Searching for Options Strategy

Everestia LLC, August 2022

Disclaimer

This short note is for informational and educational purposes only. It should not be considered as investment advice. The approach for researching for the trading strategy is the same as outlined in this note, however Everestia's target portfolio consists of more complex instruments, not just call options.

Introduction

This short note is to introduce the basic methodology of searching for the options trading strategy. The basic components of the methodology are

- Theoretical background, and high-level conceptual development to identify type of instrument to use (call spread for example)
- Model development where option price / payoff / gain and loss would be calculated
- Assumption development, certain elements (inputs, theory) of the model need to be calibrated / estimated
- Back testing with historical data – will the strategy have a good return in past 4 years for example?
- Input parameter calibration and optimization

While components of the methodology are the same as what is illustrated above, the actual trading strategy used by the firm would be more complex and development with much more analysis.

Theoretical background

A successful trading cannot be just based on data analytics / back-testing alone. The conceptually sound foundation must exist to support the choice of the strategy. Option pricing is rooted in deep mathematical theory. In the universe of strategies, it would be difficult to find the strategy solely based and data analysis which fits your personal investment goals.

In this short note, we will explore the potential return of calendar call spread strategy. Calendar call spread has two legs of long and short calls, with different strike level and maturity. The calendar call spread with max loss capped, has a slightly positive theta.

Model development

We used java as the development planform, building from the scratch. We define the following java classes.

- Option class: Variables, {spot, strike, rate, vol, call price, put price}; Methods {call price, put price, Theta, Vega, Delta...}
- Strategy class: Variables {leg1: stirike1, maturity1, Leg2: strike2, maturity2, sell time}; Methods (Mark to market series)
- Assumption class: Variable {volatility slope}; --- will explain more in the assumption development section, how the volatility input related to maturity
- Back testing class: Variables {SPY time series, Vix time series, P&L time series, Annual return, Sharpe}; Methods {Run}
- Optimization class: Variable, {leg1: stirike1, maturity1, Leg2: strike2, maturity2, sell time}; Method {Sensitivity loop}

Assumption development

The financial market is vast. It is impossible to have all model inputs precisely sourced. Some assumptions are always required. For example, the volatility surface is two dimensional, based on the maturity and strike.

In this short note, we will not model the whole surface. We will use an assumption which will “fit” / “estimate” the surface. We will assume the vol is the VIX of the day, (big assumption and approximation) and modified the VIX to “pricing” vol by maturity linearly, meaning the rough term structure is model, but the volatility smile is not. This would be a very rough estimate of the volatility surface.

An alternative approach is to use the realized volatility to price the options.

Backtesting

What if the strategy is used in the past? Back-testing is the critical tool in the trading strategy development. In this short note, spy price and VIX time series of past 5 years are used. We assume we will enter a call spread every day, exit before the option maturity. We compute the time series of the market to market of the trade, and return of the trade and compute the Sharpe ratio of the trade.

With 5 years of data, and 1000 trades, we would compile some statistics of the performance. The mean Sharpe ratio and the variance of Sharpe ratio.

Table 1 Statistics of Sharpe Ratio – Baseline case

T1	0.7	T2	0.4	Exit	0.2	Strike	1.1

	Mean	STDEV	0.1	0.25	0.5	0.75	0.9
Annualized gain	3.5	17.9	(12.9)	(2.8)	2.5	9.3	19.1
Annualized vol	11.2	7.1	4.3	6.0	9.3	13.5	21.6
Sharpe	0.3	1.4	(1.5)	(0.3)	0.3	1.0	2.0

Parameter optimization

In this step, the strike level, maturity and the two legs, and exit time are trading parameters. They would be searched to optimized the return. The search routine are simple. We will just run the steps of the parameters, compile the performance in the grid, and undersatnd the sensitivity of the performance to those parameters.

In following tables, T1 = Maturity of Leg 1, T2 = Maturity of Leg 2, Exit = holding period / exit time since entry date, Strike = Stike level as the % of Spot

Table 2 Sensitivty to Stike

T1	0.7	T2	0.4	Exit	0.2	Strike	X		
T1	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
T2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Exit	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Strike	0.95	1	1.05	1.1	1.15	1.2	1.25	1.3	1.35
Sharpe	(0.66)	(0.28)	0.19	0.30	0.09	(0.15)	(0.34)	(0.46)	(0.53)

Note: The Sharpe is a smooth function of Strike, peaking at Strike = 1.1.

Table 3 Sensitivty to Maturity with Gap of T1 and T2 Constant

T1	X+.3	T2	X	Exit	0.2	Strike	1.1		
T1	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1
T2	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7
Exit	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Strike	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Sharpe	0.42	0.36	0.30	0.25	0.21	0.17	0.14	0.11	0.08

Note: The Sharpe is a smooth function of Maturity, peaking at T1 = 0.6, T2 =0.3. Shorter the Maturity, better the Sharpe.

Table 4 Sensitivty to Maturity with T2 Constant

T1	X	T2	0.4	Exit	0.2	Strike	1.1		
T1	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95
T2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Exit	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Strike	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Sharpe	0.38	0.35	0.33	0.30	0.28	0.26	0.24	0.22	0.21

Note: The Sharpe is a smooth function of Gap between, peaking at T1 = 0.55, T2 =0.4. Smaller the Gap, better the Sharpe.

Trade Condition using VIX

More importantly, in above backtesting, we assume we will enter the same trade every day. A condition of days when to enter the trade and exit trade will greatly improve the Sharpe ratio. For example, a condition of enter and exit the trade based on VIX levels, similar to the Vol Target strategy. For the concept of the Vol Target strategy, see White Paper Series #3).

In fact, a bit of the data analytics, we found that if we only enter the trade on days when VIX<=16.25 (total 334 days), then the average Sharpe ratio will become 1.06, which is much high than the average 0.3 in Table 1.