
vix Documentation

Release 0.1

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Apr 05, 2020

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This file shows how to reproduce the VIX given the data in [1]. The code works for any option data set, not only one day as in the White Paper. The option data for this example is exactly the same as in the Appendix 1 of the White Paper. The code is only tested on Python 3.4!

Given are the prices $C_i, i \in \{0, \dots, n\}$, of a series of European call options on the index with fixed maturity date T and exercise prices $K_i, i \in \{0, \dots, n\}$, as well as the prices $P_i, i \in \{0, \dots, n\}$, of a series of European put options on the index with the same maturity date T and exercise prices K_i . Let further hold $K_i < K_{i+1}$ for all $i \in \{0, \dots, n-1\}$.

The VIX itself is

$$VIX = 100 \cdot \sqrt{V^2},$$

where V is explained below.

Since there are days when there no options with precisely 30 days to expiration, we have to interpolate between near-term index and next-term index:

$$V^2 = \left[T_1 \sigma_1^2 \left(\frac{N_{T_2} - N_{30}}{N_{T_2} - N_{T_1}} \right) + T_2 \sigma_2^2 \left(\frac{N_{30} - N_{T_1}}{N_{T_2} - N_{T_1}} \right) \right] \frac{365}{30}$$

with each σ_i^2 computed according to

$$\sigma^2 = \frac{2}{T} \sum_{i=0}^n \frac{\Delta K_i}{K_i^2} e^{rT} M_i - \frac{1}{T} \left(\frac{F}{K_*} - 1 \right)^2,$$

where the distance between strikes is

$$\Delta K_i = \begin{cases} K_1 - K_0, & i = 0 \\ \frac{1}{2} (K_{i+1} - K_{i-1}), & i = 1, \dots, n-1 \\ K_n - K_{n-1}, & i = n \end{cases}$$

the out-of-the-money option premium is

$$M_i = \begin{cases} P_i, & K_i < K_* \\ \frac{1}{2} (P_i + C_i), & K_i = K_* \\ C_i, & K_i > K_* \end{cases}$$

at-the-money strike price is

$$K_* = \max \{K_i < F\},$$

forward price extracted from put-call parity:

$$F = K_j + e^{rT} |C_j - P_j|,$$

with

$$j = \min \{|C_i - P_i|\},$$

and finally r is the constant risk-free short rate appropriate for maturity T .

CHAPTER 1

References

Bibliography

[1] CBOE White Paper, <http://www.cboe.com/micro/vix/vixwhite.pdf>

V

`vix.reproduce_vix`, [1](#)

V

`vix.reproduce_vix(module)`, 1