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Do leveraged exchange-traded products deliver their stated multiples?

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ABSTRACT

Using the longest history of a U.S. equity market index, this paper simulates the return deviation and multiple deviation for Leveraged Exchange-Traded Products (LETPs) with different rebalancing frequencies, including daily, monthly, annually, and every five years, over various holding periods. We find that the general perception that daily-rebalanced LETPs are not suitable for long-term strategies is not substantiated. Advancing the analysis, we construct a comprehensive framework that determines the deviation of an LETP's effective multiple from its stated product multiple under various rebalancing frequencies and holding period scenarios. The empirical framework and results from this paper hold the promise of guiding regulators, policy makers, and investors in their understanding of the tracking performance of LETPs.

1. Introduction

Leveraged Exchange-Traded Products (LETPs) are publicly-traded funds and notes that employ the securities comprising the underlying indices, swaps, futures, and other financial derivatives to deliver a multiple of the underlying index return.[3] The original form of LETPs is the leveraged exchange-traded fund (LETF) with a constant daily multiple. Introduced in 2006, LETFs initially gained tremendous popularity with investors. However, the global financial crisis of 2007–2009 triggered large deviations in both returns and effective multiples from their naïve expected counterparts in these funds, leading to losses that prompted investor lawsuits, warnings from regulators, such as the Financial Regulatory Industry Authority (FINRA) and the Securities and Exchange Commission (SEC), sale suspension by financial advisory firms, such as Edward Jones and UBS, and cautionary notes by their providers.[4]

The LETP market extends beyond daily-rebalanced products. For example, the Barclays ETN + Long B Leveraged Exchange-Traded Note (ticker: BXUB) has a five-year rebalancing period (from November 17, 2009 to November 20, 2014) and an initial product multiple of 300%. From inception to maturity, this five-year LETP is designed to deliver 300% of the total return on the underlying S&P 500, and therefore does not require rebalancing before maturity. There are also LETPs with monthly re-hedging needs. For example, on February 27, 2008, Deutsche Bank issued leveraged exchange-trade notes with a constant monthly multiple. Because this type of note requires the fund managers to re-hedge the exposure to the underlying index at the end of each month, we will refer to them as monthly-rebalanced LETPs and those that must be rebalanced daily as daily-rebalanced LETPs.[5]

The poor tracking performance of daily-rebalanced LETPs during the financial crisis of 2007–2009 has led the SEC, FINRA, the financial media, and investment advisors to warn investors that these daily-rebalanced LETPs are not suitable for long-term strategies.[6]

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[3] See Appendix A for the detailed definition of terms used in this paper.

[4] For example, ProShares UltraShort S&P 500 LETF (ticker: SDS) seeks a daily investment target of −200% of the returns on the S&P 500. The prospectus of the UltraShort S&P 500 fund (SDS) contains the following statement: *"This ETF seeks a return of −200% of the return of an index (target)* ***for a single day****. Due to the compounding of daily returns, ProShares' returns over periods other than one day will likely differ in amount and possibly direction from the target return for the same period."* For details, see http://www.proshares.com/funds/sds.html.

[5] Since daily-rebalanced LETPs are also referred to as LETFs in the previous literature and media, we use daily-rebalanced LETPs, daily LETPs, and LETFs interchangeably in this paper. For LETPs that are rebalanced monthly, annually and every five years, we call them monthly LETPs, annual LETPs, and 5-year LETPs, respectively.

[6] For example, using the actual historical data of LETFs from 2006 to 2008, Lu et al. (2012) conclude that the inverse double LETF return does not equal twice the inverse of the index return if the holding period is more than one quarter. Hill and Foster (2009) examine the history of the SPX and conclude that the compounding effect is neutral to LETF returns. Also, see http://www.sec.gov/investor/pubs/leveragedetfs-alert.htm for warnings from the SEC.

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However, these comments are not conclusive for at least three reasons. First, because LETPs have a short history, the warnings are based on a small sample. Second, the financial crisis was a unique global event, and generalizations from it should be tempered. Third, a comprehensive framework to determine the effective multiple for LETPs with different rebalancing frequencies over various holding periods has yet to be provided.

To address these points, we test for additional perspectives on the deviations of LETP target returns and multiples from their naively expected counterparts by using more than a century's history of the Dow Jones Industrial Average (INDU) over various investment horizons. We begin with the daily-rebalanced LETPs, which are designed to deliver a constant daily leverage. Contrary to public criticism, we find that, on average, LETP target returns, over various holding periods, perform largely in line with, and no worse than, their naive expected returns, defined as the product multiple times the cumulative returns of their underlying indices during the holding period. The holding periods include calendar months, calendar years, rolling two days, three days, and up to 2500 trading days.

Our results also show that the daily return distribution using real-world historical data is much more leptokurtic than the normal distribution. In particular, the kurtosis of the daily real-world returns is significantly higher than three for the annual holding periods. This positive excess kurtosis together with a non-zero mean is beneficial to the compounding deviation of daily-rebalanced LETPs over long holding periods.

According to its product design, the daily-rebalanced LETP is supposed to achieve a constant multiple that equals the product multiple over each holding day. However, when the holding period is more than one trading day, the effective multiple – the cumulative return of an LETP divided by the cumulative return of the underlying index during the holding period – is no longer the same as the product multiple (the difference between which we call the "multiple deviation").

Several recent studies offer additional motivation for this investigation. Cheng and Madhavan (2009), as well as Avellaneda and Zhang (2010), derive the relation between the daily-rebalanced LETP's target return and the underlying index return. Charupat and Miu (2011) examine the pricing efficiency and tracking errors of a set of Canadian LETFs using actual LETF data for 2007–2009 and offer excellent explanations of the price deviations between the actual market price and the NAV of LETFs. Tang and Xu (2013) further examine the sources of the deviation between a daily-rebalanced LETP's market return and the naïve expected return during 2006–2010.

Complementing and building on these studies, we construct a comprehensive framework to demonstrate that the deviation of a daily-rebalanced LETP's effective multiple from its product multiple can be determined by the future return and volatility of the underlying index during the holding period. Such a path-dependent deviation will benefit fund holders when the underlying index is smoothly trending, either up or down. However, it will hurt them when the market is highly volatile, as seen during the financial crisis of 2007–2009 when the VIX swung between 9 and 90. Additionally, instead of using only the actual LETF data that are constrained by a short history, limited designs, and the influence of the recent financial crisis, this study uses the longest history of equity market data to simulate the return and multiple deviations of LETPs across different rebalancing periods.[7] As a result, it provides perspectives that transcend existing LETPs and their limited data history, resulting in empirical evidence that offers an objective and systematic assessment of the return and multiple deviations of LETPs.

The rest of this paper is organized as follows. Section 2 describes the data and defines the key variables used in this study. Section 3 lays out the analytical framework and presents the empirical results. Section 4 carries out the robustness check. Section 5 concludes the paper.

2. Data and variable definitions

We use the Dow Jones Industrial Average (INDU) from its inception on May 26, 1896 to December 31, 2010. As a robustness test, we also examine the S&P 500 index (SPX) with public access from 1958 to 2010, the S&P SmallCap 600 index (SML) from 1989 to 2010, and the NASDAQ Composite Index (CCMP) from 1972 to 2010. The daily total return data on these indices are obtained from Bloomberg.

For each LETP, we simulate the return target by using the actual historical returns for each index and the LETP's product multiple. For example, if the underlying index experiences a return of 10% in a day, to calculate the daily target return of a daily-rebalanced ($3\times$) LETP, we multiply the actual daily return of the underlying index by its product multiple of three to reach a daily target return of $10\% \times 3 = 30\%$. To obtain the cumulative target return of this LETP, we accumulate the daily LETP target return over the holding period. As an illustration, if the underlying index experiences a return of -10% in the following day, then the cumulative return of the LETP during this two-day period is $(1 + 10\% \times 3) \times (1 - 10\% \times 3) - 1 = -9\%$. We define this cumulative return as the LETP's target return during the holding period.

As mentioned, when daily-rebalanced LETPs were initially created, investors were under the impression that the return on an LETP will equal the product multiple times the cumulative return of its underlying index during any holding period. This is also referred to as the "constant leverage trap." To examine it, we define the naive expected return of an LETP in a specific holding period as the product multiple times the cumulative return of its underlying index during the holding period. In our example, this naïve expected return within the two-day holding period is -3% ($3 \times$ underlying index return $= 3 \times [(1 + 10\%) \times (1 - 10\%) - 1] = 3 \times (-1\%) = -3\%$). For daily-rebalanced LETPs, the naïve expected return equals the target return on a daily basis. However, over multiple holding days, this naive expected return generally does not equal the accumulation of daily target returns of an LETP (-3% vs. -9% in this example).

It is not uncommon to find media reports indicating a widespread perception that the target return of an LETP will generally be lower than its naive expected return over a long holding period. To investigate the accuracy of this assertion, we define the compounding effect of an LETP during a holding period as the target return of an LETP less its naive expected return over the holding period. (In our previous example, this compounding effect is $-6\% = -9\% - (-3\%)$.) Based on general perception, this compounding effect will be negative over holding periods longer than a day.

An alternative way to examine the constant leverage trap is by looking at the deviation of the effective multiple from the product multiple. We define the effective multiple as the cumulative return of an LETP divided by the cumulative return of the underlying index during the holding period. The naïve expectation of investors is that the effective multiple will always be equal to the product multiple regardless of the length of the holding period. However, the actual multiple for an intra-period investor on a five-year LETP is generally different from the product multiple. To determine the

[7] One exception is Hill and Foster (2009), who simulate the LETF performance using the S&P 500 index during 1959–2008. However, our study includes the advantages of using more than a century of stock market data, 1896–2010. A longer sample period increases the statistical power of our tests. It also includes the years marked by the Great Depression (1929–1932), a time of high market volatility, a key determinant of LETF return and multiple deviations. Because this period includes a financial crisis not unlike the recent financial crisis, it is informative to include it. In addition, our simulation extends beyond daily-rebalanced LETPs, providing evidence on both return and multiple deviations across LETPs that are rebalanced daily, monthly, annually, and every five years.