Guidelines - Calculated Quotes

Implied Volatility

Option traders can never fully understand the dynamics behind pricing of stock options and stock option price movements without understanding what volatility and implied volatility are. Volatility can be calculated mathematically to arrive at an expectation of the amount of volatility in the underlying asset or market implied by current price data, hence the development of Implied Volatility. Implied volatility is the second most important price determinant of stock options other than the price of the stock itself.
Mathematically, the factors that affect implied volatility are the exercise price, the riskless rate of return, maturity date and the price of the option. These factors are taken into consideration in several option pricing models, including the Black-Scholes Option Pricing Model. Implied volatility is also the only variable that goes into a mathematical option pricing model.

ID	Title / Description
TOS-REQ-4303	**Implied Volatility Formula** This formula allows to work out the implied volatility that has already been factored into the price of an option.

$$x_{i+1} = x_i - \frac{y_i - p}{v_i}$$

until $\left|\frac{x_{i+1} - x_i}{x_{i+1}}\right| \leq \varepsilon$, at which point x_i = IVOL

Where:

xi = Volatility

vi = option's Vega at theoretical value yi
yi = option's theoretical value at volatility xi
p = option price

1 item found

Theoretical Price

This is a theoretical price of the option, which is used to analyze dependency of the option price on the following factors: changes in stock price, volatility. Option price expectations are calculated for selected expiration date.
TOS uses Bjerksund and Stensland option pricing model.
More information is available here:
http://www.global-derivatives.com/index2.php?option=com_content&do_pdf=1&id=14

ID	Title / Description
TOS-REQ-4304	**Theoretical Price Formula**

The Bjerksund-Stensland approximation assumes that the exercise is initiated to a corresponding 'flat' boundary, making use of a trigger price. This approximation is computational inexpensive and the method is fast.

For call options:

$$C = \alpha S^{\beta} - \alpha\phi(S,T,\beta,I,I) + \phi(S,T,1,I,I) - \phi(S,T,1,X,I) - X\phi(S,T,0,I,I) + X\phi(S,T,0,X,I)$$

Where:

$$\alpha = (I - X)I^{-\beta}$$

$$\beta = \left(0.5 - \frac{r-D}{\sigma^2}\right) + \sqrt{\left(\frac{r-D}{\sigma^2} - 0.5\right)^2 + 2\left(\frac{r}{\sigma^2}\right)}$$

$$\phi(S,T,\gamma,H,I) = e^{\lambda} S^{\gamma} \left[N(d) - \left(\frac{I}{S}\right)^{\kappa} N\left(d - \frac{2\ln\left(I/S\right)}{\sigma\sqrt{T}}\right)\right]$$

$$\lambda = \left[\gamma(r-D) - r + 0.5\gamma(\gamma-1)\sigma^2\right]T$$

$$d = -\frac{\ln(S/H) + (r - D + (\gamma - 0.5)\sigma^2)T}{\sigma\sqrt{T}}$$

$$\kappa = \frac{2(r-D)}{\sigma^2} + (2\gamma - 1)$$

$$I = B_0 + (B_\infty - B_0)(1 - e^{f})$$

$$f = -(T(r-D) + 2\sigma\sqrt{T})\left(\frac{B_0}{B_\infty - B_0}\right)$$

$$B_\infty = \frac{\beta}{\beta - 1} X$$

$$B_0 = \max\left(X, \left(\frac{r}{D}\right)X\right)$$

For put options:

$$P(S,X,T,r,r-D,\sigma) = C(X,S,T,D,D-r,\sigma)$$

1 item found

Covered Return

The calculation of Covered return is based on the extrinsic value of the option, the price of the stock, and time to expiration. The reason we use extrinsic value in the calculation is that if you sell an in-the-money call, you would get a large credit because the call price is large. But most of that price is intrinsic value, which you wouldn't capture because you are offsetting that intrinsic amount with the stock trade. Using the extrinsic value lets you compare the return for out-of-the-money and in-the-money options. The highest covered returns are for the at-the-money options because extrinsic value is highest there.
Specifically, the calculation takes the extrinsic value, divides it by the price of the stock, multiplies it by 365 and divides it by the days to expiration.

ID	Title / Description
TOS-REQ-4305	**Covered Return Formula** Covered Return is calculated by the following formula: **Covered Return = (Extrinsic/Mark) * (365/Days-till-expiration)**

Where:

Extrinsic - extrinsic value for selected option
Mark - Mark price of underlying stock
Days-till-expiration - quantity of days until selected option expiration date

1 item found

Extrinsic

Extrinsic Value, or sometimes known as the Premium Value or Time Value, of an option is the part of the price that is determined by factors other than the price of the underlying stock. This is what you are paying the seller of the option for the risk that the seller is undertaking for selling you the option contract. This "risk money" you are paying the seller is justified and determined by 4 main factors : Time to expiration, Interest Rates, Volatility and Dividends payable.

ID	Title / Description
TOS-REQ-4306	**Extrinsic Formula**

Extrinsic is calculated by the following formula:

Extrinsic Value Of Put Option = Put Option Price - Intrinsic Value Of Put Option
Extrinsic Value Of Call Option = Call Option Price - Intrinsic Value Of Call Option

Where:

Extrinsic - extrinsic value for selected option
OptionPrice - Mark price of underlying stock
Days-till-expiration - quantity of days until selected option expiration date

1 item found

Intrinsic

Intrinsic value of options is the value of its underlying stock that is built into the price of the option. In fact, options traders buy stock options for the sake of those options gaining intrinsic value (Long Call or Long Put options trading strategy).

When you buy call options, you do so because you want to to profit when the stock goes up. When the stock moves higher and higher, more and more of the stock's value gets built into the price of the option in the form of intrinsic value.

ID	Title / Description
TOS-REQ-4307	**Intrinsic Formula**

Intrinsic is calculated by the following formula:

Intrinsic Value Of Put Option = Strike Option Price - Last Price Of Put Option
Intrinsic Value Of Call Option = Last Price of Call Option - Strike Option Price

1 item found

Mark Price for Options

Mark price of option is the average between option Bid and Ask price.

ID	Title / Description
TOS-REQ-4308	**Mark Price for Options Formula**

Mark Price for option is calculated by the following formula:

Mark Price for Option = (Option's Bid Price + Option's Ask Price)/2

1 item found

Expected Price

ID	Title / Description
TOS-REQ-4309	**Expected Price**

Each spread has its own price which depends on current spread BID/ASK values:

SP = SIGNUM * (ASK - BID) / (2 * LEGS) + M

Where:

SIGNUM = 1 when order has positive quantity
SIGNUM = -1 when order has negative quantity
BID/ASK - bid and ask of the spread
LEGS - number of legs of the spread
M = (BID + ASK) / 2

Each spread has its own DELTA.

Each underlying instrument has its own price, UP.
Each order has Order Price, OP.

Expected Underlying Price (EUP) will be calculated as follows:

EUP = UP + (OP - SP) / DELTA

1 item found

SIZZLE Index

SIZZLE Index computes the sum of the current volumes for all calls and all puts for a single stock or index and compare that sum with an average of the sums of the last 5 trading days. The result is a ratio that is a measure of the relative activity in a stock's options. The higher the ratio, the more active the options are. This is a "live" calculation, with the algorithm calculating a new ratio at fixed intervals throughout the trading day.

ID	Title / Description
TOS-REQ-4310	**Sizzle Index**

Sizzle Index is calculated by the following formulas:

Call Sizzle Index = C0 * 5 / Sum(C1 + C2 + C3 + C4 +C5)
Put Sizzle Index = P0 * 5 / Sum(P1 + P2 + P3 + P4 +P5)
Sizzle Index = (C0 + P0) * 5 / Sum(C1 + P1 + C2 + P2 + C3 + P3 + C4 + P4 + C5 + P5)

Where:

C0 - sum of volumes of all Call options for current trading day
P0 - sum of volumes of all Put options for current trading day

C1, ..., C5 - sums of volumes of all Call options for last five trading days
P1, ..., P5 - sums of volumes of all Put options for last five trading days

1 item found

YIELD

This refers to the interest or dividends received from a security and is usually expressed annually as a percentage based on the investment's cost, its current market value or its face value.

ID	Title / Description
TOS-REQ-4311	**YIELD** YIELD is calculated by the following formula: **YIELD=Sum (Div of the year) / LAST** Where: Sum = Div*DivFreq (DivFreq may be Q - so Div value should be multiplied by 4 etc.)

1 item found

PE(Price-Earnings Ratio)

PE is the valuation ratio of a company's current share price compared to its per-share earnings.

ID	Title / Description
TOS-REQ-4312	**PE (Price-Earnings Ratio)** PE is calculated by the following formula: **PE = Last Price / Earnings Per Share**

1 item found

Put/Call Ratio

Put/Call Ratio is one of the two indicators directly derived from options trading, the other one being the VIX. Put/Call Ratio is used by options traders around the world as a contrarian indicator of market sentiment. As an indicator of market sentiment, Put/Call Ratio tells you when investors are in a bullish or bearish mood. Put/Call Ratio is arrived at by dividing the total amount of put options traded by the total amount of call options traded.

There are 2 main types of Put/Call Ratios: Total Equity Put/Call Ratio, Index Put/Call Ratio.

Equity Put/Call Ratio: There are 2 main types of Equity Put/Call Ratios; Total Equities Put/Call Ratio that measures the put/call ratio of all equities in the market and Individual Equity Put/Call Ratio that measures the put/call ratio of an individual stock. The most authoritative total equities put/call ratio in the United States is the Chicago Board Of Exchange Total Equities Put/Call Ratio. The CBOE Total Equities Put/Call Ratio divides the total volume of equity put options by the total volume of equity call options traded daily and serves as the broadest measure of market sentiment in the equity market. The CBOE total equities put call ratio is also what most options traders are referring to when talking about Put/Call Ratios.

Index Put/Call Ratio: Index Put/Call Ratios, also known as Composite Put/Call Ratios, are put call ratios calculated for component stocks in an index such as the OEX. Index put/call ratios are meant to be contrarian indicators for the underlying index but due to the amount of hedging done by portfolio managers and Market Makers in the index options resulting in a skew towards more put option buying than call option buying, Index Put/Call Options are not generally regarded by the options trading community as indicative of general investor sentiment.

ID	Title / Description

ID	Title / Description
TOS-REQ-4313	**Put/Call Ratio** Put/Call Ratio is calculated by the following formula: **Volume Of Put Options / Volume Of Call Options**

1 item found

Market Capitalization

Market capitalization/capitalisation (aka market cap) is a value of a company, which is equal to multiplication of issued shares and mark price.

ID	Title / Description
TOS-REQ-4314	**Market Capitalization** Market capitalization is calculated by the following formula: **Market Cap = Last Price * Shares**

1 item found

Volatility Index

Calculated value, which forecasts expected volatility of the stock over the next 30 calendar days. For calculation of Volatility Index in the thinkorswim we use VIX (CBOE VOLATILITY INDEX) algorithm. Calculation is based on implied volatilities of the option series which will be expired in the near and next expiration dates.

FRONT Volatility

Calculated value, which forecasts expected volatility of the stock for the near expiration date. Calculation is based on implied volatilities of the option series which will be expired in the near expiration dates.

ID	Title / Description
TOS-REQ-4315	**FRONT Volatility** FRONT Volatility is calculated by the following formula: **FRONT Volatility = Implied Volatility** of the options on the selected stock with **near expiration date**.

1 item found

BACK Volatility

Calculated value, which forecasts expected volatility of the stock for the next expiration date. Calculation is based on implied volatilities of the option series which will be expired in the next expiration dates.

ID	Title / Description
TOS-REQ-4316	**BACK Volatility** BACK Volatility is calculated by the following formula:

BACK volatility = Implied Volatility of the options on the selected stock with **near next expiration date**.

1 item found

Volatility Difference

Calculated value which shows difference between FRONT Volatility and BACK Volatility.

ID	Title / Description
TOS-REQ-4317	**Volatility Difference** Volatility Difference is calculated by the following formula: **VOLATILITY DIFFERENCE = FRONT Volatility - BACK Volatility**

1 item found

Weighted Back Volatility

ID	Title / Description
TOS-REQ-17342	**Weighted Back Volatility** Weighted Back Volatility is calculated by the following formula: **Weighted Back Volatility = sqrt((BACK_Volatility^2 * T2 - FRONT_Volatility^2 * T1) / (T2 - T1))** Where: T1 is time to next expiration **in years** T2 is time to second next expiration **in years**

1 item found

Front Expected Move

ID	Title / Description
TOS-REQ-17343	**Front Expected Move** Front Expected Move is calculated by the following formula: **Front Expected Move = expected_move(sqrt(T1) * FRONT_Volatility)** *expected_move(vol) = S * e ^ (vol ^ 2 / 2) * (2 * N(vol) - 1) Where: N(x) is Cumulative Normal Distribution function S is the price of underlying stock T1 is time to next expiration **in years**

1 item found

Back Expected Move

ID	Title / Description
TOS-REQ-17344	**Back Expected Move** Back Expected Move is calculated by the following formula:

Back Expected Move = expected_move(sqrt(T2) * BACK_Volatility)

*expected_move(vol) = S * e ^ (vol ^ 2 / 2) * (2 * N(vol) - 1)

Where:

N(x) is Cumulative Normal Distribution function

S is the price of underlying stock

T2 is time to second next expiration **in years**

1 item found

Expected Move Difference

ID	Title / Description
TOS-REQ-17345	**Expected Move Difference**

Expected Move Difference is calculated by the following formula:

Expected Move Difference = expected_move(sqrt(T2 - T1) * Weighted Back Vol ^ 2)

*expected_move(vol) = S * e ^ (vol ^ 2 / 2) * (2 * N(vol) - 1)

Where:

N(x) is Cumulative Normal Distribution function

S is the price of underlying stock

T1 is time to next expiration **in years**

T2 is time to second next expiration **in years**

1 item found

Market Maker Move

???? Market Maker Move is a measure of the expected magnitude of price movement based on market volatility. It helps to identify the implied move due to an event between now and the front month expiration

ID	Title / Description
TOS-REQ-17346	**Market Maker Move**

Market Maker Move is calculated by the following formula:

Market Maker Move = expected_move(sqrt(T1 * (FRONT_Volatility ^ 2 - Weighted Back Vol ^ 2))

*expected_move(vol) = S * e ^ (vol ^ 2 / 2) * (2 * N(vol) - 1)

Where:

N(x) is Cumulative Normal Distribution function

S is the price of underlying stock

T1 is time to next expiration **in years**

T2 is time to second next expiration **in years**

1 item found

VWAP (Volume Weighted Average Price)

A trading benchmark used especially in pension plans. VWAP is calculated by adding up the dollars traded for every transaction (price multiplied by number of shares traded) and then dividing by the total shares traded for the day. The theory is that if the price of a buy trade is lower than the VWAP, it is a good trade. The opposite is true if the price is higher than the VWAP.

ID	Title / Description
TOS-REQ-4318	**Volume Weighted Average Price (VWAP)**

VWAP is calculated by the following formula:

VWAP = Sum (Last Price * Last Size) / SUM(Last Size)

1 item found

Percent Change

ID	Title / Description
TOS-REQ-4319	**Percent Change** Percent Change is calculated by the following formula: **Percent Change = (Net Change/CLOSE)*100%**

1 item found

Mark Price

ID	Title / Description
TOS-REQ-4324	**Mark Price** Mark Price is calculated by the following formula: **If BID and ASK are both NaN or zero, or inverted, then it is equal Last Price** **If LAST is between BID and ASK, then it is equal to Last Price** **If LAST is above ASK, then it is equal to ASK** **If LAST is below BID, then it is equal to BID**

1 item found

Mark Change

ID	Title / Description
TOS-REQ-16971	**Mark Change** Mark Change is calculated by the following formula: **MarkChange = Mark - YesterdayMark** where: Mark - current Mark price, YesterdayMark - Close value from DB: Prices table

1 item found

Percent Mark Change

ID	Title / Description
TOS-REQ-16972	**Percent Mark Change** Percent Mark Change is calculated by the following formula: **%MarkChange = MarkChange / YesterdayMark**

1 item found

Net Change

The difference between the closing price of a security on the day's trading and the previous day's closing price. Net change can be positive or negative and is quoted in terms of dollars. This is what the newspaper stock tables quote.

ID	Title / Description
TOS-REQ-4326	**Net Change** Net Change for quotes is calculated by the following formula: **Net Change = Last Price - Close Price**

1 item found

Return on Capital

ID	Title / Description
TOS-REQ-4420	**Return on Capital** Return on Capital is calculated by the following formula: **ROC = MarkPrice * DV / -BPEffect * 365/ days to expiration** Where: MarkPrice is a mark price of the spread BPEffect is calculated using T-Reg rules assuming Margin account selling corresponding spread MaxRisk = difference between StrikePrice and MarkPrice

1 item found

Return on Risk

ID	Title / Description
TOS-REQ-4421	**Return on Risk** Return on Risk is calculated by the following formula: **ROR = MarkPrice / MaxRisk * 365/ days to expiration** Where: MarkPrice is a mark price of the spread MaxRisk = difference between StrikePrice and MarkPrice

1 item found

Strength Meter Indicator

The Strength Meter helps to gauge how a stock is trending. The foundation of the Strength Meter is derived from a stock's three-week trend:

- Stocks moving up 10% or more (during that period) are given a Green or Trending Up rating.

- Stocks moving down 10% or more during that period are given a Red or Trending Down rating.
- Stocks moving less than 9% during that period are given a Yellow or Range Bound rating.

ID	Title / Description	Time Point
TOS-REQ-10468	**Strength Meter Indicator**	OCT_2010 (2010-10-23)

Strength Meter indicator's value is calculated by the following formula:

3Wk_Price_Change_Percent = (Last Price - Close_Price _3Wk_Back)/Close_Price_3Wk_Back

Strength Meter = Uptrend, if 3Wk_Price_Change_Percent > 0.1

Strength Meter = Downtrend, if 3Wk_Price_Change_Percent < -0.1

Strength Meter = Range Bound, if -0.1 <= 3Wk_Price_Change_Percent <= 0.1

1 item found

Quote Trend Indicator

ID	Title / Description	Time Point
TOS-REQ-11740	**Quote Trend indicator**	178 (FEB_2011) (2011-02-05)

Each bar in the Quote Trend shall denote bid, ask or both values according to the following rules:

If either the bid or the ask price is up and the other price remains unchanged, a GREEN bar is added.

If either the bid or the ask price is down and the other price remains unchanged, a RED bar is added.

If the bid price is up and the ask price is down, the top half of the bar is RED and the bottom half is GREEN.

If the bid price is down and the ask price is up, the top half of the bar is GREEN, and the bottom half is RED.

If both the bid and ask prices are up, a bright GREEN bar is added.

If both the bid and ask prices are down, a bright RED bar is added.

The following colors shall be used for Quote Trend Indicator representation in black Look and Feel scheme of the application

Border and background - 0x000000
Red - 0xA80000
Bright Red - 0xFF0000

Green - 0x006F00
Bright Green - 0x00DD00

The following colors shall be used for Quote Trend Indicator representation in white and metal Look and Feel schemes of the application

Border and background - 0xEDEDED
Red - 0xDC7676
Bright Red - 0xCC0000
Green - 0x78B676
Bright Green - 0x038000

See trend_indicator_metrics.png and trend_indicator_overview.png attachment for details.

1 item found

Historical Volatility Formula

Historical Volatility is the realized volatility of a financial instrument over a given time period. Generally, this measure is calculated by determining the average deviation from the average price of a financial instrument in the given time period. Standard deviation is the most common but not the only way to calculate historical volatility.

Historical Volatility is also known as "statistical volatility".

Historical Volatility is often used in all types of risk valuations. Stocks with a high historical volatility usually require a higher risk tolerance.

ID	Title / Description	Status	Time Point
TOS-REQ-15172	**Historical Volatility Formula**	QA Review	Condor Release (2011-12-17)

System shall calculate **Historical Volatility** for non-optionable instrument on the period of 20 days by the following formula:

HV = StDev (ln(close/close [1]), 20) * sqrt (trading_days_in_a_year),

Where:
trading_days_in_a_year is often taken as **252**.

1 item found

Appendix A: Terminology/Glossary/Definitions list

Implied Volatility - A measure of the volatility of the underlying stock, it is determined by using prices currently existing in the market at the time, rather than using historical data on the price changes of the underlying stock.

Theoretical Price - The value generated by a mathematical model given certain prior assumptions about the terms of the option, the characteristics of the underlying contract, and prevailing interest rates. contract, and prevailing interest rates.

Covered Return - The value gives you an annualized percent, return on buying stock and selling a call, or selling stock and selling a put.

Extrinsic - The difference between an option's price and the intrinsic value.

Intrinsic - For call options, this is the difference between the underlying stock's price and the strike price. For put options, it is the difference between the strike price and the underlying stock's price. In the case of both puts and calls, if the respective difference value is negative, the intrinsic value is given as zero.

YIELD - The income return on an investment.

Put Call Ratio - The ratio of the number of open put options against the number of open call options. The higher the resulting number, the more put options are bought or shorted on the underlying asset.