BIST RISK CONTROL INDICES METHODOLOGY

1. DEFINITION

Risk Control Indices provide investors the opportunity to invest in an asset class or an index at a predetermined level of volatility. These indices comprise of two components: an underlying asset or index, such as BIST 100, and another asset or index, which is assumed to be risk-free, such as BIST-KYD Repo Index (Net). By dynamically changing the weights of the underlying index and the repo index in the index portfolio, it is aimed that the volatility level of the Risk Control Index is fixed at the predetermined target volatility level. In other words, weight of the underlying index is decreased during the high volatility periods and increased during the low volatility periods.

Risk Control indices are calculated based on the closing values of underlying index and repo index.

Base date of the indices are December 31, 2003 and base values are 100.

2. Calculation Methodology

It is possible to limit the volatility of an index portfolio by changing the weight of underlying index in the index portfolio, according to its realized volatility level. This is the basic principle used to construct Risk Control Indices. Accordingly, BIST Risk Control Indices have two main components; underlying index, which is aimed to be invested at a fixed level of volatility, and another index, which is assumed to represent a risk-free rate of return and used to stabilise the total volatility of the index portfolio. In order to attain target volatility level of the index, weights of these two components are rebalanced daily.

Two types of BIST Risk Control Indices are calculated; Excess Return and Total Return. While Excess Return index series reflects the daily return of the underlying index proportional to its weight in the index portfolio, Total Return index series includes return of both underlying and repo index proportional to the weights in the index portfolio.

2.1. BIST Risk Control Indices (Total Return)

Risk Control Indices (Total Return) is calculated using the formula below:

$$RK_t = (1 + RKG_t) \text{ x } RK_{t-1}$$

$$RKG_t = (W_t(DE_t/DE_{t-1} - 1) + (1 - W_t)(RE_t/RE_{t-1} - 1))$$

RK_t : Value of Risk Control Index (Total Return) on day t

RKG_t : Return of Risk Control Index (Total Return) on day t

DE_t : Closing value of the underlying index on day t

RE_t : Closing value of BIST-KYDRepo Index (Net) on day t

W_t : Weight of the underlying index on day t

2.2. BIST Risk Control Indices (Excess Return)

BIST Risk Control Indices (Excess Return) reflects only the return of the underlying index proportional to its weight in the index portfolio. It is calculated using the formula below:

$$RKG_t = (W_t(DE_t/DE_{t-1} - 1)$$

RKG_t : Return of Risk Control Index (Excess Return) on day t

DE_t : Closing value of the underlying index on day t

W_t : Weight of the underlying index on day t

2.3. Weight of the Underlying Index

Weight of the underlying index is calculated by dividing the target volatility level to the realized volatility level of the underlying index. Target volatility level is determined at the index development stage and remain unchanged through the index life. In order to limit the leverage of the underlying index during the high volatility periods, weight of the underlying index is capped in the index portfolio. Maximum weight of the underlying index is 150% in all BIST Risk Control Indices.

Weight of the underlying index in the index portfolio is calculated using the formula below:

$$W_t = \text{Min}((k/100), (HRS\ /GRS_{t-2}))$$

k : Maximum weight of the underlying index (%)

HRS : Target Volatility Level (%)

GRS_t : Realized volatility level of the underlying index on day t (%)

It is assumed that rebalancing of the weights in the index portfolio is done on day t-1 (based on the volatility values of day t-2) and the return of the rebalanced index is realized on day t. Thus, realized volatility level of day t-2 is used while calculating weight of the underlying index on day t.

In order to be able to take both short and long term volatility levels into acoount, the maximum of 21 and 63 day historical volatility values are used in BIST Risk Control Indices as shown in the formula below.

$GRS_t = \text{Max}\ (\ Vol_{t,21}, Vol_{t,63})$

$Vol_{t,21}$: 21 day historical volatility value on day t

$Vol_{t,63}$: 63 day historical volatility value on day t

2.4. Calculation of Realized Volatility

Below formulas are used in the calculation of realized volatility of the underlying index.

$$Vol_{t,n} = \sqrt{252 \times \frac{1}{n} \times \sum_{i=1}^{n} (R_{t-i+1} - \overline{R}_{t,n})^2}$$

$$R_t = InE_t - InE_{t-1}$$

$$\overline{R}_{t,n} = \frac{1}{n} \times \sum_{i=1}^{n} R_{t-i+1}$$

$Vol_{t,n}$: Realized volatility of the underlying index on day t (including day t)

E_t : Closing value of the underlying index on day t

n : Number of days used in the calculation of realized volatility of the underlying index

3. Data Sensitivity

Values of Risk Control Index	4 decimals after the integer
Values of Underlying Index	4 decimals after the integer
Values of Repo Index	2 decimals after the integer
Weights of Underlying Index	4 decimals after the integer

4. Calculated Indices

BIST Risk Control Indices are shown in the table below. Every index on the table is calculated as both total and excess return.

BIST Risk Control Index	Underlying Index	Target Volatility Level (%)	Underlying Index Maximum Weight Limit (%)
BIST 30 RK %10	BIST 30	10	150
BIST 30 RK %15	BIST 30	15	150
BIST 30 RK %20	BIST 30	20	150
BIST 30 RK %25	BIST 30	25	150
BIST 30 RK %30	BIST 30	30	150
BIST 100 RK %10	BIST 100	10	150
BIST 100 RK %15	BIST 100	15	150
BIST 100 RK %20	BIST 100	20	150
BIST 100 RK %25	BIST 100	25	150
BIST 100 RK %30	BIST 100	30	150

5. Miscellanous

Trading costs are ignored while calculating the return of BIST Risk Control Indices. Indices are calculated for the days where both equity and repo/reverse repo market are open. For the next business day after one or both of these two markets are closed, the last day, where both markets are open, is taken as the previous day (t-1) in the calculation of index return.