INTRODUCTION

Nearly 2 years ago, we wrote our article titled "Investing in the ETF Era", describing Exchange Traded Funds and their ever-expanding popularity and role in the world of finance (formulating a useful introductory reading to the world of ETFs). This trend hasn't changed ever since then, and it can even be said that it's accelerating with the large inflow of retail investors to the US stock market this year. This comes as no surprise, due to ETFs' attractiveness in the way that they (usually) accurately replicate the performance of underlying indices and are characterized by low costs of transactions, generally high liquidity, and quick access to diversification among classes of Assets (Equities, Bonds, Commodities, Volatility, FX), Regions & Countries (Global, US, Emerging Markets), as well as Sectors & Industries (Tech, Healthcare, Real Estate, Materials, Financials).

Then, in our article from April 2019, "Advanced ETF Mechanics and Its Flaws", we delved into the detailed structure of ETFs, understanding how the ETF replication mechanics work and what are their strengths and flaws from the perspective of a long-term passive investor.

Currently, it's clear ETFs are here to stay, reaching $7 trillion in AUM globally as of September 2020 according to ETFGI reports, an independent research firm covering the global ETF and ETP products.

However, in this article we will analyze a fairly upcoming niche (or possibly quickly becoming a widely recognized category) of the ETF world – Leveraged ETFs. These offer great short-term opportunities especially for the retail investor who might not have access to margin or more advanced methods of leverage for his portfolio. Such financial products that take advantage of leverage (including inverse ETFs) account for $89.64 billion in AUM as of July 2020 based on an ETFGI press release.

We will further aim to outline the peculiar characteristics that significantly differentiate Leveraged ETFs from traditional ETFs in terms of performance and risk, and allow you to understand why LETFs could be a good fit for short-term and portfolio hedging strategies,

WHAT ARE LEVERAGED ETFS – SCOPE AND MAIN FEATURES

Introduced in 2006, Leveraged ETFs' main aim is to amplify the return of underlying indices, applying a multiplier to the replicated performance in a given time span (in most cases daily). Namely, the reference performance can be obtained by calculating the return of the underlying index at the end of each day and multiplying it by the multiplier, then it has to be reset to obtain the next day's performance. Since this procedure may lead to an imbalance between NAV and exposure, the latter is offset. Thus, a coherent match with the NAV of the fund should be guaranteed, keeping fixed the daily leverage. However, the return for a longer than a day-long investment in a LETF is determined by the compounding of leveraged daily returns.

In general, in order to reach a higher exposure to the index and hence multiply its performance, LETFs use derivatives (futures, swaps, options), margin and/or debt, bringing new costs and risks to the fund in comparison to traditional ETFs. These extra costs arise from the daily rebalancing (i.e. FX and transaction costs, in particular if the asset is illiquid), borrowing (i.e. interest rates fluctuations) and derivatives related costs (i.e. premium paid to purchase an option, contango/backwardation effects due to the rolling of futures contracts, illiquidity of the swaps market), while risks increase because the compound return leads quickly to significant divergence from the performance of the underlying index in the long run. Moreover, overall costs may increase even further because daily resets may bring remarkable short-term capital gains taxes that may not be offset by losses.

To provide an example, let us consider the ProShares UltraPro QQQ fund (TQQQ), the largest US LETF. This product is designed to generate 3X the daily returns of the Nasdaq 100 composite index. If the index is up 10% on the day, the TQQQ performance should stand as close to +30% as possible (some divergences exist, although most popular LETFs come very close to returns 'promised' by their multipliers). The same applies in case of a negative return: if the index is down of -10% on the day, TQQQ performs at around -30%.

However, as mentioned earlier this amplification of returns only works with its intended purpose on a daily basis; now let us consider a time span of 10 positive return days in a row. Then we can observe that the daily returns compound, exploiting the larger capital obtained by the return of the previous day and leading to a performance of +1,378.58% (LETF) vs. +259.37% (index) – given the original scenario of +10% daily for the index. Likewise, 10 negative return days in a row lead to very differing losses, the index performance would be -65.13% while the LETF would generate -97.17%, almost wiping out the investment. Here the intuition is that positive returns in bullish markets lead to exponentially increasing percentage gains, while negative ones in bearish markets lead to decreasing percentage drops (compared to a direct 3X multiplier in that timespan). However, due to the cyclical nature of markets, series of 10 consecutive positive or negative days are rare and can be considered outliers in the purpose of studying LETFs.

Thus, what happens if indices fluctuate and alternate between positive and negative days in many ways with no particular pattern (as is the actual case). The short answer is that the more volatile the underlying index/asset, the larger the loss of LETFs value over the long-term. We will circle back to that thought deeper in the article as we attempt to formalize how LETFs' performance and risks are calculated. However, this main reason remains, as to why LETFs are not suitable for long-term investors and may entail huge losses.

Conversely, Inverse ETFs (IETFs) provide a linearly opposite performance from the underlying indices, taking advantage of a falling market, and Leveraged Inverse ETFs (LIETFs) combine the above-mentioned features resulting in a product that amplifies the return with the application of a negative multiplier in a given time interval (also daily in most cases).

For instance, the ProShares UltraPro Short QQQ fund (SQQQ) generates -3X the daily returns of the Nasdaq 100 composite index. If the index is down -10% on the day, SQQQ performance is +30%, while if the index is up 10% on the day, SQQQ performance is down -30% today. Likewise, returns over a wider time span are the opposite of those we have seen with TQQQ, but are accordingly impacted by the compounding effect.

WHY LETFs SHOULD BE CONSIDERED FOR SHORT-TERM TRADING?

They easily offer leverage on assets without requiring margin accounts or borrowing stocks, while other financial instruments may be either more expensive, more time consuming or riskier. For example, futures roll at the expiration date, and require large margins and knowledge to handle them, while CFDs are OTC financial instruments are less transparent than exchange traded products and hence not as regulated. On the other hand, LETFs are enticing because they promptly provide leverage in a regulated market (concerns mentioned later) without requiring margin accounts and rolling. In actuality, in the worst case scenario, losses may not exceed the amount of money invested and this leads to a safety net for investors wanting to benefit from leverage in buying or short selling the market.

LETFs AND IETFs MARKET

The major issuers of the LETFs on the market are ProShares, Direxion, and iPath, which offer products whose leverage is generally between 1.25X and 3X (attempts were made in bringing 4X leveraged ETFs to the US stock market, but were stopped by the SEC). Blackrock, the largest ETF issuer in the world with its iShares ETF business, and Vanguard (another major player) do not belong to the above list, and have raised doubts about the risks of significant losses that LETFs may entail when markets experience a rise in volatility, claiming more clarity is needed in the regulation of such products.

The most popular LETFs in the US as of September 2020 are:
1. ProShares UltraPro QQQ fund (Symbol: TQQQ / Leveraged: 3x / AUM $8.42 Billion)
2. ProShares Ultra S&P 500 (Symbol: SSO / Leveraged: 2x / AUM $2.35 Billion)
3. Direxion Daily Technology Bull 3X Shares (Symbol: TECL / Leveraged: 3x / AUM $1.75 Billion)

While the most popular LIETFs in the US as of September 2020 are:
1. ProShares UltraPro Short QQQ (Symbol: SQQQ / Leveraged: -3x / AUM $1.60 Billion)
2. ProShares UltraShort S&P 500 (Symbol: SDS / Leveraged: -2x / AUM $1.13 Billion)
3. Direxion Daily S&P 500 Bear 3X Shares (Symbol: SPXS / Leveraged: -3x / AUM $0.79 Billion)

For the sake of performance & risk analysis, it is worth considering that the majority of the most popular products are those that amplify returns with the highest multipliers available in the sector.

REBALANCE, RETURNS AND RISKS

As suggested before, LETFs are composed of cash invested in a major fraction of short-term securities and a minor fraction of a highly volatile portfolio of derivatives, which are covered by the cash in the occurrence of losses. When the underlying indices experience a change in value, consequently its exposure and NAV tend to diverge. Since the leverage multiplier must be kept constant, at the end of each day the fund must be offset through rebalancing.

Let us consider the ProShares Ultra S&P 500 (SSO) as an example to explain this concept. The leveraged multiplier of 2X in the SSO means that the exposure is theoretically twice its NAV. Assuming NAV = $100, the initial exposure will be equal to $200 ($100 the asset purchased + $100 derivatives and/or margin) and let us assume the asset performance being -10%. Then, if the assets fall to $90 and the exposure will be equal to (1 - 0.1)*$200 = $180, reporting a loss of $20. Consequently, the NAV will be equal to 100$ – 20$ = $80. Now, we know that our new base is $80, and the leverage ratio stays fixed at 2X. Therefore, we need to reset the fund in order to once again align the NAV with the market exposure at the end of the day. With the NAV = 80$, the exposure that must be guaranteed is 2*80$ = $160 and it is reached by selling the corresponding amount of $20 of overexposure (180$ - 20$ = 160$). It is worth noting that due to this process the transaction costs of the LETF are raised when compared to traditional ETFs.

Taking this concept further, returns of an LETF over time may be represented by the following formula which takes into account the compounding effect:

$$L_n = L_0 \cdot \prod_{j=1}^{n} (1 + \beta R_j)$$

Where $\beta$ is the leverage ratio of the LETF, $R_j$ the daily return, $L_0$ the initial value of the LETF and $L_n$ the value on day n. As it is shown, $L_n$ may vary positively or negatively based on $R_j$. To really see the leverage at work, let us go back to our previous example of ProShares UltraPro QQQ fund (TQQQ). Assuming $L_0$ = 100, $\beta$ = 3 (leverage ratio 3:1), $R_j$= 10%, TQQQ value on day ten (n = 10) would be:

$L_n = 100 * (1+3*0.1) * (1+3*0.1) * \ldots * (1+3*0.1) = 100 * (1.3)\hat{}10 = 1,378.59$

While $A_n$, the value on day n of the underlying index would be:

$A_n = 100 * (1.1)\hat{}10 = 259.37$

Clearly, the difference of performance is extreme: +1,378.59% against 259.37%.

By contrast, assuming $R_j$ = -10% and keeping the other parameters fixed, TQQQ value on day ten (n = 10) would be:

$L_n = 100 * (1+3*(-0.1)) * (1+3*(-0.1)) * \ldots * (1+3*(-0.1)) = 100 * (0.7)\hat{}10 = 2.83$

Leading to a startling negative performance of -97.18% with the capital almost completely wiped out.

While $A_n$ would present a lesser drop in the value of the index of -65.13%:

$A_n = 100 * (0.9)\hat{}10 = 34.87$

Now, when returns alternate, that is $R_j$ = -10% for n odd and $R_j$ = 10% for n even:

$L_n = 100 * (1+3*(-0.1)) * (1+3*(+0.1)) * \ldots * (1+3*(-0.1)) * (1+3*(+0.1)) = 100 * (1.3)\hat{}5 * (0.7)\hat{}5 = 62.40$

$A_n = 100 * (0.9)\hat{}5 * (1.1)\hat{}5 = 95.10$

Here the performance is -37.60% vs. -4.90%.

Looking at the math behind it, we can now fully understand why LETFs' performance over the long-term may be misleading because one may conclude that the leveraged performance is plainly the leveraged ratio times the return of the asset over the time span. However, this is not true since, as shown, the compounding effect leads to different results. Especially, as with higher volatility, a wider the gap in the overall performances materializes. Paradoxically, there may even occur a performance flip, where the underlying can have a positive return while the LETFs may report a negative performance.

In other words, it is safe to say that we would have earned huge profits when the series was composed only or mainly by positive daily returns, but we would have been exposed to the risk of losing our entire capital when the asset experienced a bad period of more or less 10 negative days (i.e. uncommon but still probable events such as subprime crisis, COVID-19 pandemic, etc.). The latter still holds true in real-life situations where markets tend to alternate their return between positive and negative territories, and it is the main reason why LETFs are not well-suited for long-term investors.

AFTERWORD

A lot of conflicting sides arise on the topic of LETFs. While they certainly shouldn't be utilized by beginner investors who do not have the appropriate risk management and understanding of such elevated risk leveraged products, they still attract a largely non-professional investor crowd. This is due to the fact that professionals usually prefer to utilize their own knowledge of leverage and derivatives to hedge or amplify their investment returns, bypassing the fees and potential risks that come with outsourcing such operations to a third party. Furthermore, LETFs still face a large amount of scrutiny in the financial world, shown by BlackRock and Vanguard staying out of such instruments. The SEC has also shown its concerns with shutting down attempts to bring 4X leveraged ETFs to the market, although no formal limit was set at 3X. Further evidence arises from several LETF liquidations by Direxion and ProShares in the recent market turmoil caused by the coronavirus, although none have faced as extreme of a fate as XIV in February 2020, when the ETN made to inversely track the VIX went into complete meltdown, and the subsequent liquidation on February 20 left investors with their capital nearly completely wiped out.