VOLATILITY INDEX

We introduce volatility index as a measure of relative instability of an asset under review, treating volatility as a standard deviation of returns and comparing instantaneous value to one calculated over extensive period of time in the past. We use natural logarithms and exponential weights to improve statistical properties of returns and achieve more reliable results. Therefore, formulae are as follows:

$$r_i = \ln\left(\frac{S_i}{S_{i-1}}\right), \quad \text{where} \quad \begin{array}{c} r_i \text{ - return for i}th \text{ period} \\ S_i \text{ - asset price for i}th \text{ period,} \\ \text{(e. g. currency exchange rate)} \end{array}$$

$$\sigma = \sqrt{(1-\lambda)\cdot\sum_{i=2}^{T}\lambda^{T-(i-2)}(r_i - r_{avg})^2}, \quad \text{where} \quad \begin{array}{c} \sigma \text{ - volatility} \\ \lambda \text{ - decay factor} \\ r_{avg} \text{ - arithmetical mean of returns} \end{array}$$

Inclusion of the decay factor λ represents the realization of exponential weighting that consists of granting recent returns more significance and reducing the impact of the past. As a result, we correct the model by taking into consideration the changeability of standard deviations and making it more sensitive to the latest developments. The appropriate value of λ was chosen empirically and established as .89, thus making the model sensitive enough to detect the changes and stable enough not to magnify their impact. Constant T represents the number of prices used to compute volatility and is set at 50 as an equilibrium value that gives sufficient number of observations for statistical model to be applied and does not reduce the weight of the oldest returns to zero.

The base volatility is computed as a non-weighted standard deviation of returns two thousand moments prior to earliest return in above calculations. It serves to represent the general background, showing turbulence or tranquillity of a price for a particular asset. Bearing this in mind the base volatility was chosen to be a simple average, smoothing extreme values. The number of two thousand moments is extensive enough to serve the purpose without going too far into the past, which could produce the background no longer typical for the asset. Hence, the formula is:

$$\sigma_{norm} = \sqrt{\frac{\sum_{i=2}^{C}(r_i - r_{avg})^2}{C-2}}, \text{ where returns are computed over C=2000 moments.}$$

DUKASCOPY BANK VOLATILITY INDEX

To deliver an insight into the Forex market as a whole, it is required to overview the most traded currency pairs. Hence, with *i*th currency pairs characteristics specified by index *i*, the formula for calculating volatility index is

$$Index = \frac{\sum_i \sigma_i}{\sum_i \sigma_{i\,norm}}$$

Thus we get the change in stability of a group of assets in relation to its average value over the base period. The frequency chosen for data capture, and with that the measure of “moment”, is ten minutes, which, coupled with the number of prices used for one calculation (T=50), allows to highlight short-term and long-term impact, without processing excessive amount of data by making the period too narrow or overlooking the changes by making it too broad.

As may be derived from the latter formula, volatility index is notably averaged. Therewith the value of index grows or drops with overpowering rallies or dips of its components. This defines the specifics of understanding the index: value high above unity shows that the resultant volatility of assets increased in relation to its base level, whereas value below points to its decrease. Value of or close to unity gives no specific information: it can be either a product of relatively small changes in volatility of all assets, or a result of averaging high and low instabilities. In this case additional characteristics are required for proper interpretation of the index value.

To make the dynamics more accessible, we use graphical representation, displaying the index as a function of time. At each point the formula for computing the index remains as showed above, with the only change being the movement of the moments used in calculation so that the last exchange rate corresponds to respective x (time) value.

Volatility index, along with other indicators, features in our market research releases and is used to analyse the general situation on the market and the impact of concerned currency pairs.

Currently we include the following most actively traded currency pairs in order to establish accurate representation of the Forex market: EUR/USD, USD/JPY, GBP/USD, AUD/USD, USD/CAD, USD/CHF, EUR/JPY, EUR/GBP, EUR/CHF, USD/SEK and NZD/USD.