, historical long-term performance showed that the volatility control mechanism helped to achieve robust tail risk reduction compared with a buy-and-hold index. It also offered an improvement in risk-adjusted return by taking advantage of the negative short-term relationship between volatility and return, as well as the persistence of volatility.

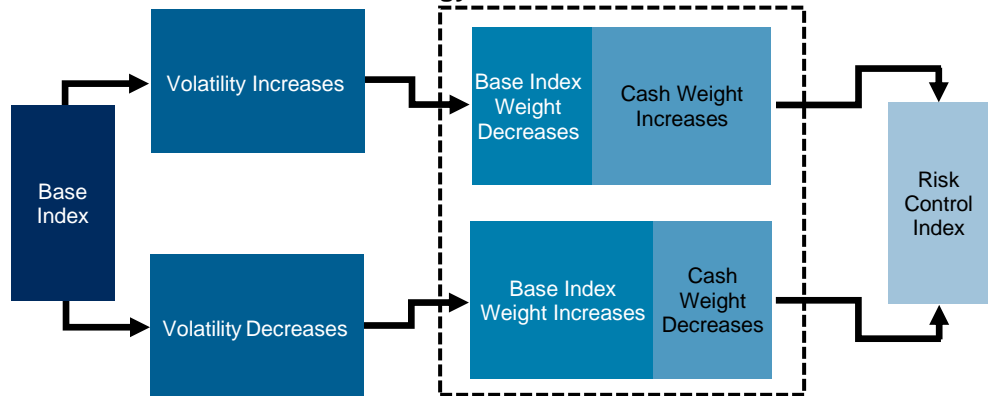
*Risk control indices give market participants the option to choose a desired volatility target level to match their appetite for risk.*

## HOW RISK CONTROL WORKS

As Exhibit 2 illustrates, risk control indices have two components: the underlying index and a cash component. When volatility increases, the risk control index moves out of the underlying index and into cash. Conversely, if volatility decreases, the risk control index moves more weight into the underlying index and weights less in cash. If the volatility of the underlying index falls below the target levels, the exposure to the index could be leveraged, if desired.

*Risk control indices have two components: the underlying index and a cash component.*

**Exhibit 2: Risk Control Methodology**



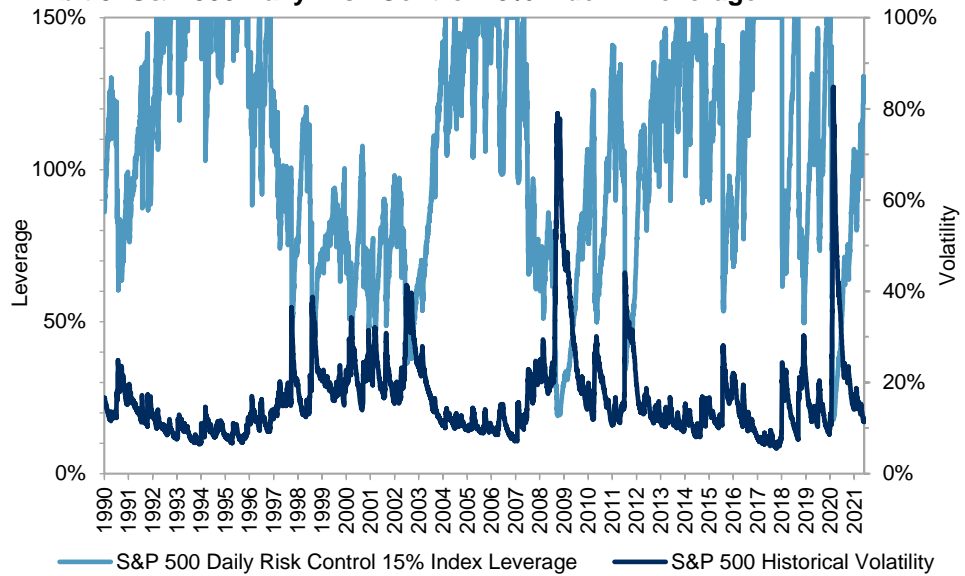
Source: S&P Dow Jones Indices LLC. Chart is provided for illustrative purposes.

*When volatility increases, the risk control index moves out of the underlying index and into cash.*

Exhibit 3 illustrates this concept with the [S&P 500 Daily Risk Control 15% Index](#), which (as the name states) has a volatility target of 15%. The exposure to the underlying index is a simple ratio of the target volatility level and the historical volatility, capped by the maximum leverage that is permissible.

For example, the maximum leverage permitted for the S&P 500 Daily Risk Control 15% Index is 150%. Therefore, when the historical volatility level falls to 12%, the index can allocate 125% (15%/12%) into the underlying index by borrowing the rest of the funds.

**Exhibit 3: S&P 500 Daily Risk Control 15% Index – Leverage**



*The exposure to the underlying index is a simple ratio of the target volatility level and the historical volatility, capped by the maximum leverage that is permissible.*

Source: S&P Dow Jones Indices LLC. Data as of June 30, 2021. Parameters for the S&P 500 Daily Risk Control Indices: maximum leverage is 150%, interest rate is overnight USD LIBOR, and volatility is exponentially weighted. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information about the inherent limitations associated with back-tested performance.

*The maximum leverage for the S&P 500 Daily Risk Control 15% Index is 150%, so when volatility falls to 12%, the index can allocate 125% (15%/12%) into the underlying index.*

Risk control total return indices represent the sum of the return of the exposure to the underlying index and the return on the cash component (interest cost or gain). The return of the cash component is a more straightforward function of the short-term rates; if exposure to the index is leveraged, cash needs to be borrowed to pay for the overexposure to the underlying index.

Excess return indices are designed to track return on investments based on indices for which the investments were made through the use of borrowed funds. Thus, the return of an excess return index will be equal to the total return of the risk control index minus the borrowing cost.

### RISK CONTROL PARAMETERS

Several questions arise about the parameters used in the calculations for risk control indices. These include volatility target, computation of historical volatility, maximum leverage, funding rates for cash returns, and the frequency of index rebalancing. All of these parameters can be customized based on product issuer or market participant requirements.<sup>1</sup>

<sup>1</sup> The parameters used in each of the existing S&P Risk Control Indices are recorded in <https://www.spglobal.com/spdji/en/documents/additional-material/sp-risk-control-indices-parameters.pdf>.

### Volatility Target

The volatility target is a predefined constant number, set according to the level of risk appetite. There could be a series of risk control indices available using the same underlying index. The volatility target ranges from 5% up to the long-term volatility of the underlying index.

*The parameters used in the calculations include volatility target, historical volatility, maximum leverage, cash returns, and rebalancing frequency.*

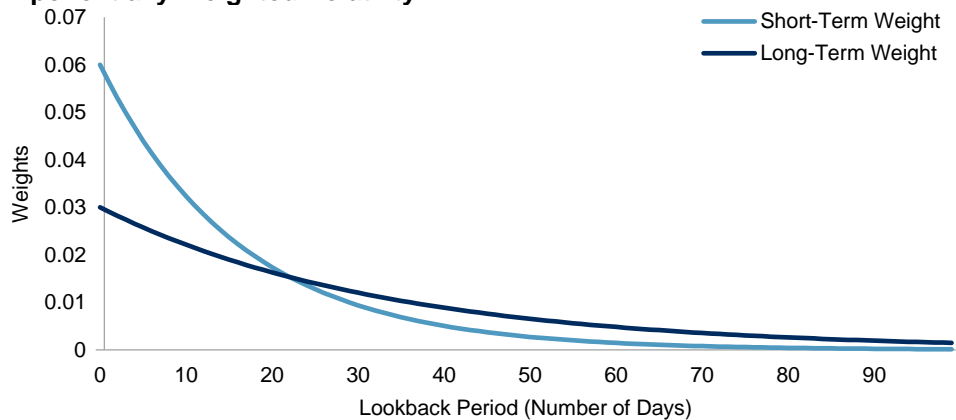
### Historical Volatility

The standard deviation of the underlying index’s natural-log returns is used to measure historical volatility, with two options: simple weighting or exponential weighting. Exponential weighting is the method that is typically preferred. It assigns higher weights to the natural-log returns closer to the rebalancing date when compared with the simple-weighted measure. The weights follow an exponential function with a certain decay factor.

Historical volatility, which is used in the computation of index exposures, is the maximum of short- and long-term volatility. With exponential weighting, the distinction between longer- and shorter-term volatility is made by using different decay factors for the exponential functions. A higher rate of decay is used to compute short-term volatility measures, which means days that are closer to the index’s rebalancing have the majority of the impact. A longer decay rate allows days further from the rebalancing to have some impact (see Exhibit 4). In the case of simple-weighted volatility, the short- and long-term volatility are computed as simple averages over different lookback periods.

*In the case of simple-weighted volatility, the short- and long-term volatility are computed as simple averages over different look-back periods.*

**Exhibit 4: Weights Attributed to Calculation of Short- and Long-Term Exponentially Weighted Volatility**



Source: S&P Dow Jones Indices LLC. Chart is provided for illustrative purposes.

### Maximum Leverage

Maximum leverage is another important factor for risk control indices. When the historical volatility falls below the volatility target, the risk control index could increase its exposure to the underlying index above 100% if the parameter is set to allow for that. This is achieved by borrowing cash

*The return on a risk control index's cash component is computed using interest rates.*

against the underlying index. The maximum leverage is typically about 150% for most of S&P Dow Jones Indices' risk control indices, but this can be changed.

### **Cash Component**

The return on a risk control index's cash component is computed using interest rates. Indices with daily rebalancing typically use an overnight rate, such as the Euro Overnight Index Average or London Interbank Offered Rate (LIBOR), or a daily valuation of a rolling investment with a three-month interest rate. Some indices use the three-month U.S. Treasury Bill or three-month German Bubbill rates. Indices use the relevant rate for the asset class or geographic region of the base index. The same rate is assumed to be used for both lending and borrowing.

*S&P Dow Jones Indices' risk control indices may employ daily, monthly, or dynamic rebalancing.*

### **Rebalancing Frequency**

How often the risk control index's exposure to the underlying index and the cash component is computed is referred to as the index's rebalancing frequency. S&P Dow Jones Indices' risk control indices may employ daily, monthly, or dynamic rebalancing.

Daily rebalancing allows the index to respond to the changes in the market every day the market is open. The index's exposure to the underlying equity index and cash are computed at the end of each trading day using the historical volatility numbers up to and including that day. While this allows the index to respond to daily changes in volatility, it creates more turnover for the index.

Monthly rebalancing only enables the index to update its exposure to the equity and cash components at the end of the last trading day of every calendar month. This reduces index turnover, but it might cause the actual volatility to differ slightly from the target level.

*Daily rebalancing allows the index to respond to the changes in the market every day the market is open.*

Dynamic rebalancing was recently introduced to address the increased turnover associated with daily rebalancing and the differences in volatility that can come with monthly rebalancing. With dynamic rebalancing, the risk control index's theoretical exposures to the equity index and cash are computed daily, based on historical volatility levels up to that date. However, those weights are not reflected in the risk control index until a certain predefined threshold is breached within the month. If that threshold is not breached, the risk control index would rebalance at the end of the month. This dynamic rebalancing enables risk control indices to respond to large position changes while controlling turnover, which allows them to be used for investable products.

## PERFORMANCE CHARACTERISTICS: THE S&P 500 RISK CONTROL INDICES

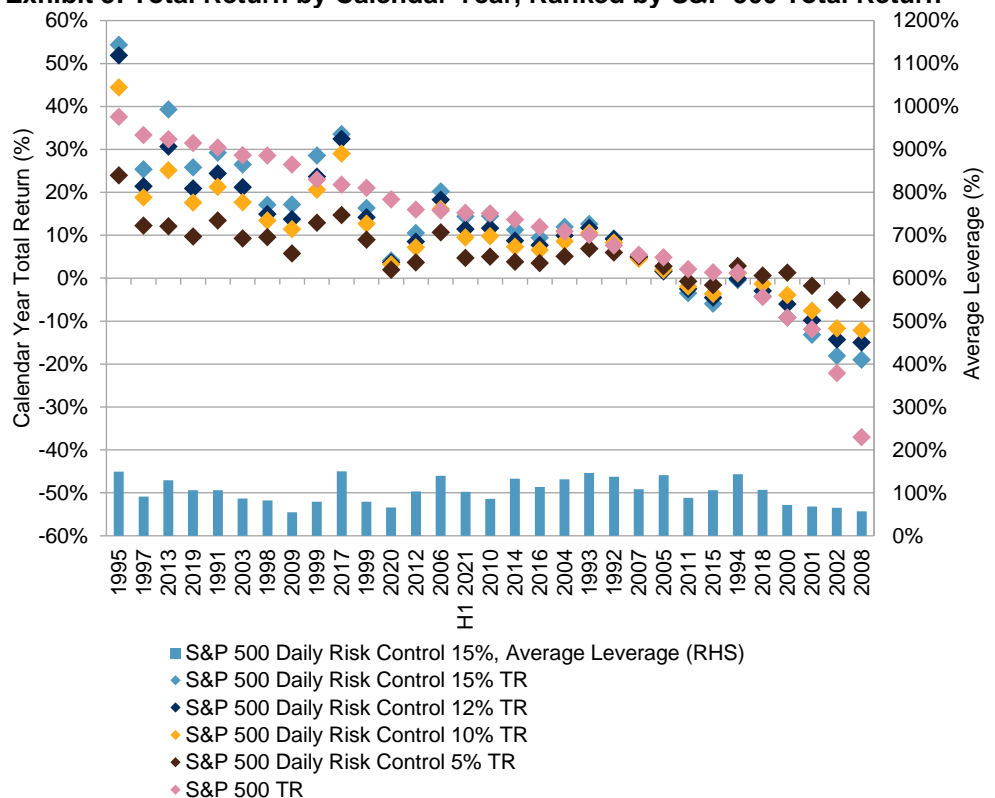
*The indices may enhance their performance by using leverage.*

The [S&P 500 Daily Risk Control Indices](#), with 5%, 10%, 12%, and 15% as the volatility targets and 150% as the maximum permissible leverage level, typically underperform the S&P 500 during a bull market. This is expected, as the long-term volatility of the S&P 500 is 14.5%. However, the indices may enhance their performance by using leverage (see Exhibit 5). During a bear market, the risk control indices cap the exposure to the underlying index and limit the downside, regardless of the severity of the bear market.

The indices with lower volatility targets produced higher returns during the severe bear markets of 2002 and 2008, which compensated for their comparatively lower returns during the bull markets of 2013 and 2003. The COVID-19 sell-off and recovery in 2020 was unprecedentedly fast and occurred in one calendar year. While not shown in Exhibit 5, the protection effect was still present during the fastest drawdown.

*During a bear market, indices cap exposure to the underlying index and limit the downside, regardless of the severity of the bear market.*

**Exhibit 5: Total Return by Calendar Year, Ranked by S&P 500 Total Return**



*The indices with lower volatility targets produced higher returns during the severe bear markets of 2002 and 2008.*

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to June 30, 2021. Index performance based on total return in USD. Parameters for the S&P 500 Daily Risk Control Indices: maximum leverage is 150%, interest rate is overnight USD LIBOR, and volatility is exponentially weighted. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information about the inherent limitations associated with back-tested performance.



*Risk reduction in these indices is not symmetric, evident from the improvement of skewness.*

Exhibits 6 and 7 provide a detailed comparative overview of the S&P 500 Daily Risk Control Indices and S&P 500 from Dec. 31, 1990, to June 30, 2021. These statistics confirm that risk reduction in these indices is not symmetric, which is evident from the improvement of skewness as well as the Sharpe, Sortino, MAR, and omega ratios.

Drawdowns were intensively reduced in the risk control indices. With the 5% volatility target, the maximum drawdown was cut by 80% and drawdowns greater than 5% only occurred three times over the period studied. It also took less time to recover to the high watermark for the risk control indices—37 months for the S&P 500 to recover to the pre-GFC level, versus 16 months for the [S&P 500 Daily Risk Control 5% Index](#).

*Drawdowns were intensively reduced in the risk control indices.*

**Exhibit 6: Statistical Summary of the S&P 500 and S&P Daily Risk Control Indices**

STATISTICAL METRIC	S&P 500 DAILY RISK CONTROL INDICES				S&P 500
	15%	12%	10%	5%	
Annual Return (%)	10.74	9.65	8.70	5.81	11.03
Maximum Drawdown (%)	-39.22	-31.55	-25.98	-10.37	-50.95
Annual Volatility (%)	12.89	10.67	8.99	4.52	14.49
Annual Skewness	-0.14	-0.13	-0.12	-0.11	-0.17
Monthly Alpha Against the S&P 500	0.15	0.19	0.20	0.22	-
T-Stats of Alpha	1.73	2.46	3.11	6.44	-
Beta to the S&P 500	0.80	0.66	0.55	0.27	-
Correlation With the S&P 500	0.90	0.89	0.88	0.88	-
Sharpe Ratio	0.62	0.65	0.67	0.69	0.57
Sortino Ratio	0.99	1.04	1.07	1.12	0.78
MAR Ratio	0.27	0.31	0.33	0.56	0.22
Omega Ratio	1.83	1.91	1.99	2.44	1.81
Average Annual Turnover (%)	426	421	391	200	-
Average Daily Leverage (%)	106	88	74	37	-

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to June 30, 2021. Index performance based on total return in USD. Parameters for the S&P 500 Daily Risk Control Indices: maximum leverage is 150%, interest rate is overnight USD LIBOR, and volatility is exponentially weighted. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information about the inherent limitations of back-tested performance.



**Exhibit 7: How the S&P Risk Control Indices Performed during S&P 500's Drawdowns**

DRAWDOWN METRIC	S&P 500 DAILY RISK CONTROL INDICES				S&P 500
	15%	12%	10%	5%	
<b>MAXIMUM DRAWDOWN GFC (OCTOBER 2007 TO FEBRUARY 2009)</b>					
Drawdown	-27.2	-21.6	-17.8	-7.7	-50.9
Peak to Trough Length (No. of Months)	21	16	16	16	16
Recovery Length (No. of Months)	22	22	20	13	37
<b>SECOND MAXIMUM DRAWDOWN DOT-COM BUBBLE (AUGUST 2000 TO SEPTEMBER 2002)</b>					
Drawdown	-39.2	-31.5	-26.0	-10.4	-44.7
Peak to Trough Length (No. of Months)	25	25	25	25	25
Recovery Length (No. of Months)	48	42	40	16	49
<b>THIRD MAXIMUM LARGEST DRAWDOWN COVID-19 SELL-OFF (DECEMBER 2019 TO MARCH 2020)</b>					
Drawdown	-12.2	-9.6	-7.9	-3.8	-19.6
Peak to Trough Length (No. of Months)	3	2	2	2	3
Recovery Length (No. of Months)	8	8	8	8	4

*With the 5% volatility target, the maximum drawdown was cut by 80% and drawdowns greater than 5% only occurred three times over the period studied.*

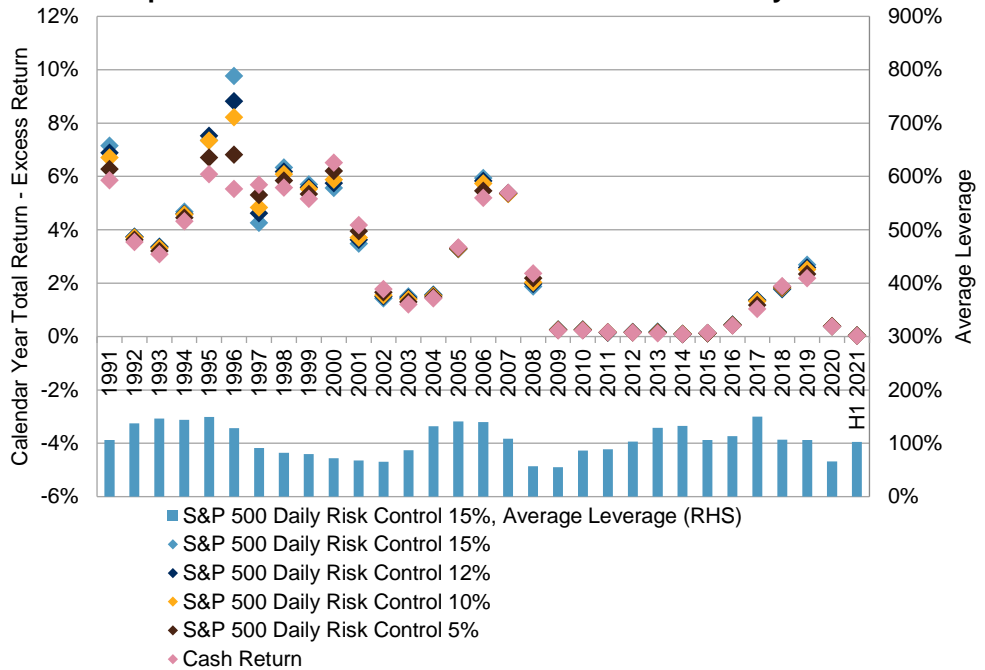
*It also took less time to recover for the risk control indices—37 months versus 16 months for the S&P 500 and the 5% volatility target index to recover to the pre-GFC level, respectively.*

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to June 30, 2021. Index performance based on total return in USD. Parameters for the S&P 500 Daily Risk Control Indices: maximum leverage is 150%, interest rate is overnight USD LIBOR, and volatility is exponentially weighted. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information about the inherent limitations of back-tested performance.

The cash component return is the other part of the risk control index total return, represented by the spread between the total return and excess return. For the S&P 500 Risk Control Indices illustrated in Exhibit 8, the income from the cash component is historically positive for most years and has come down quite a bit together with the interest rate ever since the GFC in 2008.

**Exhibit 8: Spread Between Total Return and Excess Return by Calendar Year**

The cash component return is the other part of the risk control index total return, represented by the spread between the total return and excess return.



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to June 30, 2021. Index performance based on total return in USD. Parameters for the S&P 500 Daily Risk Control Indices: maximum leverage is 150%, interest rate is overnight USD LIBOR, and volatility is exponentially weighted. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information about the inherent limitations of back-tested performance.

The S&P Risk Control 2.0 Indices are the next generation of risk control indices, in which the cash portion of the investment in the standard risk control strategy is replaced with a liquid bond index.

**RISK CONTROL 2.0**

The [S&P Risk Control 2.0 \(RC2\) Indices](#) are the next generation of risk control indices, in which the cash portion of the investment in the standard risk control strategy is replaced with a liquid bond index. Unlike the risk control 1.0 indices, in which the cash component is assumed to be risk free and hence have zero volatility, the risk control 2.0 indices assign positive weights to either the underlying index or the bond index so that the target volatility can be achieved. This exercise takes into consideration the volatility of both indices and the correlation between them. The detailed index rules are documented in the [S&P RC2 Index Methodology](#), and please see “[Understanding the S&P 500 Daily Risk Control 2 Indices](#)” for more background on index performance.

## RISK CONTROL IN THE CONTEXT OF OTHER VOLATILITY STRATEGIES

In recent years, a few other volatility management strategies have come into focus. Prominent among those are low volatility strategies and strategies (e.g., the [S&P 500 Dynamic VEQTOR Index](#)) that allocate between equities and an uncorrelated asset class, like VIX®. Although these strategies tend to be talked about as one group, they are differentiated in their objective, performance in various market cycles, and usage (see Exhibit 9). More information and details can be found in prior S&P Dow Jones Indices research.<sup>2</sup>

*In recent years, other volatility management strategies have come into focus, such as low volatility strategies and strategies that allocate between equities and an uncorrelated asset class, like VIX.*

**Exhibit 9: Risk Control Compared with Other Volatility Strategies**

INDEX CHARACTERISTIC	LOW VOLATILITY	RISK CONTROL	VEQTOR
Approach	Allocate to perceived lower-risk companies	Rules-based strategy that dynamically adjusts the assets within a portfolio to target a consistent level of risk	Invest directly in volatility and use it as an asset allocation signal
Strong Bull Markets	Lag benchmark: Strategies have lower beta than benchmark by design	Lag benchmark: Cap on volatility reduces participation in the benchmark, as there is no distinction between upside and downside volatility	Lag benchmark: Some allocation is always to volatility, which will drag down performance
Strong Bear Markets	Typically outperform	Typically outperform	Typically outperform
Flat Markets*	Typically outperform slightly or are even	Typically outperform slightly or are even	Typically underperform: Allocation in and out of volatility is costly
Usage	Core holding or combining with core	Capital protection or capital-guaranteed products with some equity participation	Hedge against black swan events

\* Flat Markets refer to markets that are moderately positive or negative or oscillating around a band. Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

## CONCLUSION

Risk control indices provide a means to measure volatility in an underlying index and limit volatility of investments to a tailored level, while still allowing exposure to the index’s returns. The data discussed show that, in the past, these indices have supported necessary protection in bear markets while allowing market participants to take part in some of the upswings. Both academic research and these indices’ historical performance have shown that this performance has been a result of these predefined risk levels, and that a low volatility strategy has been effective in delivering the desired risk-adjusted returns.

*Risk control indices provide a means to measure volatility in an underlying index and limit volatility of investments to a tailored level, while still allowing exposure to the index’s returns.*

<sup>2</sup> Liu, Berlinda, “[Limiting Risk Without Limiting Equity Exposure](#),” S&P Dow Jones Indices, March 2014.

## APPENDIX

Exhibit 10: S&P Risk Control Indices	
INDEX CATEGORY	INDEX SERIES
Dynamic Rebalancing Risk Control Indices	S&P 500 Dynamic Rebalancing Risk Control 10% Index
	S&P 500 Futures Dynamic Rebalancing RC 4% Index
	S&P LTVC Global Dynamic Rebalancing Risk Control 10% Index
	S&P Global 1200 Low Carbon Low Volatility High Dividend Risk Control Indices
Developed Market Risk Control Indices	S&P 500 Risk Control Indices
	S&P 500 Capex Efficiency Risk Control Indices
	S&P 500 Riskcasting Risk Control Indices
	S&P 500 Low Volatility Riskcasting Risk Control Indices
	S&P Europe 350 Riskcasting
	S&P Global 1200 Riskcasting
	S&P 500 Average Risk Control Indices
	S&P/TSX 60 Risk Control Indices
	S&P Europe 350 Risk Control Indices
	S&P Asia 50 Risk Control Indices
	S&P/ASX 200 Risk Control Indices
	S&P/JPX Risk Control Indices
	S&P 500 Dividend Aristocrats Risk Control Indices
	S&P 500 Low Volatility Risk Control Indices
	S&P 500 Low Volatility (CAD) Hedged Risk Control Indices
	S&P U.S. Retiree Spending Index
	S&P 500 Low Volatility Rate Response Risk Control Indices
	S&P 500 Low Volatility High Dividend Risk Control Indices
	S&P Nordic LargeCap Risk Control Indices
	S&P Italy LargeMidCap Capped Risk Control Indices
S&P 500 Growth Value Rotator Daily Risk Control 5% Index (USD) ER	
Emerging Market Risk Control Indices	S&P BRIC 40 Risk Control Indices
	S&P BRIC High Yield Risk Control Indices
	S&P BRICT Risk Control Indices
	S&P Latin America 40 Risk Control Indices
	S&P/BMV Mexico Risk Control Indices
	S&P Southeast Asia 40 Risk Control Indices
	S&P Africa 40 Risk Control Indices
	S&P Access Africa Risk Control Indices
	S&P Next Emerging 40 Risk Control Indices
	S&P Emerging Asia 40 Risk Control Indices
S&P Pan Asia Low Volatility Risk Control Indices	

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

<b>Exhibit 10: S&amp;P Risk Control Indices (cont.)</b>	
<b>INDEX CATEGORY</b>	<b>INDEX SERIES</b>
Global Thematic Risk Control Indices	Dow Jones Brookfield Global Infrastructure Daily Risk Control Indices
	S&P Asia Infrastructure Risk Control Indices
	S&P Emerging Markets Infrastructure Indices
	S&P Global Clean Energy Risk Control Indices
	S&P Global Infrastructure Risk Control Indices
	S&P Global Natural Resources Risk Control Indices
	S&P Latin America Infrastructure Risk Control Indices
	S&P 500 Buyback Risk Control Indices
	Dow Jones U.S. Real Estate Risk Control Indices
Commodities Risk Control Indices	S&P GSCI Risk Control Indices
	S&P GSCI Dynamic Roll Risk Control Indices
	S&P GSCI Dynamic Roll Alpha Light Energy Risk Control Indices

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

<b>Exhibit 11: S&amp;P Risk Control Indices Performance</b>								
INDEX NAME	RETURN/VOLATILITY (ANNUALIZED)							
	15-YEAR		10-YEAR		5-YEAR		3-YEAR	
S&P 500	10.73	15.17	14.84	13.59	17.65	14.99	18.67	18.52
S&P 500 Low Volatility Index	10.01	11.56	12.28	11.00	9.92	12.40	11.37	15.11
S&P 500 Dynamic VEQTOR Index	10.01	11.68	7.65	8.99	10.67	9.26	9.95	10.51
<b>S&amp;P 500</b>								
S&P 500	10.73	15.17	14.84	13.59	17.65	14.99	18.67	18.52
S&P 500 Daily Risk Control 15% Index	10.34	12.56	11.93	13.05	15.76	13.27	12.32	14.80
S&P 500 Daily Risk Control 12% Index	8.94	10.35	10.23	10.85	13.90	11.34	9.76	12.21
S&P 500 Daily Risk Control 10% Index	7.87	8.74	8.96	9.19	12.35	9.72	8.31	10.22
S&P 500 Daily Risk Control 5% Index	4.63	4.37	4.91	4.61	6.84	4.87	4.84	5.09
S&P 500 Daily RC2 15% Index	10.75	11.23	12.10	10.84	14.30	10.93	13.80	12.84
S&P 500 Daily RC2 10% Index	9.02	8.78	9.70	8.49	11.86	8.69	10.47	9.62
S&P 500 Daily RC2 8% Index	8.42	6.91	8.63	7.09	10.32	7.51	8.54	8.01
<b>S&amp;P 500 DIVIDEND ARISTOCRATS</b>								
S&P 500 Dividend Aristocrats	11.75	14.29	14.49	12.84	13.64	14.80	16.33	18.00
S&P 500 Dividend Aristocrats Daily Risk Control 15% Index	11.48	12.71	12.35	13.38	11.49	14.26	10.40	15.85
S&P 500 Dividend Aristocrats Daily Risk Control 12% Index	9.83	10.50	10.46	11.14	10.33	12.13	8.08	13.07
S&P 500 Dividend Aristocrats Daily Risk Control 10% Index	8.72	8.87	9.23	9.46	9.57	10.41	6.98	10.97
S&P 500 Dividend Aristocrats Daily Risk Control 8% Index	7.38	7.09	7.67	7.57	8.08	8.34	6.02	8.77
S&P 500 Dividend Aristocrats Daily Risk Control 5% Index	5.32	4.42	5.26	4.72	5.75	5.20	4.53	5.47
<b>S&amp;P 500 LOW VOLATILITY</b>								
S&P 500 Low Volatility Index	10.01	11.56	12.28	11.00	9.92	12.40	11.37	15.11
S&P 500 Low Volatility Daily Risk Control 15% Index	12.34	12.60	13.49	13.07	11.62	12.96	12.78	14.58
S&P 500 Low Volatility Daily Risk Control 12% Index	10.66	10.73	11.39	11.28	10.24	11.46	10.70	12.40
S&P 500 Low Volatility Daily Risk Control 10% Index	9.40	9.14	9.89	9.67	9.35	9.96	9.17	10.50
S&P 500 Low Volatility Daily Risk Control 8% Index	8.05	7.38	8.39	7.84	8.33	8.17	7.76	8.41
S&P 500 Low Volatility Daily Risk Control 5% Index	5.74	4.60	5.71	4.91	5.93	5.12	5.60	5.27
<b>S&amp;P BRIC</b>								
S&P BRIC 40	7.98	23.76	5.18	19.91	15.58	17.20	10.67	18.64
S&P BRIC 40 Daily Risk Control 18% Index	6.48	18.02	3.85	18.54	16.18	17.53	8.09	18.06
S&P BRIC 40 Daily Risk Control 15% Index	6.04	15.09	3.83	15.55	14.31	14.75	7.25	15.04
S&P BRIC 40 Daily Risk Control 10% Index	4.82	10.06	3.16	10.37	10.21	9.78	5.67	10.00
S&P BRIC 40 Daily Risk Control 5% Index	3.39	5.05	2.26	5.19	6.02	4.84	3.87	4.97
S&P BRIC 40 Daily RC2 15% Index	7.02	15.10	3.62	15.12	12.69	14.15	7.76	14.81
S&P BRIC 40 Daily RC2 10% Index	5.55	10.24	3.35	10.49	9.23	10.00	6.11	10.22
S&P BRIC 40 Daily RC2 8% Index	4.92	8.35	2.90	8.48	7.16	8.19	5.28	8.44

Source: S&P Dow Jones Indices LLC. Data as of June 30, 2021. Index performance based on total return in USD. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information about the inherent limitations associated with back-tested performance.

## PERFORMANCE DISCLOSURE/BACK-TESTED DATA

The S&P 500 Daily Risk Control 5% Index and S&P 500 Daily Risk Control 15% Index were launched Sept. 9, 2010. The S&P 500 Daily Risk Control 10% Index was launched May 13, 2009. The S&P 500 Daily Risk Control 12% Index was launched April 21, 2010. The S&P 500 RC2 Indices (10% and 15%) were launched May 26, 2011. The S&P 500 RC2 8% Index and S&P BRIC 40 Daily RC2 Indices (8%, 10%, and 15%) were launched June 3, 2011. The S&P BRIC 40 Risk Control 18% Index was launched Nov. 17, 2008. The S&P BRIC 40 Daily Risk Control Indices (5%, 10%, and 15%) were launched Sept. 16, 2009. The S&P BRIC 40 was launched June 20, 2006. The S&P 500 Dividend Aristocrats was launched May 2, 2005. The S&P 500 Dividend Aristocrats Daily Risk Control Indices (5%, 10%, 12% and 15%) were launched Aug. 25, 2010. The S&P 500 Low Volatility Index was launched April 4, 2011. The S&P 500 Low Volatility Daily Risk Control Indices (5%, 10%, 12%, and 15%) were launched Aug. 18, 2011. The S&P 500 Dynamic VEQTOR Index was launched Nov. 18, 2009. All information presented prior to an index's Launch Date is hypothetical (back-tested), not actual performance. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. Complete index methodology details are available at [www.spglobal.com/spdji](http://www.spglobal.com/spdji). Past performance of the Index is not an indication of future results. Back-tested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results. Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations. Back-tested performance is for use with institutions only; not for use with retail investors.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its data feed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate S&P DJI's ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance. "Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the [FAQ](#). The methodology and factsheets of any index that employs backward assumption in the back-tested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used.

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