Dr. Jan-Carl Plagge, Head of Applied Research, STOXX Ltd.





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Abstract

The EURO STOXX 50® Multi-Asset Momentum Risk Cap indices combine the performance of two components – the EURO STOXX 50® and the EURO STOXX 50® Corporate Bonds Index. The allocation between these two underlying indices is hereby based on a combination of a momentum strategy and a cap on volatility. In order to account for differences in investors' risk preferences, indices with volatility caps of 5%, 7,5%, 10%, 15% and 20% are available.

The empirical analysis indicates that a binary momentum strategy based on the EURO STOXX 50 and the EURO STOXX 50 Corporate Bonds Index delivers superior performance results over the time period analyzed, hereby outperforming single index investments into either the EURO STOXX 50 or the EURO STOXX 50 Corporate Bonds index. The combination of momentum with a risk ceiling enables investors to profit from the performance-increasing effect stemming from the momentum factor while simultaneously being sensitive to risk. The offering of various risk caps allows investors to find their individually preferable trade-off between risk and return. However, additional return is found to come for the price of additional risk. Thus, the lower the risk ceiling, the lower the expected return.

Index Methodology

The EURO STOXX 50 Dynamic Multi-Asset Indices combine the performance of two components – the EURO STOXX 50 Equity and Corporate bond indices.

The allocation between the two underlying indices is hereby based on a combination of a momentum strategy and a cap on volatility.

The strategy incorporates the momentum factor with the aim to increase absolute returns. Empirical research suggests that momentum strategies contribute positively to overall returns. This observation is explained, among other factors, by human behavior. Investors tend to overreact to information which may cause prices to move further away from fundamentals and extend past performance patterns into the future. However, the momentum factor works in both directions, positive and negative. In order to capture this factor and to simultaneously consider its trajectory, both sub-indices are sorted in ascending order based on their past 60-day performance while the index with higher historical performance is selected (subject to risk ceilings described below): If both indices generated a positive past performance, the strategy seeks to invest as much as possible into the index with the higher historical performance; whereas if both indices generated negative past performance, the strategy seeks to invest performance.

In order to additionally account for differences in investors' risk preferences, the momentum strategy is combined with a risk control component in the form of a volatility ceiling. The EURO STOXX 50 Dynamic Multi-Asset Indices are available with risk caps of 5%, 7,5%, 10%, 15% and 20.

In a first step, both underlying indices are ranked according to their momentum, with momentum defined as historical 60-day performance. The application of the volatility-cap as second step is case dependent. The following cases need to be distinguished:

Case 1: If the historical 60-day volatility of the sub-index with the higher momentum is below the ex-ante defined maximum risk level, 100% of the overall investment is allocated into this index. Thus, the ex-ante defined maximum risk level is a non-binding constraint as the preferred investment, the index with higher momentum, has a volatility which falls below the maximum.

Case 2: If the index with higher momentum violates the volatility threshold while the sub-index with the lower momentum falls below the threshold, a trade-off between volatility and momentum is sought. In this scenario, the risk-ceiling becomes a binding constraint in the form of a target-risk level. The weights of both indices are determined in such a way that the maximum possible share is invested in the sub-index with the higher momentum while adhering to the risk-cap.

Case 3: If the historical 60-day risk levels of both sub-indices range above the defined ceiling, 100% of the overall investment is allocated to the index with the lower realized volatility.

Thus, the index methodology tries to balance the importance of both factors, momentum and volatility. In case 1, the allocation is entirely driven by momentum as volatility is a non-binding constraint. In case 2, where the index with higher momentum violates the volatility threshold but the "second best alternative" falls below this threshold, an effective tradeoff between volatility and momentum is sought. In case 3,

where the volatilities of both sub-indices violate the upper volatility bound, the strategy aims for "damage control" by choosing the investment alternative that violates the volatility constraint the least, hereby ignoring the momentum signal.

The regular rebalancing takes place on a quarterly basis at the last trading day of the months, March, June, September and December. In order to react to substantial changes in the relation of targeted and realized risk as they may arise between two regular rebalancings, an extraordinary rebalancing takes place whenever the historical volatility of the previously determined portfolio allocation exceeds the risk-cap by more than 20%.¹

Risk and Return Characteristics

In order to better understand the characteristics and performance drivers of the EURO STOXX 50 Dynamic Multi-Asset Indices, the empirical analysis focuses on a decomposition of a) the underlying subindices and b) the different strategy-components.

Figure 1 graphically displays the historical performance of the underlying indices, the EURO STOXX 50 and the EURO STOXX 50 Corporate Bonds index as well as the performance of a strategy which is constructed purely based on the momentum-factor, hereby ignoring the risk ceiling. At the bottom of Figure 1, the asset allocation of the momentum strategy is given.



FIGURE 1: INDEX PERFORMANCE AND ASSET ALLOCATION 03/2011 TO 05/2016.

Source: STOXX

¹ Please refer to the Appendix for a detailed overview of the underlying calculation steps.

It can be observed that the momentum strategy lead to very favourable risk and return characteristics compared to stand alone investments into the underlying indices. While it mostly ignored the bear market in 2011 by being fully invested in the EURO STOXX 50 Corporate Bonds index at the time of the peak of the crisis, it shifted to equity just in time to participate in the recovery periods of 2012 to 2014. However, in early 2015 when the EURO STOXX 50 index saw its most significant positive performance, the momentum signal favoured the bond space, thus, missing out on this positive trend. A position, however, that turned out to be favourable towards the second half of 2015 when equity markets started to contract again.

The question now arises of how the introduction of a risk-ceiling affects the behaviour of the momentum strategy. In order to address this question, the impact of a risk ceiling is demonstrated based on a comparable moderate 10% risk-cap.



FIGURE 2: INDEX PERFORMANCE AND ASSET ALLOCATION 03/2011 TO 05/2016.

The top of Figure 2 compares the performance of the EURO STOXX 50 Multi-Asset 10% Risk Cap index with that of both sub-indices as well as with the previously discussed pure momentum index.

We find that the index performance is very similar to that of the pure momentum strategy. However, overall returns are a slightly lower. The lower overall performance can be explained when looking at the asset allocation of the index strategy (see bottom of Figure 2). We find that in all periods in which the pure momentum strategy was fully invested in equity, i.e. in the EURO STOXX 50 index, the addition of a

risk-ceiling of 10% lead to a partial investment also into bonds. Thus, the allocation within those periods are described by the case-2 scenario: *If the index with higher momentum (i.e. the EURO STOXX 50) violates the volatility threshold while the sub-index with the lower momentum (i.e. the EURO STOXX 50 Corporate Bonds index) falls below the threshold, an effective tradeoff between volatility and momentum is sought. In this scenario, the risk-ceiling becomes a binding constraint in the form of a target risk level in order to invest the maximum possible share into the sub-index with the higher momentum(i.e. the EURO STOXX 50). In other words, we find that the participation in the equity index is partially sacrificed for the sake of sticking to the ex-ante defined maximum risk level.*

The relation between volatility, the chosen risk-ceiling and the resulting multi-asset allocation becomes even more apparent when graphically displaying historical volatility levels of both sub-indices and the resulting asset allocations, again for the case of a ten 10% risk ceiling (see Figure 3).



FIGURE 3: HISTORICAL VOLATILITIES AND ASSET ALLOCATION 03/2011 TO 05/2016.

Source: STOXX

We find that volatility levels of the EURO STOXX 50 Corporate Bonds index were constantly below the ceiling of 10% while volatility levels of the EURO STOXX 50 index were constantly above the ceiling. Thus, we did not encounter a Case 3 scenario (a scenario where the volatilities of both indices were above the targeted ceiling). This leaves us with Cases 1 and 2. In all scenarios where the index was fully invested in either equity of bonds, the allocation followed Case 1., i.e. an allocation driven purely by the momentum factor. In any other case, the allocation was based on a trade-off between adhering to the risk ceiling and momentum.

As mentioned, this tradeoff comes for the price of a deviation from the maximum performance achievable by investing in a pure momentum factor. The extent of this tradeoff is displayed graphically (Figure 4) as well as numerically (Table 5) for all index versions available.



FIGURE 4: INDEX PERFORMANCE OVER TIME PERIOD 03/2011 TO 05/2016.

Source: STOXX

TABLE 1: RISK AND RETURN CHARACTERISTICS BASED ON TIME PERIOD 03/2011 TO 05/2016.

	EURO STOX> 50	EURO ⁽ STOXX 50 Bonds	₎ Momentu m Only	Momentu m + 5%	Momentu m + 7.5%	Momentu m + 10%	Momentu m + 15%	Momentu m + 20%
Return (Overall)	5.55%	5.43%	6.47%	5.65%	5.70%	5.77%	6.05%	6.16%
Return 1y (ann.)	-10.93%	2.13%	-9.94%	-0.66%	-2.59%	-4.47%	-7.35%	-9.79%
Return 3y (ann.)	7.18%	3.71%	4.87%	4.17%	4.44%	4.63%	5.12%	4.93%
Volatility (Overall)	20.83%	2.54%	12.84%	4.42%	6.07%	7.81%	10.64%	12.07%
Volatility 1y (ann.)	23.60%	2.09%	14.32%	3.97%	5.59%	7.30%	10.58%	13.08%
Volatility 3y (ann.)	18.95%	1.93%	12.68%	4.33%	6.25%	8.23%	11.03%	12.23%
Sharpe Ratio (Overall)	0.2666	2.1322	0.5037	1.2782	0.9398	0.7382	0.5685	0.5106
Sharpe Ratio 1y	-0.4632	1.0147	-0.6941	-0.1663	-0.4631	-0.6119	-0.6949	-0.7490
Sharpe Ratio 3y	0.3790	1.9241	0.3843	0.9634	0.7096	0.5629	0.4648	0.4031
Max. Drawdown	31.90%	3.29%	24.04%	6.29%	9.62%	12.78%	18.00%	22.31%

Source: STOXX

Measured over the entire time period observed, the pure momentum strategy generated the highest annual return with 6.5%. The lower the risk-ceiling of the EURO STOXX 50 Multi-Asset Risk Cap index, the lower the overall performance.

However, additional return comes for the price of additional risk as indicated by volatility figures. The index with a 5% risk ceiling has an overall realized volatility of only 4.42% while the index with a risk ceiling of 20% has an overall annualized volatility of 12%. This reasoning is further underscored when looking at maximum drawdown figures. While a 5% risk ceiling experienced a maximum drawdown of just 6.29% over the time period observed, the 20% risk ceiling version suffered from a maximum drawdown of 22.31%.

Thus, investors need to balance risk against performance in order to find the multi-asset solution that best suits their individual risk preferences.

Summary

The EURO STOXX 50 Multi-Asset Momentum Risk Cap indices combine the performance of two components – the EURO STOXX 50 and the EURO STOXX 50 Corporate Bonds Index. The allocation between these two underlying indices is hereby based on a combination of a momentum strategy and a cap on volatility. In order to account for differences in investors' risk preferences, indices with volatility caps of 5%, 7,5%, 10%, 15% and 20% are available.

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Appendix

The EURO STOXX 50 Multi-Asset Risk Cap indices involve dynamically allocated long positions into the EURO STOXX 50 Equity and Corporate Bond Indices at each quarterly rebalancing.

A.1 Regular Rebalancing:

STEP 1 - Calculation of historical price momentum of both sub-indices

$$M \qquad \qquad \qquad m_{r_{1},i} = \frac{U_{r_{1},-1,i}}{U_{r_{1},-60,i}} - 1$$

STEP 2 - Ranking of sub-indices by momentum in ascending order

STEP 3 – Determination of weights of both sub-indices

Case I: If RealizedVol_{t,rank1} \leq RiskCap, set $w_{rank1} = 1$, $w_{rank2} = 0$.

RealizedVol_{t,i}=
$$\sqrt{\frac{252}{59} * \sum_{s} \left[ln \left(\frac{U_{s,i}}{U_{s-1,i}} \right) \right]^2}$$

Case II: If RealizedVol_{t,rank1} > RiskCap:

3 a. RealizedVol_{t,rank2} ≤ RiskCap, set PortfolioVol_{t,MA} = RiskCap and solve for w_{rank1}, where:

$$PortfolioVol_{t, MA} = \sqrt{w_{rank1}^{2} * RealizedVol_{rank1}^{2} + w_{rank2}^{2} * RealizedVol_{rank2}^{2} + 2^{*}w_{rank1} * w_{rank2} * RealizedCov_{rank1,rank2}}$$

with:

RealizedCov_{t,rank1,rank2} =
$$\frac{252}{59} \times \sum_{s} \left[\ln \left(\frac{U_{s,rank1}}{U_{s-1,rank1}} \right) \times \ln \left(\frac{U_{s,rank2}}{U_{s-1,rank2}} \right) \right]$$

w_{rank1}+w_{rank2}=1

w_{rank1},w_{rank2}≤1

w_{rank1},w_{rank2}≥0

3 b. RealizedVol_{t,rank2} > RiskCap, use 100% weight for the sub-index with the lower RealizedVol.

STEP 4 – Assign w_{rank1} and w_{rank2} to the relevant $w_{reb,i}$.

A.2 Extraordinary Rebalancing:

At any other calculation day recalculate $P_{t,M}$ and check whether it breaches the RiskCap adjusted with 20% tolerance buffer:

a. PortfolioVol_{t,MA} \leq 1,2 * RiskCap, no changes required, use previous weights.

b. PortfolioVol_{t,MA} > 1,2 * RiskCap, set PortfolioVol_{t,MA} = RiskCap and solve for w_{rank1} (refer to formulas in Case II a.) Assign the new calculated weights w_{rank1} and w_{rank2} to the relevant $w_{reb,i}$.

A.3 Index calculation:

At any calculation time t, the value of a EURO STOXX 50 Multi-Asset Risk Cap index value is calculated as follows:

$$|V_t = |V_{reb} \times \sum_{i=1}^2 w_{reb,i} \times \frac{U_{t,i}}{U_{reb,i}}$$

With:

U _{t,i}				Value of sub-index i (bond or equity) at time t
S				t-59 to t-1
R	t,i			Realized volatility measured over 60 days for sub-index i at day t
RiskCap				Predefined maximum level of volatility (i.e. 5%, 7,5%, 10%, 15% or 20%)
R	r	1,r	2	Covariance of the bond and equity sub-indices
R	t,M			Realized volatility measured over 60 days for multi-asset index i at time t
W _{reb,i}				Weight of sub-index i at rebalancing date or intra-monthly weight change date
U _{reb,i}				Close value of sub-index i at rebalancing date or intra-monthly weight change date
IVt				Index value at time t
IV _{reb}				Index close value at last rebalancing date or extraordinary weight change date
reb				Last rebalancing date of the bond index, which is the last trading day of March, June,
				September and December or extraordinary weight change date

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www.stoxx.com

Selnaustrasse 30 CH-8021 Zurich P +41 (0)58 399 5300 stoxx@stoxx.com www.stoxx.com

Frankfurt: +49 (0)69 211 13243 London: +44 (0)20 7862 7680 New York: +1 212 669 6426 Tokyo: +81-3-4578-6688 / 03-4578-6688



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