Title: ORATS Data Guide for Quandl

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Introduction

Option Research and Technology Services (ORATS), established in 2001, uses superior methods for observing historical and implied volatility built on two massive databases of underlying tick data and option market data.

ORATS proprietary historical volatilities are calculated from tick data by simulating hedging and turning that profit into an accurate daily volatility. Alternatively, we present a widely used method of calculating historical volatility based on close-to-close prices.

The ORATS implied volatility summarization technique produces an extremely accurate smoothed market value curve. Our method of summarizing the implied volatility surface allows simplification of strike relationships to a few factors. These factors are comparable over time and across related equities.

Historical Volatility Data

Over many years of trading on the floor of the CBOE, Matt Amberson, Principal of ORATS, was never satisfied with any standard volatility calculations. To combat this frustration, his firm developed a method that was more reflective of the profit or loss from holding an actual option position. This more realistic method uses actual tick data to simulate the hedging profit a trader might experience on a simulated option position. A measurement of volatility is solved for iteratively by comparing the cost of the position with the hedging profit. Based on our extensive analysis, we believe we have found the most accurate historical volatility measure available.

SIMULATION

In order to simulate hedging an option position, ORATS uses 10 different hedging intervals to obtain a representative average profit. The hedging strategy is delta neutral and follows these steps:

1. When the underlying security opens for trading, the delta of the position is neutralized;
2. Throughout the trading day, a simulated position is scalped whenever the hedge interval is reached;
3. Immediately prior to the close of trading, the delta of the position is neutralized.

Below, the 10 hedging intervals are displayed in the top row of the table with different periods on the side column. The first three intervals are static over time while the remaining seven intervals (with an orange background below) are dynamic, meaning they change as the expected daily standard deviation of the equity changes. The intervals are expressed as percentages of the daily standard deviation. The expected daily standard deviation can be calculated by dividing the annualized at-the-money implied volatility by the square root of the number of trading days in a year. This produces the expected daily standard deviation in percentage terms. Multiply this percentage by the current equity price to arrive at the expected daily standard deviation in dollars. This number can be seen in the upper right corner of the table.

Tick Volatility			Delta Hedging Strategy w/1000 gamma								
Length	**$0.50**	**$1.00**	**$2.00**	**25%**	**37.5%**	**50%**	**75%**	**100%**	**200%**	**300%**	**s.d 2**
1219Av	2,666	2,930	3,117	2,767	2,951	3,019	3,184	3,324	**3,401**	3,360	324287
Median	1,800	1,953	**2,266**	1,843	1,901	1,921	2,076	1,894	1,380	1,380	
100day	2,105	2,257	**2,450**	2,111	2,274	2,273	2,392	2,405	2,350	2,364	31413
Last 20	3,672	3,961	**4,220**	3,701	3,792	3,966	3,990	4,114	3,929	3,929	31413
Last 5	1,098	1,221	**1,242**	1,098	821	1,221	924	1,178	734	734	2102
Last 1 d	**1,758**	965	769	**1,758**	767	965	769	769	769	769	966
1-5-20a	2,176	2,049	2,077	**2,186**	1,793	2,051	1,894	2,021	1,811	1,811	**Max**

CALCUATION

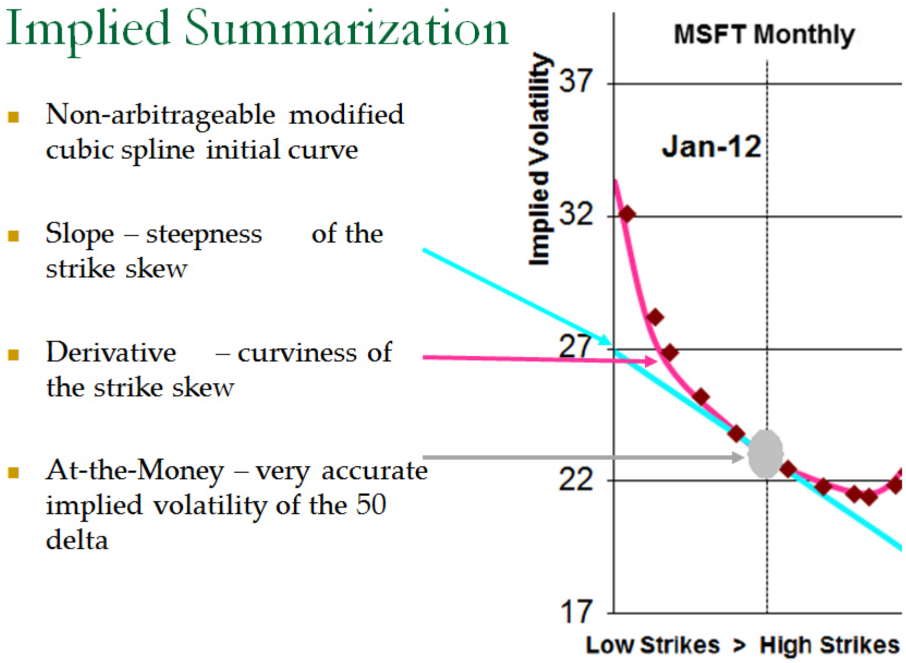
The average profit from the 10 hedging intervals is converted to a daily volatility by a proprietary method using the cost of the position compared to this profit. Importantly, this method produces a one day volatility and more accurate short term volatilities. This is not possible with the more common method of volatility calculation which uses close-to-close prices.

Implied Volatility Data

Combining the theoretical volatilities implied by a symbol's option prices produces a volatility surface. Each expiration's surface can be described generally by three factors shown in the graph below. Summary information about this surface gives the trader a macro view of the implied volatilities for each option chain.

ORATS captures a snapshot of bid ask prices for stocks and options near the close when the markets are of the highest quality. The actual time may vary. Markets at the close can sometimes widen out as market makers reflect the difficulty of hedging trades made at the close.

ORATS measures the surface using the following summary characteristics: at-the-money volatility, strike slope (sometimes called skew) and derivative (curvature).



The "Smile"

At-the-money volatility is the implied volatility at the 50 delta call and put, or in other words, at the straddle. ORATS defines the strike Slope as a measure of the amount that implied volatility changes for every increase of 10 call delta points within the intra-month skew. It measures how lopsided the 'smile' or 'smirk' is. Derivative is a measure of the rate at which the strike slope changes for every increase of 10 call delta points within the intra-month skew. It measures the curvature of the intra-month skew or 'smile'.

Term Structure of the Smile

To apply Slope across all expiration months, ORATS has developed a term structure of volatility equation that very closely matches the term structure observed empirically in the market. This equation describes a smoothed relationship between short term and very long term volatility. We define short term volatility with a forecast or measurement of a 20 trading day implied volatility. Long term volatility is defined with an expected infinite volatility. Our systems can then interpolate for the expected at-the-money implied volatility for any time to expiration between 20 trading days and infinity. When using the term structure equation, the volatility that is used for at-the-money options with 20 trading days to expiration is the same volatility that is used to price at-the-money volatilities for contracts trading with less than 20 trading days to expiration.

Data

Following is the short description, a sample data point and the long description for the ORATS data set for Quandl:

ticker	YHOO	The stock or ETF ticker
date	1/4/2010	The date of the reading
IV30	28.4	The interpolated 30 calendar day implied volatility
IV60	29.08	The interpolated 60 calendar day implied volatility
IV90	27.31	The interpolated 60 calendar day implied volatility
m1atmiv	27.28	The month 1 at-the-money implied volatility
m2atmiv	29.8	The month 2 at-the-money implied volatility
m3atmiv	27.5	The month 3 at-the-money implied volatility
m4atmiv	28.54	The month 4 at-the-money implied volatility
slope	1.96	The slope of the best fit curve through the interpolated 30 day expiration strike by strike implied volatilities.
deriv	0.121	The derivative of the best fit curve through the interpolated 30 day expiration strike by strike implied volatilities.
slope Inf	2.96	The slope of the best fit curve through the interpolated infinite expiration strike by strike implied volatilities.
deriv Inf	0.101	The derivative of the best fit curve through the interpolated infinite expiration strike by strike implied volatilities.
10dclsHV	27.98	The 10 trading day close-to-close historical volatility
20dclsHV	23.68	The 20 trading day close-to-close historical volatility
60dclsHV	24.2	The 60 trading day close-to-close historical volatility
120dclsHV	34	The 120 trading day close-to-close historical volatility
252dclsHV	42.06	The 252 trading day close-to-close historical volatility
10dORHV	24.69	The 10 trading day ORATS tick historical volatility
20dORHV	24.31	The 20 trading day ORATS tick historical volatility
60dORHV	24.1	The 60 trading day ORATS tick historical volatility
120ddORHV	30.83	The 120 trading day ORATS tick historical volatility
252ddORHV	37	The 252 trading day ORATS tick historical volatility

Advanced: Calculating an Implied Volatility for Each Strike

Given the at-the-money implied volatility, the slope and the derivative, an implied volatility can be calculated for each strike.
First, a call delta is calculated for the strike using a standard option pricing model (not provided).
Second, the slope and derivative for the expiration is calculated given the interpolated slope and derivative for that expiration.
Third, the implied volatility formula is used to determine the strike implied.

Formula:
Atmiv*(1+slope/1000+(deriv/1000*(delta*100-50)/2)*(delta*100-50))

For example, assume the following:
m1atmiv=30: slope=1:deriv=.1:delta=.75
Since we are finding the month 1 volatility the 30 day slope and derivative can be used.
=30*(1+(1/1000+(0.1/1000*(0.75*100-50)/2))*(0.75*100-50))
=31.688

Example2, assume:
M2atmiv=32: slope=1:deriv=.08: slopeInf=2:derivInf=.08:delta=.25
In this example we first need to interpolate the slope and derivative between the 30 day and in the infinite. This is done by weighting the 30day * 71% and the infinite 29% (see below).
Slope:
=0.71*1+0.29*2
=1.293
Derivative:
=0.71*.1+0.29*.08
=0.094
Implied volatility at 25 delta:
=32*(1+(1.293/1000+(0.059/1000*(0.25*100-50)/2))*(0.25*100-50))
=31.907

Finding the weightings:
The weighting for the 30 day is found by 1/Sqrt(days to expiry of the desired month / 365) divided by 1/Sqrt(30 day expiry / 365) or:
=(1/SQRT(60/365)) / (1/SQRT(30/365))
=~.71
The weighting for the infinite is the complement percentage of the 30day.