



## Sources of CBOE Collar Index Returns



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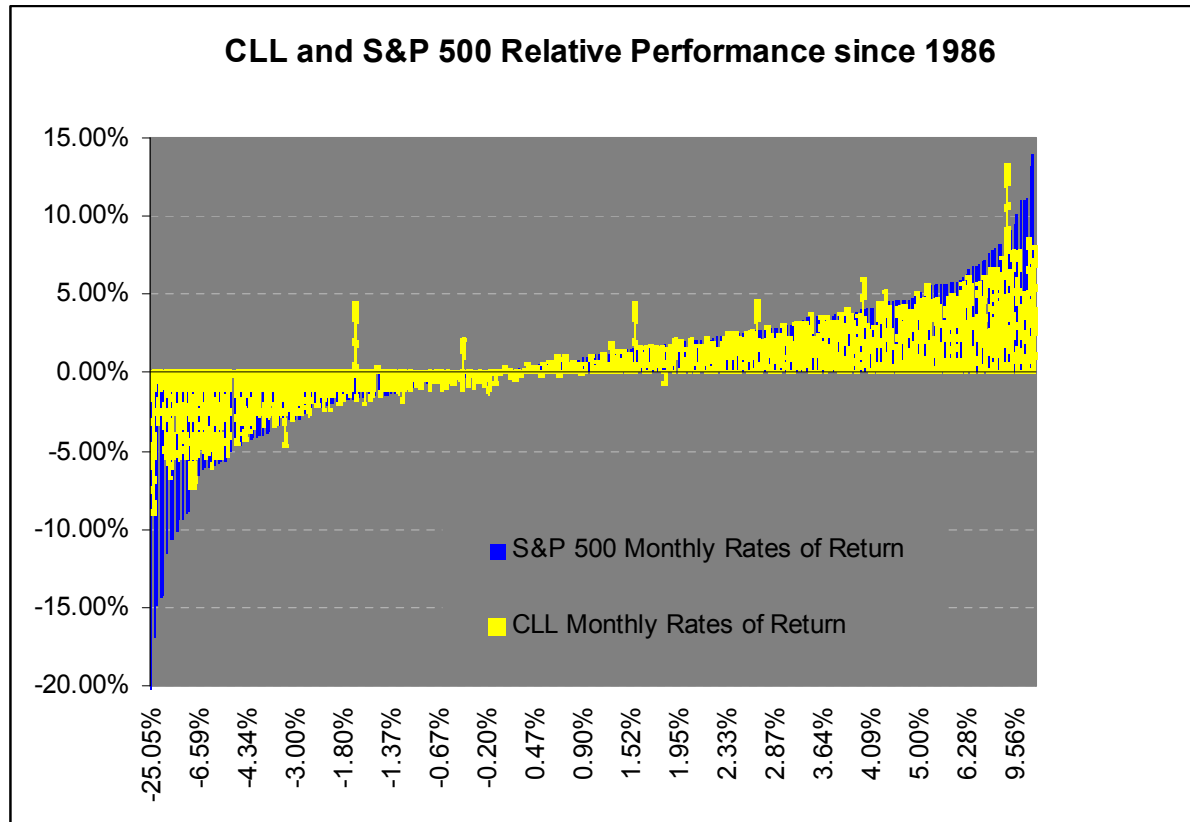
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## I. Introduction

- The CBOE Collar Index (CLI) applies a 95 -110 collar strategy to the S&P 500: buy 5% out-of-the-money (OTM) puts to protect the S&P 500 from negative returns, and sell 10% OTM calls to help finance the puts.
- To decrease the net cost of protection, the puts are sold on a quarterly basis while the calls are sold monthly.
- This document outlines the distinctive features of the CLI, and decomposes the CLI rate of return over a roll cycle into its different sources: (a) the return of the S&P 500, (b) the return from the options, and (c) the return from compounding daily dividends.

# I. Overview of CLL Index



- Source: CBOE Research

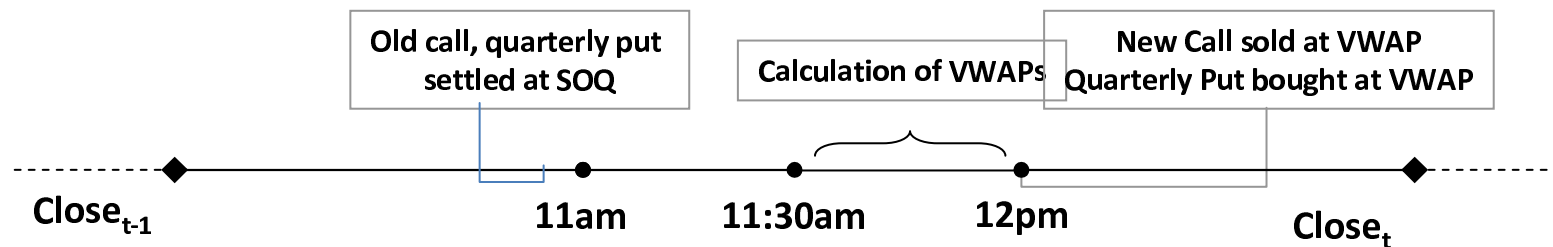


## I. Overview of CLL Index

- The CLL portfolio is long the S&P 500, long 5% OTM SPX puts and short 10% OTM SPX calls. The puts are quarterly puts usually rolled on 3<sup>rd</sup> Fridays in the March quarterly cycle, and the calls are one-month calls rolled every 3<sup>rd</sup> Friday. However, if the strike of a new call “crosses” below the strike of the put on a non-quarterly roll date, the put is sold and replaced by a new 5% OTM put with the same quarterly expiration. We call this a cross-roll date
- As illustrated in the previous chart, since 1986, the CLL has mitigated negative returns of the S&P 500 in exchange for smaller positive returns. Equivalently, the CLL compresses the distribution of returns so that it becomes less negatively skewed and shorter-tailed.
- The natural period of time in which to analyze CLL returns is from 12:00 p.m. on a roll date to 12:00 p.m. at the next roll date, when new options are bought or sold. This period is called a roll cycle.
- To better understand roll cycle returns, let’s first review CLL mechanics on a roll date.

## II. CLL Roll Date Mechanics

- The expiring call, as well as the puts on quarterly roll dates are settled at 11:00 a.m. ET to a Special Opening Quotation (SOQ) of the S&P 500.
- A new 10% OTM call at strike  $K_c$  is sold at 12:00 p.m. at its volume-weighted average price ( $C_{VWAP}$ ). The VWAP covers the period from 11:30am ET to 12pm ET. On quarterly rolls, a new put at strike  $K_p$  is bought at its VWAP price ( $P_{VWAP}$ ). The S&P500 is also deemed bought at its VWAP price ( $I_{vwap}$ ).
- Note that on a 3<sup>rd</sup> roll date, the S&P 500 is held uncovered from 11:00 a.m. to 12:00 p.m. ET. On all roll dates, there is no call in the portfolio during this hour
- If the strike of the new call crosses below the strike of a non-expiring put, the put is replaced by a new quarterly put with the strike reset at 5% OTM.



### III. Rate of Return of CLL over a Roll Cycle

- The CLL gross rate of return over a roll cycle is compounded from 12:00 p.m. on the initial roll date to 12:00 p.m. on the next roll date. If we exclude dividends, all intermediary terms of the compounded chain cancel out, and the gross rate of return reduces to a product of two terms:
  - (a) The gross rate of return from 12:00 p.m. ET to 11:00 a.m on the next roll date, when the call and quarterly put are settled (or marked to market for a non-expiring put). This period, period I, is called the settlement leg.
  - (b) The gross rate of return from 11:00 p.m. to 12:00 pm. This period, period II, is called the VWAP leg.
- Since the CLL is a portfolio of assets, its rate of return over each leg can be decomposed into a weighted sum of the rates of return of the different assets.

### III. Rate of Return of CLL over Settlement Leg

- Over the settlement leg, the CLL rate is equal to :

$$R_{CLL}^I = w_{S\&P\ 500}^I * R_{S\&P\ 500}^I + w_{put}^I R_{put}^I + w_{call} R_{call}$$

$$w_{S\&P\ 500}^I = \frac{I_{VWAP\ 0}}{I_{VWAP\ 0} + \{Put_{@12}\ or\ Put_{VWAP}\} - Call_{VWAP}}$$

$$w_{put}^I = \frac{\{Put_{@12}\ or\ Put_{VWAP}\}}{I_{VWAP\ 0} + \{Put_{@12}\ or\ Put_{VWAP}\} - Call_{VWAP}}$$

where the ws' are the asset weights and add up to 1.

Note that the weight of the S&P 500 is smaller than 1, because the net option position is long.

### III. Rate of Return of CLL over VWAP Leg

- Similarly, the rate of return of the CLL over the VWAP leg is

$$R_{CLL}^{II} = w_{S\&P\ 500}^{II} * \frac{I_{VWAP\ 1}}{SOQ} + w_{put}^{II} R_{PUT} , \quad w_{S\&P\ 500}^{II} = \frac{SOQ}{SOQ + Put_{11}}$$

where  $w_{S\&P\ 500}^{II}$  is the weight of the S&P 500 after settlement.

- On quarterly expirations,  $w_{S\&P\ 500}^{II} = 1$ , and  $w_{put} = 0$ . The rate of return of the CLL reduces to the S&P 500 rate.
- On non-quarterly expirations,  $w_{S\&P\ 500}^{II} < 1$ .
- Now compounding CLL returns over the settlement and VWAP legs and adding back compounded dividends:

$$R_{CLL} = (1 + R_{CLL}^I) * (1 + R_{CLL}^{II}) + Div - 1$$

## IV. Illustration

Settlement Leg Rates of Return							Settlement Leg CLL Rate of Return Ex- dividend
Monthly "Roll" Dates	SPX Weight	Put Weight	Call Weight	S&P 500 R	Put R	Call R	
9/19/2008							
10/17/2008	97.36%	2.89%	-0.25%	-25.90%	531.08%	-100.00%	-9.60%
11/21/2008	95.43%	6.87%	-2.30%	-19.20%	138.53%	-100.00%	-6.50%
12/19/2008	97.99%	5.75%	-3.74%	17.04%	-100.00%	123.24%	6.34%
1/16/2009	93.85%	6.58%	-0.43%	-3.43%	1.84%	-100.00%	-2.67%
2/20/2009	93.03%	7.66%	-0.69%	-8.52%	36.51%	-100.00%	-4.44%
3/20/2009	97.54%	3.29%	-0.83%	3.32%	-100.00%	-100.00%	0.78%
4/17/2009	94.78%	5.88%	-0.66%	11.51%	-71.07%	3.52%	6.71%
5/15/2009	98.96%	1.51%	-0.47%	2.95%	-78.41%	-100.00%	2.21%
6/19/2009	99.88%	0.37%	-0.25%	4.60%	-100.00%	-100.00%	4.47%
7/17/2009	96.50%	3.56%	-0.06%	1.76%	-45.31%	-100.00%	0.15%
8/21/2009	98.14%	1.98%	-0.12%	9.02%	-88.99%	-100.00%	7.21%
9/18/2009	99.85%	0.18%	-0.03%	4.60%	-100.00%	-100.00%	4.45%
10/16/2009	97.13%	2.94%	-0.07%	1.97%	-47.37%	-100.00%	0.59%

## IV. Illustration

VWAP Leg Rates of Return							
Monthly "Roll" Dates	S&P 500 Weight	Put Weight	S&P 500 Rate	Put Rate	VWAP Leg CLL Rate of Return	Compound d CLL Rate of Return Ex-dividend	12 to 12 CLL with Dividends
<b>9/19/2008</b>							
<b>10/17/2008</b>	79.80%	20.20%	2.40%	-0.60%	1.79%	-7.98%	-7.88%
<b>11/21/2008</b>	82.48%	17.52%	-0.42%	-5.18%	-1.26%	-7.68%	-7.39%
<b>12/19/2008</b>	100.00%	0.00%	0.02%	-100.00%	0.02%	6.36%	6.60%
<b>1/16/2009</b>	93.11%	6.89%	-2.29%	8.81%	-1.52%	-4.15%	-3.94%
<b>2/20/2009</b>	89.06%	10.94%	-0.55%	1.80%	-0.29%	-4.72%	-4.38%
<b>3/20/2009</b>	100.00%	0.00%	-1.10%	-100.00%	-1.10%	-0.33%	-0.15%
<b>4/17/2009</b>	98.42%	1.58%	-0.58%	-5.71%	-0.66%	6.00%	6.17%
<b>5/15/2009</b>	99.68%	0.32%	-0.63%	14.04%	-0.58%	1.61%	1.83%
<b>6/19/2009</b>	100.00%	0.00%	-0.26%	-100.00%	-0.26%	4.20%	4.44%
<b>7/17/2009</b>	98.05%	1.95%	-0.39%	1.07%	-0.36%	-0.21%	-0.07%
<b>8/21/2009</b>	99.80%	0.20%	0.35%	-10.84%	0.33%	7.56%	7.83%
<b>9/18/2009</b>	100.00%	0.00%	-0.47%	-100.00%	-0.47%	3.96%	4.11%
<b>10/16/2009</b>	98.46%	1.54%	-0.30%	-2.65%	-0.33%	0.26%	0.37%

## Disclaimer

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