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Equity Derivatives

MONTRÉAL EXCHANGE

Options on leveraged ETFs

Leveraged ETFs were first launched in 2006 and it took a few years and more volatile markets – post financial crisis - for trading activity and volume to pick up noticeably in these products.

One initial caveat with these products was the fact that the return profile was likely to be misunderstood by many non-institutional investors. In fact, a 2x leveraged ETFs on an index delivers every single day 2 times the return of the index but some investors thought that the 2x return would materialize and was true for any time horizon and as a result considered these type of products as "buy and hold". They realized that was not the case and generally market participants are well aware of this misconception today.

Subsequently, options on some popular leveraged products were listed on derivatives exchanges and some of them were quickly adopted by investors. The Montréal Exchange also offers options on a number of leveraged ETFs.

In this note we will discuss the relationship between the difference of return between the unlevered and leveraged ETFs as a function of leverage and characteristics of the price behavior of the unlevered ETF.

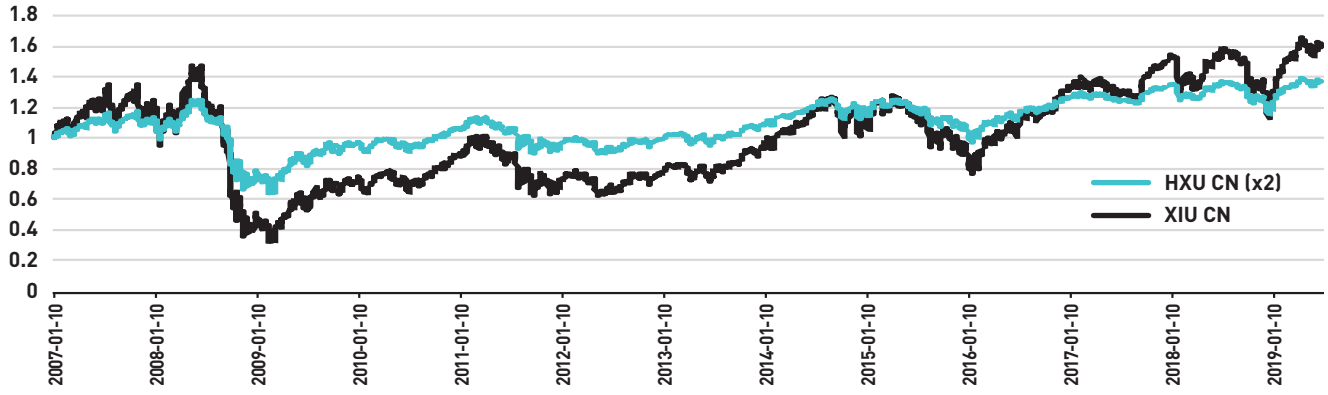
Then we explain how this relationship is core in pricing options on leveraged ETFs. As always, we will also provide practical trades and implementation ideas.

Daily leverage is not the same as long-term leverage

The biggest misstep by many investors in early days was to implement mid and long-term trades via leveraged ETFs. If an investor was bullish on the S&P/TSX60, he/she would purchase a 2x leveraged ETF (HXU CN) with the expectation that he/she will achieve two times the return of the index over his/her holding period. They quickly realized this was not the case.

Figure 1 below shows the value of $1 invested in the XIU CN (tracking the S&P/TSX60 Index) vs. $1 invested in HXU CN (2x daily return of the S&P/TSX60 index).

FIGURE 1
Comparison XIU CN vs. HXU CN

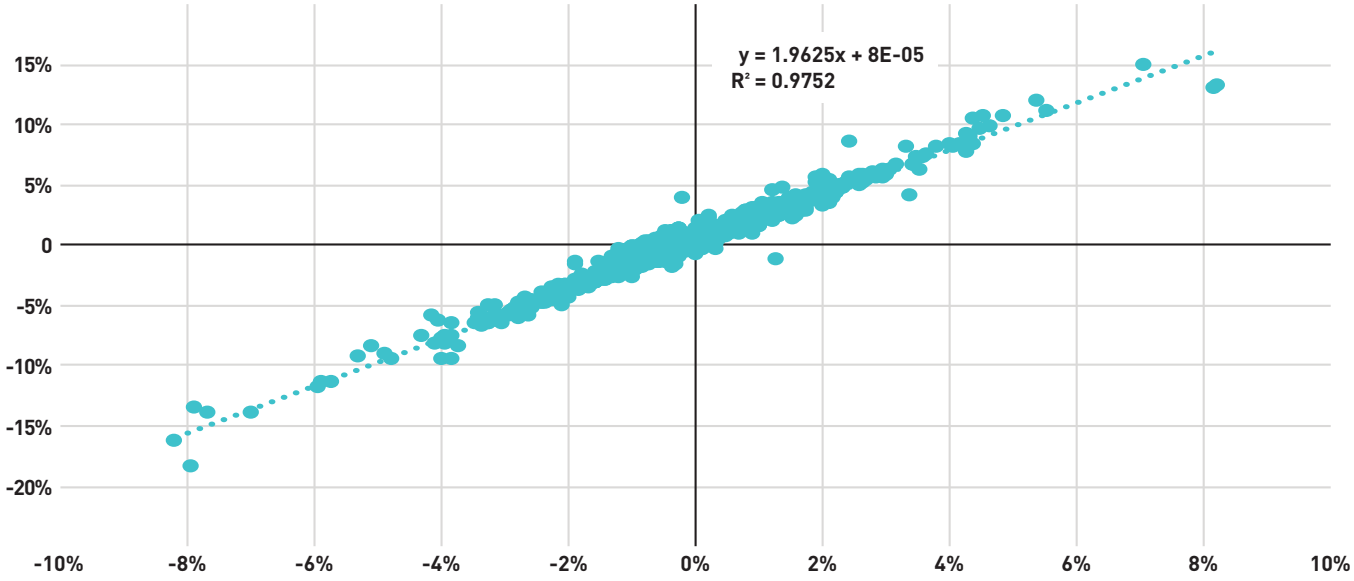


Source: Yahoo Finance

We easily observe that the return on HXU CN is not necessarily two times the return on XIU CN. For example, from January 2007 to January 2015 both ETFs had a similar return of 20%!

However, during this 8-year period - as figure 2 shows - in every given day HXU CN returned 2x the percentage return of XIU CN!

FIGURE 2
Daily returns of HXU CN vs. XIU CN



Source: Yahoo Finance

More noticeably, it seems that a clear relationship can can not established between the returns of HXU CN and XIU CN beyond a one-day horizon. Over similar time horizons of for instance 1 year the ratio of return between HXU CN and XIU CN can be very different.

TABLE 1
Return comparison between HXU CN and XIU CN for some select periods

Year	HXU CN	XIU CN	Ratio
FY2011	-22.3%	-11.1%	2.00
FY2012	6.4%	0.8%	8.14
FY2013	21.1%	9.0%	2.35
2007-present	59.7%	36.5%	1.63

Source: Yahoo Finance, LFC Calculations

Given all the above observations, key question is: why the mid and long-term return between a 2x leveraged ETF and the unlevered version is not a factor 2? and what drives the observed difference?

The battle of trend vs. volatility

The two drivers to the relationship of the price return of a leveraged ETF with a leveraged factor *m* (we will take m=2, i.e. a 2x leveraged ETFs for all our examples) vs. the price return of the unlevered ETF times *m*, are the trend and volatility of the price of the unlevered ETF.

Here is the intuition behind each case.

Trending

If the unlevered ETF were to rally 1% a day for 10 days in a row (a simple case of trending), then the price return over this 10-day period would be about 10.4% (= 1.01^{10} -1).

Over the same period the 2x leveraged ETF would return 2% per day so for the entire 10-day period its return is equal to: 1.02^{10} -1 = 21.9%.

So, the return of the leveraged ETF (21.9%) exceed the return of the unlevered ETF x2 (10.4 x 2= 20.8%) by 1.1%. We will not get into the technical details of generalizing this sample, but the main take away is:

If the unlevered ETF price trends higher (lower) then, the leveraged ETF return will outperform (underperform) the price return of the unlevered ETF x the leverage factor over that period of time.

Volatility

Let's look at a sample case where for a full year the unlevered ETF moves up 1% in a day and then -1% the next and then the same pattern repeats. (+1%, -1%, +1, -1% ...). In this case the annual volatility of the unlevered ETF is about 16%. By the end of the year the unlevered ETF's return is about -1.25%. (This due to compounding of log returns).

During the same period, the daily returns for the 2x levered ETF are: +2%, -2%, +2%, ... Once we calculate the return of the leveraged ETF over the same year period, we find that it is -5%.

Now if we consider the case of a 2% daily move (up then down) for the unlevered which corresponds to a 4% per day move (up then down) for the leveraged ETF we find that the returns are respectively -5% (as expected) and -18.3%!

Table 2 shows the returns as a function of the daily changes (of same amount and opposite sign day after the other) and the corresponding annualized volatility.

TABLE 2
Unlevered and leveraged ETF price returns over 1 year (252 business days)

Year	Unlevered ETF	2x Leveraged ETF	Annual vol. unlevered
+1%, -1%, +1, ...	-1.2%	-5.0%	16%
+2%, -2%, +2%, ...	-5.0%	-18.3%	32%
+3%, -3%, +3%, ...	-11.0%	-36.5%	48%

We observe that in a "sideways" price action scenario (i.e. when the unlevered ETF lacks any trend and hovers around a relatively static price) the leveraged ETF price decays noticeably. Moreover, the higher the volatility of the market the more the leveraged ETF "decays".

It is this decay that surprised many investors when they first started using leveraged ETFs. In fact, in years following the crisis despite the market rallying, the leveraged ETF failed to have a return equal to the unlevered return x the leverage factor simply because the immediate post crisis years were quite volatile and therefore resulted in decay of the leveraged ETFs.

Takeaway: If the unlevered ETF price has no trend then the leveraged ETF price decays and, the higher (lower) the volatility of the unlevered ETF the faster (slower) the leveraged ETF price will decay.

It is this battle between trend and volatility that defines how the leveraged ETF price evolves on longer time periods (weeks to years) compared to the price of the unlevered ETF.

The more a security exhibits strong trending behavior (volatility) the less (more) likely its leveraged ETFs are to decay. Table 3 sums up the pervious take away in a "rule of thumb" format.

TABLE 3
Leveraged ETF price returns compared to unlevered ETF x leverage factor

	Volatility	
	High	**Low**
No trend	Strong decay	Slow decay
Strong downtrend	Additional info*	Underperforms
Strong uptrend	Additional info*	Outperforms

* Additional information on the level of volatility and the strength of the trend are needed to evaluate precisely any outperformance/underperformance.

Options prices

The key in pricing options is the volatility of the underlying. As we noted before the daily volatility of the leveraged ETF is:

***abs(m)* (absolute value of the leverage factor) x the volatility of the unlevered ETF**

Naturally, one can expect the future volatility of the leveraged ETF to be *abs(m)* (absolute value of the leverage factor) x the expected volatility of the unlevered ETF. (We will use *m=2*)

In light of the above relations and given that market makers usually hedge their options positions on a daily basis, then options on a leveraged ETF are priced using an implied volatility that is 2 x the implied volatility of the unlevered ETF.

Take away: at-the-money implied volatility of a 2x leveraged ETF option for a given maturity is 2 times the implied volatility of the unlevered ETF.

This means that the price of an at-the-money option for 2x leveraged ETF for a given maturity is 2 times the price of the at-the-money option of the unlevered ETF.

Let us look at actual market data for select ETFs and see how implied volatilities compare.

Ideally, we need to compare the implied volatility of options on an ETF with those on its leveraged version. In Canada, we were unable to identify a leveraged ETF with listed options which has an unlevered equivalent with the same exact benchmark and with available listed options.

However, we identify HGU CN (BetaPro Canadian Gold Miners 2x Daily Bull ETF) and the XGD CN (iShares S&P/TSX Global Gold Index ETF) which provide a strong relationship with daily returns of HGU CN being 2x those of XGD CN.

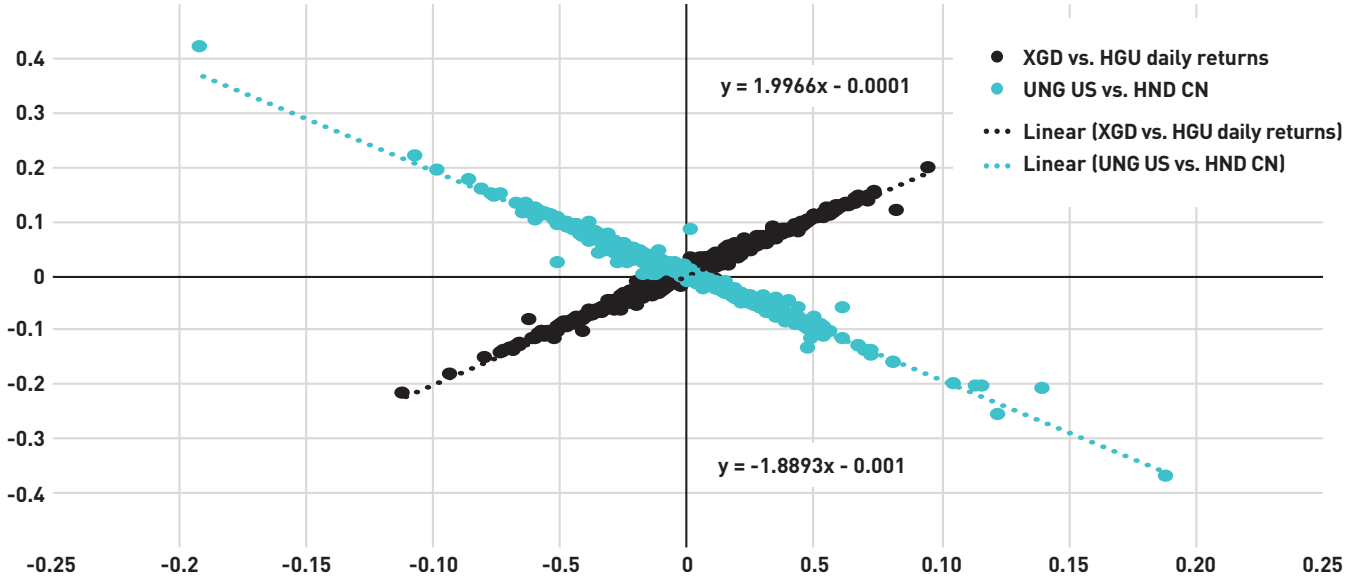
Additionally, we also look at a Canadian inverse leveraged ETFs with relatively high volume of traded options HDN CN (BetaPro Natural Gas -2x Daily Bear ETF) versus its respective US unlevered version UNG (United States Natural Gas Fund LP). They also exhibit a strong daily return relation.

TABLE 4
Selected Leveraged ETF and their corresponding unlevered ETF

Unlevered ETF	Leveraged ETF	Leverage factor
XGD CN	HGU CN	+2x
UNG US	HDN CN	-2x

In fact, to make sure that the choice of unlevered ETF is appropriate, we study the daily changes of the chosen leveraged ETFs vs. the corresponding unlevered ETF. Figure 3 confirms that the daily return of HGU is 2x that of XGD CN. For HND CN is nearly 2x (1.89x) that of UNG US.

FIGURE 3
Relationship of daily return of leveraged and unlevered ETFs



Source: Yahoo Finance

Tables 5 & 6 show the implied volatility of near the money options for the selected ETFs. The market data confirms, as expected, that the ratio of the implied volatility of near money options is equal to the leverage factor, in this case 2x.

TABLE 5 & 6
Near the money implied volatility on June 28th, 2019

Volatility	HGU CN	XGD CN	Ratio	HND CN	UNG	Ratio
30 days	51.5	27.3	1.89	71.5	38.3	1.86
60 days	54.9	26.0	2.12	70.9	34.7	2.04
90 days	53.7	26.1	2.06	69.0	35.0	1.97
120 days	52.4	25.4	2.07	66.7	35.6	1.87
150 days	53.4	24.9	2.14	69.2	36.7	1.89
180 days	53.4	24.7	2.16	69.2	37.4	1.85

Source: ivolatility.com

Opportunities?

Recall that a near the money option on the leveraged ETF is worth m (leverage factor) times the price of the unlevered ETF. For instance, by buying (selling) 2x the unlevered call (or put) option and selling (buying) 1x the leveraged ETF call (or put) option, we have premium neutral trade and also a neutral position on the benchmark index at the trade initiation.

However, as we saw initially over the mid or long-term the return profile of the leveraged and unlevered ETF can diverge significantly, depending on whether the benchmark index mostly trends or is stagnant and its volatility.

One can therefore take a view with limited risk on a trending vs. stagnant market by trading leveraged ETF options vs. its corresponding unlevered ETF.

Strategy 1 – capture the trend:

If one expects a strong trend (usually short-term), buy leveraged ETF options and sell the corresponding amount of unlevered ETF options to achieve a premium neutral and exposure neutral positions. (at initiation)

Example: in June 2019 ahead of OPEC meeting (later reported to July) and the G20 as well as FOMC meeting if one was bullish on the S&P500 with continued low volatility, he/she on June 3rd would:

- Buy SPXL (3x S&P500 leveraged ETF) at the money July 19, 42 calls for 7.26%
- Sell 3x SPY at the money July 19, 274 calls for 2.54%

By July 3rd, SPY had rallied by 8.42% while SPXL returned 27.6% exceeding 3 x 8.42% (= 25.3%) as the low volatility and trending scenario materialized, resulting in a total return for the strategy of 2.58%.

Note: prices used for this example are based on end of day mid prices. Source ivolatility.com and Nasdaq.

Strategy 2 – capture the decay:

If one expects a volatile period with no or a weak trend (mid to long-term), buy leveraged ETF put options and sell the corresponding amount of unlevered ETF options puts to achieve a premium neutral and exposure neutral positions.

This strategy aims to benefit from the decay of the leveraged ETF. If a year one was of the view that natural gas prices will be volatile yet generally stay range bound then, he/she could have:

- Buy HNU CN (BetaPro Natural Gas 2x Daily Bull ETF) Jul 2019 at the money puts *
- Sell UNG July 2019 at the money puts (in 2x the notional of HNU CN puts)
- The trade would be near premium neutral **

Over the 1-year period from July 3rd 2018 to 2019, UNG US return was -17.8% while HNU CN dropped by 49.9%. Potential return on the put vs. put strategy would have been +14.3%. (=2 x -17.8% + 49.9%)

In fact, natural gas was extremely volatile in fall 2018 and early winter 2019 resulting in a strong decay of the leveraged ETF (HNU CN), which this trade allowed to capture.

* These trades could not be implemented using listed options as HNU CN options were listed only as far as Nov 2018 back in Jul 2018.
** It is likely that if the options were available the borrowing cost of HNU CN would make the trade slightly less than premium neutral. This is because leveraged ETF traditionally have a high borrowing cost (2 to 3%)

Conclusion

Many other strategies can be devised using combinations of leveraged and inverse ETFs (as well as along with the corresponding unlevered ETF) options to express views on volatility and trends. It is important to emphasize a great advantage of using options on leveraged ETF to achieve this type of strategies, as well as many other variations that can be structured: the fact that it allows for controlling both tail and mark-to-market risk.

For instance, if one simply shorts the leveraged ETF and buys the unlevered ETF x2 notional (as opposed to the option based version of buying a put and selling 2x notional puts respectively), he/she incurs the risk of potential unlimited losses or a very adverse mark-to-market, should he/she be wrong and the leveraged ETF rally (whereas the long put has known maximum losses). In the case of leveraged ETFs which by design can exhibit high levels volatility this element of risk control is crucial.

Finally like all instruments with embedded leverage, it is important that every investor acquires a good level of familiarity with the products and strategies before implementing them.

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In addition to niche derivatives strategies, LFC also provides risk-management, hedging and overlay advisory services to family offices, institutional investor and businesses.

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