

APPROVED

by resolution of
the Executive Board of
Open Joint Stock Company «Moscow
Exchange MICEX-RTS»
(Minutes No 24 as of 11 April 2014)

Russian Market Volatility Index Methodology

1. Summary

- 1.1. The Russian Market Volatility Index (the Index) is calculated by the Moscow Exchange MICEX-RTS (the Exchange) in accordance with this methodology (the Methodology).
- 1.2. The Index's name in Russian is "Индекс волатильности российского рынка", and, in English, it is called the "Russian Market Volatility Index". The index code is "RVI".
- 1.3. The Index measures volatility over a 30 day period.

2. Calculation methodology

- 2.1. The Index is calculated every 15 seconds.
- 2.2. The Index is calculated during the main (day) and additional (evening [if any]) trading sessions on the Exchange. The Index's first value of the day and evening trading sessions is calculated five minutes after the session begins; its last value is calculated at the session's close.
- 2.3. The Index's value is expressed in points and is calculated up to two decimal places.
- 2.4. The Index is calculated in accordance with the following formula:

$$RVI = 100 * \sqrt{\frac{T_{365}}{T_{30}} * \left| T_1 * \sigma_1^2 * \left(\frac{T_2 - T_{30}}{T_2 - T_1} \right) + T_2 * \sigma_2^2 * \left(\frac{T_{30} - T_1}{T_2 - T_1} \right) \right|}$$

where:

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|-----------|--|
| T_{30} | – 30 days, expressed as a fraction of a calendar year (year = 365 days); |
| T_{365} | – 365 days, expressed as a fraction of a calendar year; |
| T_1 | – Time to expiration expressed as a fraction of a calendar year of the nearest options series; |

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- T_2 – Time to expiration expressed as a fraction of a calendar year of the next options series;
- σ_1^2 – Variance of the near-series options;
- σ_2^2 – Variance of the next-series options.

2.5. Variances of both options series are calculated as follows:

$$\sigma_1^2 = \frac{2}{T_1} \sum_{i=-7}^7 \frac{\Delta K_i}{K_i^2} * \Pr(K_i) - \frac{1}{T_1} * \left(\frac{F_1}{K_0} - 1 \right)^2$$

$$\sigma_2^2 = \frac{2}{T_2} \sum_{i=-7}^7 \frac{\Delta K_i}{K_i^2} * \Pr(K_i) - \frac{1}{T_2} * \left(\frac{F_2}{K_0} - 1 \right)^2$$

where:

- ΔK_i – Interval between strike prices (only primary strike prices are used; half-interval strike prices are ignored);
- T_1 – Time to expiration expressed as a fraction of a calendar year of the near-series options.
Updates every 15 seconds;
- T_2 – Time to expiration expressed as a fraction of a calendar year of the next-series options.
Updates every 15 seconds;
- K_i – i-th strike price. $K_i < K_{i+1}$ (only primary strike prices are used; half-interval strike prices are ignored);
- F_1, F_2 – Quotes of the futures contract. There may be options on futures contracts with different or the same expiration dates.

2.6. Value $\Pr(K_i)$ for the K_i -th option is calculated as follows:

- i. If there were trades in the K_i -th option during the current session:

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$$\Pr(K_i) = \begin{cases} \text{Deal}(K_i), & \text{if } \text{ask}(K_i) \geq \text{Deal}(K_i) \text{ and } \text{bid}(K_i) \leq \text{Deal}(K_i), \\ & \text{or no bid/ask prices available;} \\ \text{ask}(K_i), & \text{if } \text{ask}(K_i) \neq 0 \text{ and } \text{ask}(K_i) < \text{Deal}(K_i); \\ \text{bid}(K_i), & \text{if } \text{bid}(K_i) > \text{Deal}(K_i). \end{cases}$$

where:

- $\text{Deal}(K_i)$ – Last trade price of this session in the K_i -th option at a given time;
- $\text{bid}(K_i)$ – Best bid for the K_i -th option at the last moment in a given time period;
- $\text{ask}(K_i)$ – Best ask for K_i -th option at the last moment in a given time period;

ii. If there were no trades in the K_i -th option during the current session:

$$\Pr(K_i) = \begin{cases} \text{TheorPrice}(K_i), & \text{if } \text{ask}(K_i) \geq \text{TheorPrice}(K_i) \text{ and} \\ \text{bid}(K_i) \leq \text{TheorPrice}(K_i), & \text{or no bid/ask prices available;} \\ \text{ask}(K_i), & \text{if } \text{ask}(K_i) \neq 0 \text{ and } \text{ask}(K_i) < \text{TheorPrice}(K_i); \\ \text{bid}(K_i), & \text{if } \text{bid}(K_i) > \text{TheorPrice}(K_i). \end{cases}$$

where:

- $\text{TheorPrice}(K_i)$ – Theoretical price derived from the volatility smile for K_i -th option at a given time.

- To determine $\Pr(K_i)$ for seven strikes with values above the ATM strike, $\Pr(K_i)$ for call options is used;
- To determine $\Pr(K_i)$ for seven strikes with values below the ATM strike, bid/ask quotes for put options are used;
- To determine $\Pr(K_i)$ for the ATM strike, the futures quote is used in the following way: if the futures quote is higher than the ATM strike price, then $\Pr(K_i)$ for put options is used; otherwise, $\Pr(K_i)$ for call options is used.

2.7. The futures quote equals either the last trade price, or the ask price which is less than the last trade price, or the bid price which is higher than the last trade price at a given moment. If there were no trades during a given session, the midpoint between the bid/ask is taken. If no bid/ask prices are available, the settlement price is used.

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- 2.8. Two RTS Index options series are used to calculate the Index. These are determined as follows: the monthly or quarterly nearest- and the next-series options with time to expiration of more than seven days are used (weeklys are ignored).
- 2.9. The Index's values are published at www.moex.com two minutes after the Index calculation.
- 2.10. The text of the methodology is available at www.moex.com.

3. Changes to the Methodology

- 3.1. The CEO of the Exchange reserves the right to add, delete, or amend the terms of the Methodology.
- 3.2. The text of the Methodology, including any changes, is available at www.moex.com no later than one business day before the day such changes come into effect.