

JULY 2011

iSTOXX[®]

METHODOLOGY GUIDE



STOXX

INNOVATIVE. GLOBAL. INDICES.

1. INTRODUCTION TO THE STOXX INDEX GUIDES	3
2. CHANGES TO THE GUIDE BOOK	4
2.1. HISTORY OF CHANGES TO THIS METHODOLOGY GUIDE	4
3. iSTOXX EUROPE MINIMUM VARIANCE	5
3.1. iSTOXX EUROPE MINIMUM VARIANCE INDICES	5
3.1.1. OVERVIEW	5
3.1.2. INDEX REVIEW	6
3.1.3. ONGOING MAINTENANCE	8
4. iSTOXX WORLD SELECT INDEX	10
4.1. iSTOXX WORLD SELECT INDEX	10
4.1.1. OVERVIEW	10
4.1.2. INDEX REVIEW	11
4.1.3. ONGOING MAINTENANCE	11

1. INTRODUCTION TO THE STOXX INDEX GUIDES

The STOXX index guides are separated into the following sub-sets:

- » The STOXX calculation guide provides a general overview of the calculation of the STOXX indices, the dissemination, the index formulas and adjustments due to corporate actions.
- » The STOXX methodology guide contains the index specific rules regarding the construction and derivation of the indices, the individual component selection process and weighting schemes.
- » The STOXX strategy guide contains the formulas and description of all non-equity/strategy indices.
- » The STOXX dividend points calculation guide describes the STOXX dividend points products.
- » The iSTOXX methodology guide contains the index specific rules regarding the construction and derivation of the indices, the individual component selection process and weighting schemes of the iSTOXX family.

2. CHANGES TO THE GUIDE BOOK

2.1. HISTORY OF CHANGES TO THIS METHODOLOGY GUIDE

- June 2011: Publication of a completely new rule book
- Juli 2011: Inclusion of iSTOXX World Select

3. iSTOXX EUROPE MINIMUM VARIANCE

3.1. iSTOXX EUROPE MINIMUM VARIANCE INDICES

3.1.1. OVERVIEW

The aim of the index is to minimize the volatility of the STOXX Europe 600. To do so, the portfolios' variance is minimized based on historical price data. The optimization process including all relevant constraints is described in detail below.

The concept significantly reduces the variance of the STOXX Europe 600 portfolio with far fewer stocks included. It therefore offers the possibility to achieve a much better risk profile without the need to trade all 600 components of the STOXX Europe 600.

Universe: Stocks of the current composition of the STOXX Europe 600 index. Only the stocks that have a price and volume history for at least the past N days will be considered for inclusion in the index.

Weighting scheme: The index is price weighted.

Index value formula:

$$\text{Index}_t = \frac{\sum_{i=1}^M P_t^i q_i^i C_t}{D_t}$$

The divisor D transforms the value of the hypothetical index portfolio into index level, and ensures continuity of the index after accounting for the transaction costs. The quantities q_i are weighting factors, that are defined as

$$q_t^i = \frac{w_t^i}{P_t^i C_t}$$

At each rebalancing date T each stock is assigned a weighting factor that is based on its target weight and on the day T closing price. If there are no corporate actions or extraordinary adjustments in the composition of the investment universe, the rebalancing factors will remain unchanged until the next rebalancing date.

Adjustment for transaction costs: The index value undergoes adjustments on rebalancing dates that aim to account for transaction costs incurred during the rebalancing. At every rebalancing date a turnover is calculated as the sum of the absolute values of weights just before the rebalancing minus the weights just after the rebalancing for all components:

$$\text{turnover}_t = \sum_{i=1}^M |w_t^i - \tilde{w}_t^i|$$

w = weights just before rebalancing

\tilde{w} = weights just after rebalancing

Total transaction costs for the rebalancing is calculated as a fixed transaction fee θ times turnover

$$\text{TCost}_T = \theta \cdot \text{turnover}_T$$

Index divisor is adjusted as:

$$D_T = D_{T_{\text{prev}}} \frac{1}{(1 - \text{TCost}_T)}$$

T_{prev} the previous rebalancing date

Base values and date: At May 20, 2011 the Index value is set to the Base Level of 100.

3. iSTOXX EUROPE MINIMUM VARIANCE

Index types and currency: The index is calculated in EUR as price and net-return version.

Trading and holidays: The index is calculated and disseminated according to XETRA dissemination calendar.

3.1.2. INDEX REVIEW

The universe as defined by the STOXX Europe 600 is screened for the following criteria:

Liquidity: Only the most liquid stocks from the investment universe are selected. Liquidity is estimated for each stock, using most recent transaction volume data from the primary exchange. Then the Average Daily Volume is calculated as a simple average of the daily transaction volume series over the past T_v days:

$$ADV^i = \frac{1}{T_v} \sum_{t=T-T_v}^T V_t^i \cdot P_t^i \cdot C_t$$

T = estimation date

V_t^i = volume in number of shares of index component (i) at time (t)

P_t^i = stock price in home currency of index component (i) at time (t)

C_t = relevant exchange rate against the Euro at time (t)

The stocks from the investment universe are ranked by their ADV in descending order. The first M stocks featuring the highest liquidity are selected. The liquidity filter is applied when index is rebalanced, i.e. before calculating new optimized weights.

Data: The following data is used in the index construction process:

P daily stock prices at market close in local currency,

TR daily share gross return price in local currency. The gross return price is adjusted for corporate actions and dividend payments,

V daily transaction volume from primary exchanges,

C foreign exchange rates

Additionally, the classification of the STOXX Europe 600 Index by industrial sector corresponding to level 1 of the ICB classification is used:

Component selection: Index constituents are weighted by an optimization procedure, aimed at minimizing portfolio variance under constraints.

Return Data: The optimization procedure starts by calculating daily arithmetic price returns according to the following formula:

$$r_t^i = \frac{TR_t^i \cdot C_t}{TR_{t-1}^i \cdot C_{t-1}} - 1$$

(t-1) = previous business day

TR = close total return prices

C = relevant exchange rate against the Euro

Variance Estimation Details: For all the stocks admitted to the optimization step a variance-covariance matrix is estimated as follows:

3. iSTOXX EUROPE MINIMUM VARIANCE

$$\sum_T^{i,j} = \delta_T^i \cdot \delta_T^j \cdot \rho_T^{ij}$$

M = number of stocks admitted for optimization

δ^i = volatility of stock (i)

ρ^i = correlation between stock (i) and (j)

The ingredients of the covariance matrix are estimated on arithmetic daily returns as follows:

$$\delta_T^i = \sqrt{\frac{1}{T_s - 1} \sum_{t=T-T_s+1}^T (r_t^i - \bar{r}^i)^2}$$

T_s = volatility estimation period in days

\bar{r} = simple average of stock returns

Correlation coefficients are estimated as

$$\rho_T^{i,j} = \frac{\frac{1}{T_r - 1} \sum_{t=T-T_r+1}^T (r_t^i - \bar{r}^i)(r_t^j - \bar{r}^j)}{\sigma_T^i \cdot \sigma_T^j}$$

T_r correlation estimation period in days; volatilities in the denominator are estimated over the T_r -day period

Only the days when equity markets were open are included in the estimation of the means and the variance-covariance.

Optimization:

Objective function: The function to be minimized is the variance of the index portfolio:

$$\sigma_{ind}^2 = \sum_{i=1}^M \sum_{j=1}^M w_i \sum_{ij} w_j$$

Constraints: The optimization is subject to the following constraints:

100% leverage constraint: $\sum_{i=1}^M w_i = 1$

Long-only constraint: $w_i \geq 0$, for all i

Maximal weight constraint: $w_i \leq w_{max}$

Maximal sector exposure constraint: $w_i \leq w_{max}$ where $w_s = \sum_{i \in S} w_i$ is the net exposure to the sector S.

Diversification target: $\sum_{i=1}^M w_i^2 = \frac{1}{H}$

Numerical Algorithm: The optimization problem is a quadratic constrained minimization problem. It is solved numerically, using the interior-point algorithm. This algorithm solves an iterative sequence of approximate minimization problems, where inequality constraints are transformed into equality constraints using slack variables. The optimal solution is defined with the help of the following convergence criteria:

TolFun termination tolerance on the function value

TolCon tolerance on the constraint violations

MaxIter maximal number of iterations allowed

3. iSTOXX EUROPE MINIMUM VARIANCE

Rounding Issues: Input data to the optimization, as well as all intermediate calculations, are not rounded. The optimized weights that are smaller than *wtol* (i.e. that are essentially zero) are rounded to exact zero.

Estimation Period Definition: For the variance estimation procedure we only consider days when all stock exchanges where components of the STOXX Europe 600 index trade are actually open. So, if on a certain date at least one of the exchanges is closed, this day is omitted from the historical series used to estimate the stocks' variance-covariance matrix.

The same restriction is applied to the liquidity (ADV) estimation.

Review frequency: The reviews are conducted on a monthly basis, on the third Friday of each month. The new index composition and weights becomes effective on the rebalancing date, immediately after the market close. The weighting factors are calculated after the market close at the reference date that is *K* business days prior to the rebalancing date.

Derived indices: not applicable

Parameters

N	= 10%	maximum share of missing values inside observation period accepted
Tv	= 50 days	liquidity estimation period
M=	= 300	number of the most liquid stocks selected by liquidity filter
Ts	= 125 days	volatility estimation period
Tr	= 500 days	correlation estimation period
wmax	= 4.5%	maximum weight
Smax	= 20%	upper bound for single sector exposure
Sect. Classif	= ICB	Sector classification
H	= 50	Inverse diversification target
TolFun	= 10^{-12}	termination tolerance on the objective function value
TolCon	= 10^{-8}	tolerance on constraints violation
MaxIter	= 10^{12}	maximal number of iterations
Wtol	= 10^{-5}	significance threshold for weights
θ	= 0.0003	fixed transaction fee
K	= 2 days	gap between weight calculation date and rebalancing date

3.1.3. ONGOING MAINTENANCE

Treatment of corporate actions:

Share and price adjustments that do not affect the membership of the index or their risk characteristics do not lead to changes in the index value or composition. Below are the maintenance rules for the most common corporate actions. For all the cases not explicitly mentioned in this document or in case of doubts the maintenance is made according to the general practices of the STOXX index family.

Spin-offs: A spin-off is added to the index with a price of zero; the close of the original company is not adjusted. The spin-off will be deleted after the first trading day with the closing price.

New weighting factor of the spin - off = weighting factor of the parent company $\cdot \frac{B}{A}$

Shareholders will receive "B" new shares for every "A" share held

3. iSTOXX EUROPE MINIMUM VARIANCE

Merger & Acquisition: We denote companies by the capital letters A, B, C to demonstrate consequences of M&A.

A takes over B and forms company C

a) if A and B are in the index:

$$w_c = \min(w_A + w_B, w_{\max})$$

$$wf_c = \min\left(\frac{wf_A \cdot p_A}{\sum_{i=1}^n wf_i \cdot p_i} + \frac{wf_B \cdot p_B}{\sum_{i=1}^n wf_i \cdot p_i}, \frac{w_{\max}}{p_C}\right)$$

wf = weighting factor

p = price of constituent in index currency

w = weight of constituent

b) if A is in the index, and B is not: $w_c = w_A$

$$\text{new weighting factor (c)} = \text{old weighting factor (c)} \cdot \frac{B}{A}$$

Shareholders will receive "B" new shares for every "A" share held

c) if only B is in the index:

The acquired stock is eliminated from the index and the proceedings are reinvested pro-rata in the remaining stocks.

Share conversion: If a company converts its shares from one class to another the weighting factor is adjusted in the following way:

$$\text{new weighting factor} = \text{old weighting factor} \cdot \frac{B}{A}$$

Shareholders will receive "B" new shares for every "A" share held

Class A shares that are converted into non-component class B-shares are kept in the index until the next rebalancing. The new share class (B-shares) is considered a new entity after the next review, if it is a component of the investment universe. It does not inherit the historical price/volume data of the old share class (A-shares)

Fast Exits: If a company that is currently present in the index is excluded from the investment universe between two subsequent rebalancing dates, it is not replaced and its weight is distributed pro-rata among the remaining stocks:

4. iSTOXX WORLD SELECT INDEX

4.1. iSTOXX WORLD SELECT INDEX

4.1.1. OVERVIEW

The iSTOXX World Select Index is a blue-chip representation of the EURO STOXX 50 countries, Japan and the USA.

Universe: The universe is defined as the EURO STOXX 50, STOXX Japan 50 and STOXX USA 50 Index ("the underlying indices").

Weighting scheme: The underlying three indices are equally weighted to form the iSTOXX World Select Index.

Index value formula:

$$\text{Index}_t = \frac{\sum_{i=1}^3 \text{Weight Factor}_{it} \cdot \text{Index Value}_{it}}{\text{Divisor}_t}$$

Where:

$$\text{Weight Factor}_i = \frac{\text{Target Weight}}{\text{Index Value}_{it}}$$

Where:

$$\text{Target Weight} = \frac{1}{\text{Number of Indices}} = \frac{1}{3}$$

Component files are not being produced, because index calculation is based on index values level and not on individual component level. However, to get the component weights, one can get index weights from original files (i.e. EURO STOXX 50, STOXX Japan 50 and STOXX USA 50 component files). These weights then have to be multiplied by the corresponding single index weight within the combined index that is provided in the historical index file. Weights are calculated as follows:

$$\text{Weight}_{\text{index}_{it}} = \frac{\text{Weight Factor}_{it} \cdot \text{Index Value}_{it}}{\sum_{i=1}^3 \text{Weight Factor}_{it} \cdot \text{Index Value}_{it}}$$

The index weight changes daily (or every 15 seconds for the real-time index) and is used to calculate weights of the individual stocks within the iSTOXX World Select Index. The index weight factor changes every 3 months and serves as an input for the index value calculation.

Consequently, single stock weight is calculated as follows:

$$\text{Weight}_{\text{stock}_{jkt}} = \text{Weight}_{\text{index}_{it}} \cdot \text{Weight}_{\text{stock}_{jit}}$$

Base values and date: 1,000 on 28 December 2001.

Index type and currencies: Price, net return in EUR and USD and gross return in EUR.

4. iSTOXX WORLD SELECT INDEX

4.1.2. INDEX REVIEW

Component selection: The index combines all stocks of the underlying indices.

Review procedure: The iSTOXX World Select Index is composed of the underlying indices. .

Review frequency: The underlying indices are reviewed according to their defined index methodology. The combined iSTOXX World Select Index is equal weighting the underlying indices quarterly.

Derived indices: not applicable.

4.1.3. ONGOING MAINTENANCE

Corporate action adjustments are done on the level of the underlying indices