# RESEARCH NOTE

*October 2009*

# Inverse and Levered ETFs: Not your father's ETF

It was not very long ago that equity ETFs came into being and investors came to know them as index surrogates with almost identical return and risk characteristics. The early or traditional ETFs continue to be close substitutes for passive index mutual funds but have the added features of intraday pricing and liquidity and, in many cases, superior tax efficiency. They can be convenient vehicles for gaining exposures to broad or narrow asset classes as represented by a wide variety of financial market indexes. Newer, innovative ETFs, however, can have very different objectives accompanied by return and risk properties unlike those of the first generation ETFs—as many investors have recently discovered. This short note explains why some investors were surprised and dismayed by the recent performance of levered and inverse (short) equity index ETFs. This example serves to remind investors that new exchange traded funds (ETFs) should be reviewed carefully—without preconceived notions that they resemble the "old" ETFs.

**Current state and trends of the ETF industry**

Exchange traded funds (ETFs) have evolved in many ways since the first U.S. fund, the S&P Depository Receipts Trust Series 1 (SPDR), began trading in 1993. While the SPDR was conceived as a relatively simple but more tax-efficient alternative to passive S&P 500 index mutual funds[1], ETFs are now available for hundreds of indexes around the globe, bonds, commodities, currencies and active investment strategies, including hedge funds and private equity. The ETF industry has grown rapidly in terms of both size and innovation. According to recent studies by Barclays Global Investors (BGI)[2], there were 1,768 ETFs from 94 providers trading on 42 exchanges around the globe at the end of July 2009. In the U.S., there were 706 ETFs from 22 providers with $582 billion of assets under management at the end of Q2 2009. BGI, State Street Global Advisors, and Vanguard continue as the top-ranked U.S. providers in terms of $AUM with 48.2%, 15.2%, and 7.8%, respectively, of the $858 billion in global ETF assets.

Following investor acceptance of traditional "long" index ETFs, providers began to expand offerings, including many designed to facilitate short-term hedging objectives. In 2006, ProShares introduced the first "inverse" and "levered" ETFs. Inverse ETFs are designed to produce the returns of a short position in an index, and levered ETFs attempt to produce magnified index returns by employing various forms of leverage. Other providers quickly entered the market, with the largest and best-known now being PowerShares, Rydex, and Direxion. ProShares currently has 74 products and plans for another 99, while PowerShares has 124 and 37 planned. Among products in the planning or registration process are new versions of inverse and levered ETFs.

**What are inverse and levered ETFs?**

The traditional index ETF is designed to deliver the returns of the index if held long, that is, 1 times or 1X the index return for any time period. An inverse ETF is designed to earn the return of the index if it were sold short, that is, the negative of the index return or -1X the index return. An inverse ETF would be purchased if one expected (or wanted to hedge the possibility) that an index would fall, in which case the inverse ETF would gain what the long ETF lost.

If an ETF is levered, it is designed to earn more than the return of a simple long or inverse ETF. We can characterize any such ETF by the multiple "M" (or MX) of the index return it is designed to earn. Currently, most

[1] Traditional ETFs settle most trades by receiving and delivering securities rather than cash. The IRS rules that there is no taxable gain or loss on in-kind transactions, which means that traditional ETFs have few taxable realized capital gains to distribute to shareholders. In contrast, index mutual funds trade mostly on a cash basis and must distribute 90+% of realized capital gains, meaning that shareholders frequently incur annual capital gains tax liabilities even though they themselves engage in no selling.

[2] *ETF Landscapes, Industry Review August 2009,* Barclays Global Investors, August 2009, and *ETF Landscapes, U.S. Handbook, Q2 2009,* Barclays Global Investors.

levered ETFs are either 2X, 3X, -2X, or -3X, and therefore offer investors the opportunity to earn 2 or 3 times (and lose 2 or 3 times) the daily return of a simple long or short position in the index. These levered ETFs have leverage (borrowing) built into their structure, thus eliminating the need for investors to do their own borrowing (margin, futures, swaps, etc.) or short-selling, but the leveraging process is built to achieve an objective quite different from that of the simple, traditional ETF.

**The difference with inverse and levered ETFs**

Like the traditional ETFs, inverse and levered ETFs trade intraday, but they differ from traditional ETFs in terms of fees, expenses, tax efficiency, investment time horizon, mechanics, and tracking error. Fees and expenses are higher, often exceeding 1% per annum, and tax efficiency is lower because most trades settle in cash rather than in kind and realized gains from the use of derivatives are generally taxed at ordinary income tax rates instead of the lower capital gains tax rates.

The important difference, expenses and taxes aside, is obviously the leverage, but most important from a performance point of view is the investment holding period dictated by the leverage scheme. The objectives of traditional (1X) ETFs are independent of time period; that is, they are designed to meet the goal of returning 1X the benchmark return regardless of the investment holding period. On the other hand, most inverse and levered ETFs are structured to achieve their 2X, 3X, -1X, -2X, or -3X returns for *one day only.* The holdings and positions of these ETFs are rebalanced at the end of each trading day to re-establish the stated market exposure (MX).[3]

The mechanics of rebalancing depend on the method used to achieve the stated levered exposure to the ETF's benchmark, with total return swaps and futures being the vehicles most commonly used by stock index ETFs. If the index changes in either direction over a day, the ETF's Net Asset Value (NAV) changes, which means that the swap in place at the start of the day no longer provides the required multiple exposure. Therefore, before the market closes the ETF manager re-contracts to re-establish the appropriate multiple on the day's closing price—not its beginning price. If an investor purchased at the opening price, his ***initial*** investment began with the stated multiple exposure[4], which translated into a given dollar amount. By the end of the day, however, the leverage has to be adjusted for the gain or loss over the day. If the ETF is 2X or 3X, market exposure must be reduced when the market falls and increased when the market rises. If the ETF is -1X, -2X, or -3X, market exposure must also be reduced when the market falls (since the ETF's NAV increased, more shorting is required) and increased when the market rises (since NAV decreased, less shorting is required).[5]

Although ETF prospectuses state the objective and the one-day horizon, it seems clear that some investors either assumed these ETFs could be bought and held like the traditional ones, did not read the prospectus carefully, or did not understand the implications of daily rebalancing. It is also the case that the effects of daily rebalancing became pronounced and thus obvious only when the volatility of market indexes soared, particularly in late 2008 and early 2009. The SEC and FINRA were apparently unaware of the level of misunderstanding and consequent inappropriate use of these ETFs, as it was not until August 2009 that the SEC staff and FINRA issued an Alert saying "…we believe individual investors may be confused about the performance objectives of leveraged and inverse exchange-traded funds (ETFs). Leveraged and inverse ETFs typically are designed to achieve their stated performance objectives on a daily basis. Some investors might invest in these ETFs with the expectation that the ETFs may meet their stated daily performance objectives over the long term as well. Investors should be aware that performance of these ETFs over a period longer than one day can differ significantly from their stated daily performance objectives."

**The difference revealed**

As the credit crisis and ensuing bear market unfolded, more interest, attention, and cash were focused on levered and inverse ETFs. Interest and attention picked up even more as their performance diverged from that of

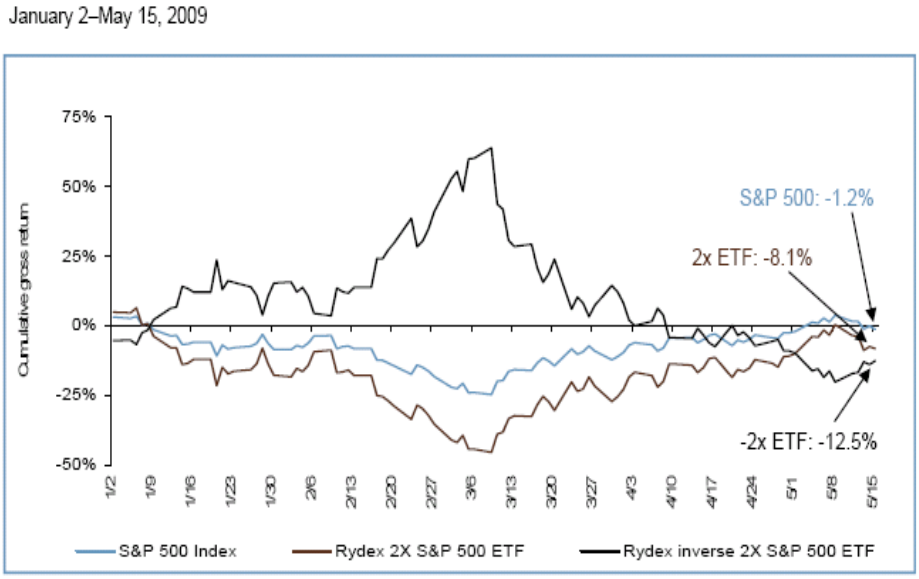
[3] To the best of our knowledge, one provider has filed with the SEC for approval of ETFs with monthly rebalancing and a number of other providers are considering them; approval is not expected until 2010. However, as of September 30, 2009, Direxion enacted changes to its levered and inverse open-end mutual funds, converting them from + or – 2.5X with daily rebalancing to + or -2X with monthly rebalancing.

[4] This assumes that the opening price equals the closing price of the preceding day when the ETF was reset to the stated multiple.

[5] Cheng and Madhaven (see references) make this point clear in their paper. They discuss how both the long and inverse levered funds exert the same buying or selling pressure on markets at the close of the trading day, impacting prices in the same direction and increasing volatility.

the underlying indexes on a cumulative basis. By the first quarter of 2009 "underperformance" by levered ETFs—both long and short—was a hot topic. The following example, courtesy of Vanguard, describes the cumulative return behavior of levered ETFs that surprised many. Graph 1 shows how over the period January 2, 2009 through May 15, 2009, the S&P 500 returned -1.2% while the 2X ETF returned -8.1% or 6.75X the index—underperforming 2X the S&P 500 over this period. The -2X ETF, returned -12.5% or +6.25X (!) the index—not only underperforming -2X the S&P 500 but failing to produce an inverse return.

***Graph 1: Unleveraged long ETF versus 2X ETF and -2X ETF on the S&P 500 Index***

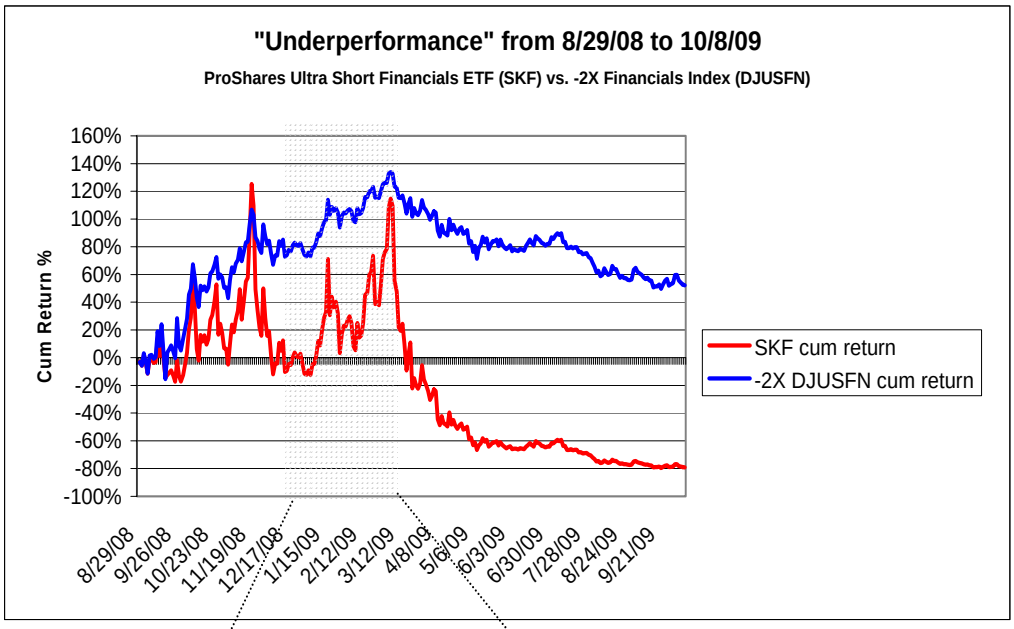



Source: Vanguard calculations using data from Thomson Datastream. All returns are total returns. Cumulative returns are indexed to 1 as of January 1, 2009. The Rydex indexes are provided by RydexShares and are benchmarked to the S&P 500 Index.

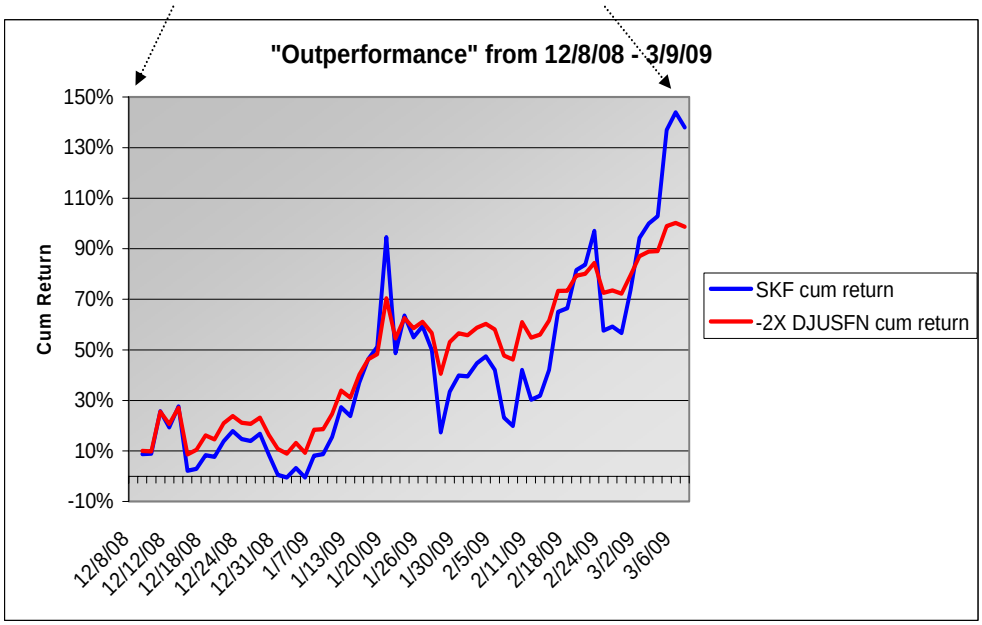
The following two graphs show how a -2X ETF on the Dow Jones Financials Index fared relative to -2X the index (ticker: DJUSFN) from the end of August 2008 through October 8, 2009. Graph 2 shows that the cumulative return to the ProShares Ultra Short Financials ETF (ticker: SKF) over this timeframe was -79%, while -2X the index's cumulative return was + 52%. Graph 3 shows that outperformance relative to the -2X target can occur when price-trending is particularly favorable, as exemplified by the period from December 8, 2008 to the market bottom on March 9, 2009.[6]

[6] This is not the only period when SKF outperformed its target -2X the index for more than one day. We did not quantify the likelihood of such "outperformance" for all possible holding periods but note that trading precisely and correctly before index reversals (being very talented or prescient) was crucial.

***Graph 2: Cumulative Performance of a -2X ETF relative to -2X the Cumulative Return of its Index***




***Graph 3: Periods of "Outperformance" relative to -2X the Cumulative Index Return***




**The issue**

Clearly, any investor who bought and held the long or inverse S&P 500 ETFs in Graph 1 for the January to May 2009 period was the recipient of massive cumulative underperformance relative to their target multiples. Likewise, any investor who bought the levered, inverse Financials ETF (SKF) and held through the volatility spikes shown in Graph 2 also suffered cumulative underperformance. Although Graph 3 identifies an extended holding period with outperformance *ex poste*, it was not, in our opinion, easily identified *ex ante.*

The previous "Underperformance" graphs describe *not* a case of ETF mismanagement but a case of what can happen if the product is misunderstood or misused. The key issue is the automatic daily rebalancing (re-levering)

that is required when the ETF's objective is to produce a multiple of the index return *for a one day investment period*. On a daily basis, each of the inverse and levered ETFs returned approximately its target X multiple. Over multiple days, weeks, or months, these ETFs underperformed and out-performed uninformed expectations significantly on a cumulative or compounded basis.

Daily rebalancing, that is, resetting leverage to the specified multiple is responsible. If the *dollar* amount of leverage—not the % of leverage—at the time of purchase were locked in, an investor would watch his initial investment return the stated multiple times the index return for any investment period. This of course ignores the drag created by management fees and expenses and assumes that market moves do not result in margins calls or bankruptcy. Compounding itself is not the problem; it is *what* is being compounded.

**Analyzing the performance**

For a thorough analysis and understanding of the consequences of rebalancing, we highly recommend the papers by Minder Cheng and Ananth Madhaven (CM) and Richard Co (*see References)*. CM develop a continuous time model for investigating the valuation problem, potential market impacts, and policy implications. Co explains the basic valuation effect and discusses its similarity to the gamma risk of option trading strategies.

The analysis of levered ETF underperformance or outperformance begins by recognizing the difference in compound returns from static leverage and dynamically rebalanced leverage. Static leverage means levering an investment position once and "letting it ride." Static leverage is apparently what many investors thought they were getting with the first generation levered ETFs. For the purposes of this note, a simple two-day example allows us to make the key points. We ignore borrowing costs, fees, expenses, and taxes so that we can focus on the effect of rebalancing.

For the long static leverage case, an investor who has one dollar to invest (any number would do) also borrows (M-1) dollars and invests M dollars in a simple 1X stock index ETF. The index returns $r_1$ on the first day and $r_2$ on the second day. At the end of two days, (M-1) dollars of debt must be repaid, and the value of the position with static leverage is

(1) Value with Static Leverage = $M (1+r_1) (1+r_2) – (M-1)$.

The index has a cumulative two-day return of (1+r1)(1+r2)-1, and the investor has earned M times the index return, assuming $r_1$ and $r_2$ were not sufficiently negative to generate margin calls and/or bankrupt the position.

For the levered ETF case, the investor uses his one dollar to buy shares in a levered ETF on the same index with a leverage multiple of M. If the index returns $r_1$ and $r_2$, this ETF returns $M \cdot r_1$ and $M \cdot r_2$. The value of the levered ETF with rebalancing at the end of day 2 is

(2) Value with Leverage Rebalanced Daily =$1 (1+ M \cdot r_1) (1+ M \cdot r_2)$.

The levered ETF has a cumulative two-day return of $(1+ M \cdot r_1) (1+ M \cdot r_2)$ -1, which differs from that of the position using static leverage unless $r_1$ and $r_2$ equal zero.

If we take the difference of equations (2) and (1) we can see when the levered ETF underperforms or out-performs the statically levered alternative. After collecting terms and simplifying, the difference is

(3) Difference between Daily Rebalanced and Static Leverage = (2) – (1) = $(M^2 – M) (r_1 \cdot r_2)$.

The term $(M^2 – M)$ is always positive given that M is greater than 1 for levered long ETFs (and less than -1 for inverse levered ETFs). Therefore, the second term $(r_1 \cdot r_2)$ determines whether the levered ETF with daily rebalancing produces a cumulative return that is greater or less than M times the index return. Note that the difference increases at an exponential rate as M increases. There are only four possibilities in the two-day case:

1) If the index rises both days, $r_1 \cdot r_2 r>0$ so the levered ETF returns more than M times the index return (outperforms).The intuition is that rebalancing levers up the first day's gain in advance of a gain on the second day; levering gains in a favorable market environment will beat the returns from static leverage (MX the index return). The levered inverse ETF likewise outperforms. Its

NAV falls on day 2, so leverage (total short exposure) is reduced to maintain the target MX; the ETF therefore loses less than if a static leverage were employed.

2) If the index falls both days, $r_1 \cdot r_2 > 0$ so the levered ETF returns more than M times the index return (outperforms). The explanation mirrors that of the previous case 1).
3) If the index is unchanged both days, the levered ETF and the index both have zero returns.
4) If the index rises one day and falls the other day, in either order, $r_1 \cdot r_2 < 0$ so the levered ETF returns less than M times the index return (underperforms). If the index moves favorably the first day, the ETF's exposure will be increased—resulting in greater losses on the second day than if leverage had not been increased. If the index moves unfavorably the first day, the ETF's exposure will be decreased—resulting in lower gains on the second day than if leverage had not been decreased.

If we extend the investment period beyond two days, the equations and results become complicated. We can, however, expand on the four outcomes above by generalizing the results developed by Cheng and Madhaven in their multiperiod analysis. Without being as precise and specific, we summarize their general findings:[7]

- If the index has an upward trend and low volatility, the levered long ETF can return more than M times the index return. The intuition is that rebalancing levers up each day's gain in advance of successive gains as in case 1) above. So long as index reversals as in case 4) above are relatively small or infrequent, rebalancing can beat static leverage. (outperform)
- If the index has a downward trend and low volatility, the levered long ETF can return more, that is, lose less than M times the index return. In this case, the long ETF pares back leverage as its NAV falls, so loses less than a statically levered position. The inverse ETF experiences a rising NAV so increases leverage (short exposure), that is, levers the gains whereas static leverage does not. Again, so long as index reversals are relatively minor, rebalancing can beat static. (outperform)
- If the index is totally unchanged (trivial case), the levered ETF and the index both have zero returns. If the index is unchanged from the start to the end of the holding period but exhibits even low volatility over the period, levered ETFs can return less than M times the index return. (underperform).
- If the index has high volatility and little trend, levered ETFs return less than M times the index. This is exemplified by the S&P 500 ETFs shown in Graph 1. Even with definite trending, high levels of volatility can cause levered ETFs to return less than M times the index return. (underperform)
- The greater volatility and the longer the holding period, the greater is cumulative underperformance relative to M times the index.
- Given the costs associated with daily rebalancing and sizeable management fees, cumulative outperformance faces a head wind even with favorable price-trending and low volatility.

**ETFs with Monthly Rebalancing**

Although we know of no inverse or levered ETFs with other than daily rebalancing, they are apparently being developed. Akin to these are recently introduced inverse and levered open-end mutual funds, which have already been approved for monthly resets. For example, as of September 30, 2009, investors can purchase monthly-rebalanced levered and inverse mutual funds from Direxion. Direxion changed the terms of its levered and inverse equity index mutual funds from + or -2.5X with daily rebalancing to + or -2X with monthly rebalancing. We discuss this Direxion example because the salient issues will apply to similarly engineered ETFs rolled out in the future.

The longer rebalancing period has numerous implications for investors:

- The calendar month return should track + or -2X the index return closely, of course, with the ever-present reduction due to fees and expenses.

[7] CM model the valuation problem in continuous time with the index price assumed to follow a geometric Brownian motion. This allows them to derive results in terms of drift and volatility.

- The X multiple is not constant intra-month. At the end of each month, the required leverage is set as closely as possible to the target multiple using swaps (and/or futures), so that any investor who buys at the end of the month will have the targeted X exposure at the day's close. The initial exposure will not be adjusted until the end of the last trading day of the next month. Any subsequent change in the value of the underlying index therefore results in the multiple changing: If the index moves favorably, NAV increases, and because dollar leverage is fixed, the exposure multiple falls below the target. If the index moves against the fund, NAV falls, and because the dollar leverage is fixed, the exposure multiple rises above the target. Therefore, investors must research the effective multiple before making intra-month purchases.
- In the same way that investors should not expect daily-rebalanced ETFs to earn the target multiple for more than one day, they should not expect monthly-rebalanced ETFs (or mutual funds) to earn the target multiple for more than one month.
- Monthly rebalancing means there is increased risk of a levered long or inverse ETF's NAV going to zero, that is, of the investor losing 100%. Consider a 2X ETF: effectively, the ETF uses $1 of debt for every $1 of equity, investing $2 in the index stocks. If the index falls 50%, the value of the stocks just covers the debt—there is no equity remaining (NAV goes to zero). While this may seem a very low probability event for broad indexes, it may not be for narrow sector or specialty indexes.

**Final Words**

The day is long past that ETFs can be assumed to have the characteristics of the SPDR-like ETFs that investors have found so convenient and reliable. As the proliferation of ETFs continues, it is important to recognize that innovation means change and probably added complexity, and it is more important than ever to delve into prospectuses. We think that many investors and even investment professionals failed to recognize the impact of daily rebalancing on the performance of levered ETFs for holding periods longer than one day. It seems obvious that the planned creation of new levered ETFs with monthly investment periods is a response to demand for more pre-packaged statically leveraged investment vehicles. It is important to recognize that the same problems discussed in this note will still exist if the rebalancing period is lengthened. As these new products are rolled out, new risks must be analyzed—for static leverage over longer periods increases the risk of losing all before the rebalancing period is up. Although any form of ETF offers reliable limited liability, meaning that the investor cannot lose more than the price of the ETF, the risk of losing all increases as the rebalancing period for levered and inverse ETFs is lengthened, especially for high multiples of exposure. Any ETF should be used in accordance with its stated objective.

There are many uses for daily-rebalanced ETFs, such as equitizing cash and accrued cash, hedging other long or short positions in the portfolio, maintaining market exposures during portfolio transitioning—all of which can be accomplished easily and with low transactions cost. Of course, it is also true that levered ETFs (as is usually the case with other hedging instruments) provide investors a simple way to achieve leverage and magnified rates of return. Investors seeking levered returns are usually fully aware of the accompanying magnification of volatility risk, but they must be equally aware of additional risks associated with rebalancing and the derivatives employed in the strategy—and not subject themselves to unintended risks by using ETFs for unintended uses.

***References***

Minder Cheng and Ananth Madhavan, *The Dynamics of Leveraged and Inverse Exchange-Traded Funds,* Barclays Global Investors, May 9, 2009. Available at SSRN: http://ssrn.com/abstract=1393995

Richard Co, *Leveraged ETFs vs. Futures: Where is the Missing Performance?,* CME Group, February 2009.

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