MONTRÉAL EXCHANGE

Focus on Derivatives

Issue 2

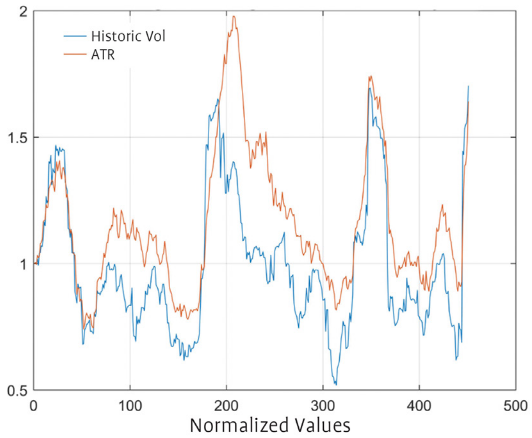
What is Volatility and how does it impact Option Selling Returns?

There's just no way around it – if you are selling options and the Historic Volatility (HV) during the holding period is higher than the Implied Volatility (IV) you sold at, you will incur negative returns over the long run. You might occasionally get lucky but the impact from volatility will eventually catch up to you.

There are many mistaken beliefs regarding volatility so it would not be surprising if the above is something that investors had given little consideration to. To see the misuse of the term volatility in action, consider the widely used phrase "In these volatile times" (try running a Google search on it). It shows up in advertisements, blogs, financial publications and even the general media. What strikes me as particularly odd about the use of the phrase in the financial markets is that it often doesn't bear any resemblance to the state of volatility for the reference market. Maybe it's a pet peeve of mine, but hearing someone say, "In these volatile times" when the loudest thing on the trading floor are crickets is quite irritating. I suspect that this is now just a stock phrase with little consideration given to its actual meaning but then again, maybe it just depends on your frame of reference? Let's explore this theme while providing some further insight into volatility.

The first thing of note about volatility is that it's not observable. It's not like a stock price where the last price can easily be found. Volatility has to be calculated and there are a variety of ways that this can be accomplished. Having multiple calculation methods creates uncertainty as to what volatility "is" while security prices, for example, are known. The most common means of estimating volatility is using the standard deviation of returns over a historical period, i.e. historical volatility. While this method is generally accepted, there are also other methods for estimating volatility, such as, the Average True Range. For the sake of comparison, the following graph shows normalized values for Average True Range and Historic Volatility, both using the same lookback period.

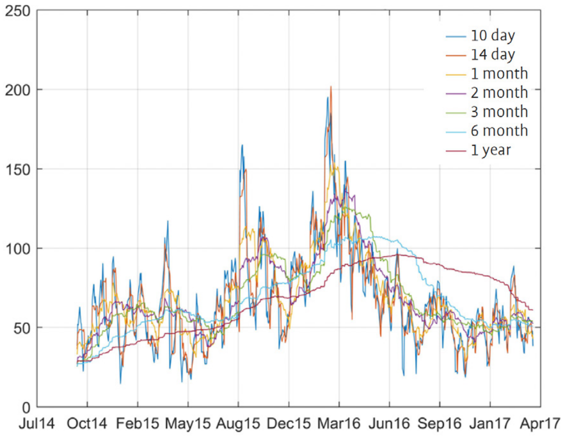
Average True Range vs Historical Volatility



These two measures are similar, yet there are enough differences that conflicting conclusions about the state of volatility could be reached.

Once you've determined what method you are going to use to measure volatility a time frame or lookback period over which to measure it will have to be selected. 30 day historic volatility is often quoted in the financial markets, but 30 days is not cast in stone. The following graph displays a range of HV's for TECK.B using measurement periods from 5 days to 12 months. The interesting thing here is that there are many instances on this graph where you could argue that volatility was high using 5 day HV and also argue that at the same time it was low, using 12 month volatility. The reverse is also true.

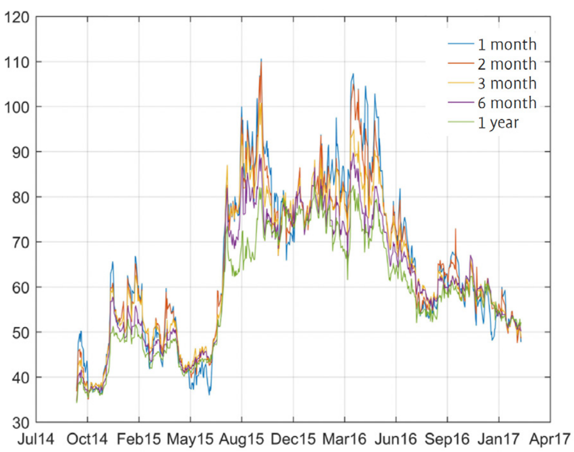
Teck.B Historic Volatilty



Another interesting thing about the commonly used 30 day HV is that it does not have to be days that are used. HV can be calculated on almost any time frame from monthly data all the way down to intra-day ticks, although days are a more commonly used frequency.

As you can see, there are a variety of means to calculate HV but volatility can also be referenced by using implied volatility (IV). Similar to HV there is not one single representative number for IV as each optionable security has a variety of strikes and expiries, each with its own IV. The graph below shows the 50 Delta (approximately at-the-money) IV for TECK.B across five different interpolated time frames.

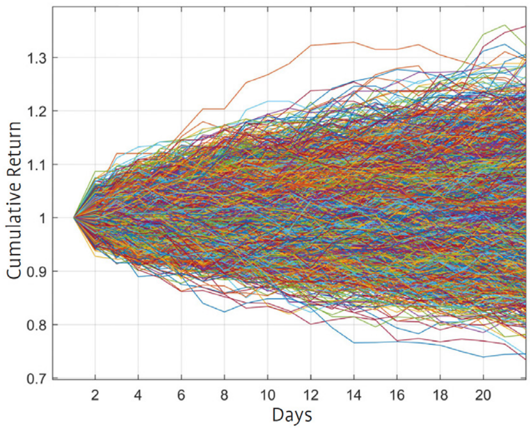
Teck.B 50 Delta Implied Volatility



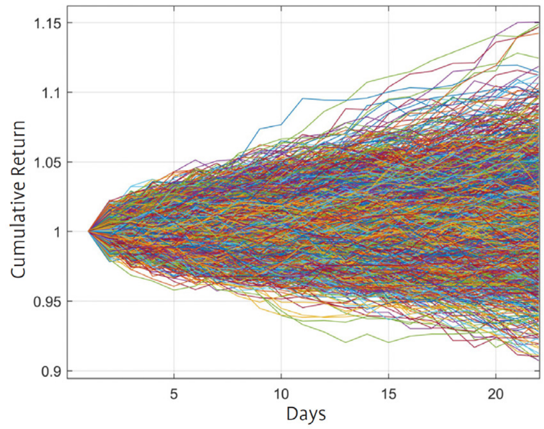
The IV's and HV's for TECK.B resemble each other, but more like distant cousins than siblings. With different methodologies, lookbacks, expiries and strikes, it's no wonder that there are different interpretations as to whether the market is volatile or not. Don't be dismayed though, because the good news is that this spells opportunity. Your unique method (or frame of reference) for estimating volatility might lead you to a different conclusion as to the price of an option than the market has settled upon. As we will see, having an expectation for future volatility is essential as it has a huge impact on the performance of option selling strategies.

One of the key attributes of volatility that investors frequently fail to consider is that it can unfold in countless different ways. The price paths associated with a specific volatility level will cover a broad range of prices. This is best seen graphically. To create the following graphs approximately 3,000 21 day price paths were selected across a wide range of securities with each price path having HV between 29.9% and 30.1% for the first graph and between 9.9% and 10.1% for the second graph.

Historic Vol Approximately 30



Historic Vol Approximately 10



Unlike normally distributed price movement, as is used in the Black Scholes model, these price paths do not form perfectly symmetrical distributions because they are taken from actual market data. Some key points that can be taken from these graphs are:

- Higher volatility produces a wider distribution of returns than lower volatility
- The level of volatility provides no information about return. Higher volatility might only be associated with downside price movement, but the reality is that both positive and negative returns can occur under any volatility scenario
- The probability that a security will close through a strike is different under each volatility scenario
- The payoff at each strike is different depending on the volatility level.

This last point is of crucial importance, but is often overlooked in favour of the probability of closing through a strike. At 10 HV, the percentage of times that the price paths resulted in a final value that was higher than a 2% OTM strike price was 37.9%, while for 30 HV, it was 45.8%. This is an interesting piece of information, but unfortunately I've seen many investors make the mistake of estimating their expected option selling returns by using the probability of closing through the strike as follows:

- Probability of closing through the strike = 37.9%
- Premium sold = $0.40
- Probability of being correct = 62.1% (100% - 37.9%). Therefore...
- The expected PL is $0.2484 ($0.40 *0.621).

Unfortunately, this is completely wrong as it's the payoff that matters, not the probability. Examining the data used to create these graphs should help clarify. A simplified example of how to calculate the payoff is as follows:

- Asset Price = $30.
- Strike = $31
- Assumed asset prices at expiry (terminal values) = 28, 29, 30, 31, 32, 33, 34

1. Find the terminal value for each price path (this is simply the last value ex. 28, 29, 30, 31, 32, 33, 34).
2. Calculate the PL as the difference between the terminal values and the strike. The differences are -3, -2, -1, 0, 1, 2, 3.
   Ex. [28 29 30 31 32 33 34] – 31.
3. Set all negative PL values to 0. PL's are now 0, 0, 0, 0, 1, 2, 3.
4. Sum the PL's. This equals $6 = 0 + 0 + 0 + 0 + 1 + 2 + 3.
5. Payoff = PL divided by the total number of price paths or observations. The payoff equals $0.85714 ($6 / 7).

Some will quickly recognize that if these price paths are normally distributed and the terminal values are discounted back to today, that we will have roughly replicated Black Scholes given enough price paths. As this is not meant to be a technical paper, I'll stick with the data used above as opposed to simulated and normally distributed data. The payoff can easily be double checked by looking at the PL that would be earned if an option was bought at $0.85714 and the above terminal values were realized. The PL in each case is -.85714, -.85714, -.85714, -.85714, 0.142857, 1.142857, 2.142857 which sums to 0. Bringing this full circle, if you sell an option at $0.85, and the expected historic volatility results in the terminal values used in this example, your expected PL = $0.

The payoff or premium can also be calculated in percentage terms as opposed to dollars. Using our example above the percentage premium is 2.83% ($0.85 / $30). Applying our simple method to the 10 HV and 30 HV data gives payoffs of 1.62% (10 HV) and 4.06% (30 HV) for a 2% OTM call. Relating this to option selling, if a 2% OTM call was sold at an IV level that provides 1.62% in premium, then the expectation is to make money over the long run if HV during the life of the option is 10 or less. Conversely, selling a call option with a premium of 1.62% will, on average, result in a loss if HV during the holding period is greater than 10. One-off trades might see some success, but the certainty of losing rises with the number of times that the strategy is attempted.

This critically important concept is highlighted using historic options data. This study uses 10 years of ABX data to calculate the returns for put and call selling under two scenarios:

1. HV for the holding period was higher than the IV sold
2. HV for holding period was lower than the IV sold.

The following data and assumptions were used:

- One month calls and puts with a delta value of 30 (Strike averaging 7.25% OTM)
- Return calculations are for options only (assumes no security position i.e. these are not covered writes)
- Returns are calculated as a percentage of the initial stock price as follows:

  Call Sell

  ((strike + option_premium) – stock_price_at_expiry) / stock_price_at_initiation
  For all values > 0 the value is set to the minimum of the formula above and the premium sold.

  Put Sell

  (stock_price_at_expiry - (strike - option_premium)) / stock_price_at_initiation
  For all values > 0 the value is set to the minimum of the formula above and the premium sold.

- Mid-market options prices were used and are derived from a volatility surface on a daily basis (calculating the returns on subsequent days means that the periods under analysis were overlapping)
- Transaction costs were not included

The average of all of the call IV's was found to be approximately 40. To approximate this, call data was selected with IV's between 37.5 and 42.5. Similarly, put data was selected where put IV's where between 39.0 and 44.0 (around average of 41.5). From the put and call data two subsets were selected based on the holding period HV's (1 month).

- High HV: 50 (between 47.5 and 52.5)
- Low HV: 30 (between 27.5 and 32.5)

We can now compare the performance of selling puts or calls when the holding period HV is high (approximately 50) or low (approximately 30) vs a starting IV around 40. The returns as a percentage of the initial stock price are as follows:

OPTION TRADE	**HISTORICAL VOL**	
	30	**50**
Sell 30 Delta One Month Calls @ 40 IV	0.45%	-0.64%
Sell 30 Delta One Month Puts @ 40 IV	1.06%	-0.73%

To summarize, for this data, if a one month 30 delta call is sold at an IV of 40, the expectation on average, is to lose 0.64% if the holding period HV is 50. The expectation is to make 0.45% if the holding period HV comes in at 30.

The variety of methods to calculate volatility may seem overwhelming, but compare this with the many ways and means analysts use to arrive at the "fair value" for a security price. Having a solid understanding of volatility and the impact of historic volatility on your overwriting returns is essential to long term success.

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