

Calculation Formula for the volatility indicators
on the Nikkei Stock Average (Nikkei225)

• Realized Volatility (RV) on Nikkei225 is calculated based on one minute intra-day returns in a day. As there are no index prices in the evening and nighttime (after the closing) and the lunch break (after the morning session), the returns at 9:01 and 12:31 are rate of changes from the previous day's closing and the closing in the morning session respectively.

$$RV = \sqrt{\sum_{t=1}^{300} (R_t)^2 \times 250} \times 100$$

where $t=1,2,\dots,300$, e.g. $t=1$ as 9:01, $t=300$ as the closing time of the day.

$$R_t = \ln\left(\frac{\text{Nikkei 225}_t}{\text{Nikkei 225}_{t-1}}\right)$$

• Historical Volatility (HV) on the Nikkei 225 is calculated based on daily returns for the past 20 days.

$$HV = \sqrt{\frac{1}{20} \sum_{i=1}^{20} (R_i)^2 \times 250} \times 100$$

$$R_i = \ln\left(\frac{\text{Nikkei 225}_i}{\text{Nikkei 225}_{i-1}}\right)$$

• Nikkei Stock Average Volatility Index is calculated by using the traded price on Nikkei 225 option market and the indicator represents the volatility in the one month period expected by the investors. For the details regarding the calculation formula for the VI, please refer to [the Index Guidebook for the Nikkei Stock Average Volatility Index](#).