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It was not very long ago that equity exchange-traded funds (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 recently discovered. This article explains why some investors were surprised and dismayed by the recent performance of leveraged and inverse (short) equity index ETFs. This example serves to remind investors that they should review new ETFs carefully—without preconceived notions that they resemble the "old" ETFs.

CURRENT STATE AND TRENDS OF THE ETF INDUSTRY

Exchange-traded funds 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 covering equities, bonds, commodities, currencies, hedge funds and private equity. The ETF industry has grown rapidly in terms of both size and innovation. According to BlackRock [2010], there were 3,775 ETFs from 109 providers trading on 40 exchanges around the globe at the end of 2009. In the United States, there were 772 ETFs from 28 providers with $705 billion of assets under management. Barclays, State Street Global Advisors, and Vanguard continued as the top-ranked U.S. and global providers in terms of assets under management, with 47.4%, 15.6%, and 8.9%, respectively, of the $1,032 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 "leveraged" ETFs. Inverse ETFs are designed to produce the returns of a short position in an index, and leveraged 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, Direxion, and Rydex. At the end of 2009, ProShares had 78 products and plans for 98 more, while PowerShares

had 106 and plans for 37. Direxion and Rydex plan launches of 192 products. Among products in the planning or registration process are new versions of inverse and leveraged ETFs.

WHAT ARE INVERSE AND LEVERAGED 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 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, percentage-wise.

If an ETF is leveraged, 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 leveraged 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 leveraged ETFs have leverage built into their structure, thus eliminating the need for investors to do their own borrowing (margin, futures, swaps, etc.) or short selling. The leveraging process, however, is built to achieve an objective quite different from that of the simple, traditional ETF.

The Difference with Inverse and Leveraged ETFs

Like the traditional ETFs, inverse and leveraged 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. 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 leveraged 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).[2]

The mechanics of rebalancing depend on the method used to achieve the stated leveraged 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,[3] which translated into a given dollar amount. By the end of the day, however, the leverage must 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).[4]

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."

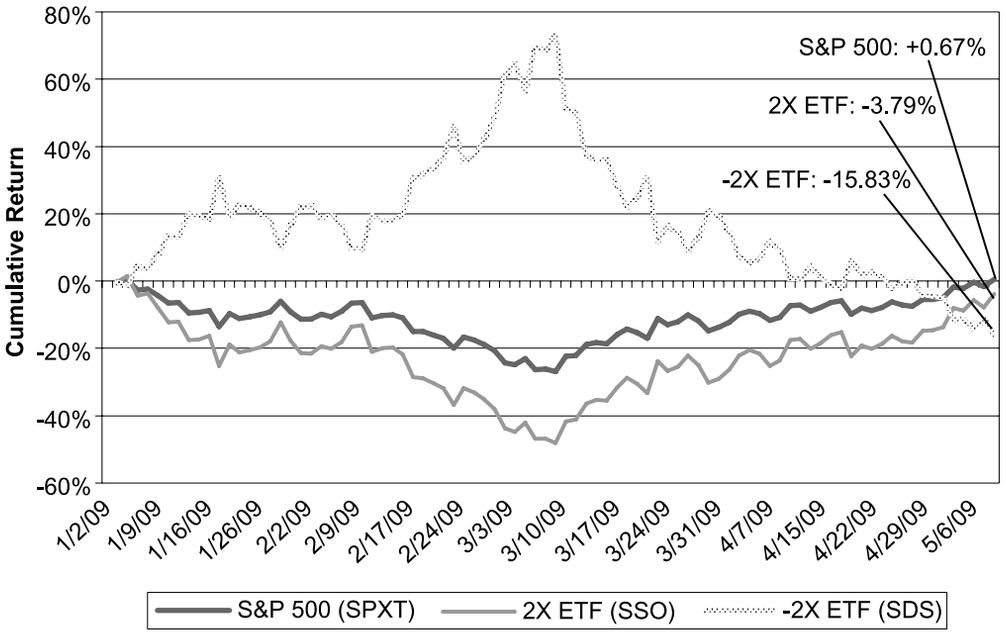
THE DIFFERENCE REVEALED

As the credit crisis and ensuing bear market unfolded, more interest, attention, and cash were focused on leveraged and inverse ETFs. Interest and attention picked up even more as their performance diverged from that of the underlying indexes on a cumulative basis. By the first quarter of 2009, "underperformance" by leveraged ETFs—both long and short—was a hot topic. The following examples describe the cumulative return behavior of leveraged ETFs that surprised many. Exhibit 1 shows how leveraged ETFs fared relative to the S&P 500 total return index during the first five months of 2009. The S&P 500 gained 0.67% while the ProShares 2X ETF (ticker: SSO) returned –3.79% or –5.7X the index—not only underperforming 2X the S&P 500 over this period, but generating a loss instead of a magnified gain. The ProShares –2X ETF (ticker: SDS), returned –15.83%—an amazing –23.6X the index's return for the period. Although the underlying index was almost unchanged over the period, both leveraged long and leveraged inverse ETFs suffered losses that bore no resemblance to their daily multiple targets.

Exhibits 2 and 3 show how a –2X ETF on the Dow Jones Financials Index performed relative to –2X the index (ticker: DJUSFNT) from September 2008 to June 2009, when the index lost about 26%. Exhibit 2 illustrates a period of magnified underperformance: the cumulative return to the ProShares UltraShort Financials ETF (ticker: SKF) over this timeframe was –79%, while –2X the index's cumulative return was +52%. Exhibit 3, on the other hand, 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.[5]

EXHIBIT 1

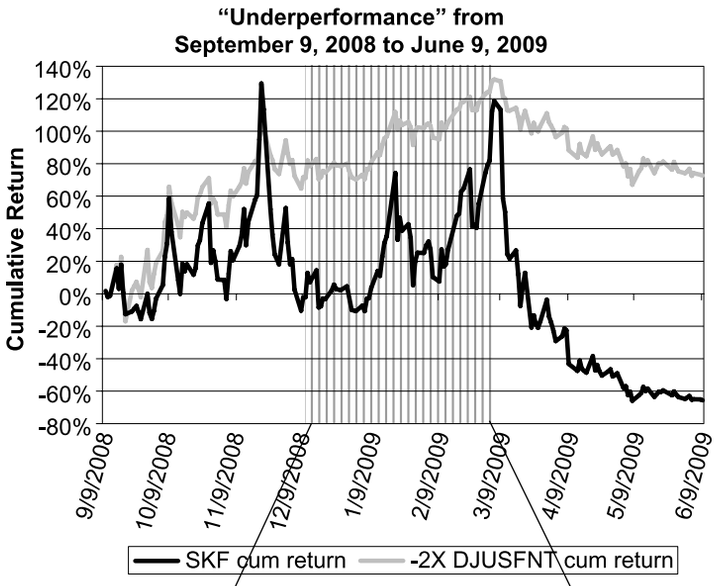
"Underperformance" from January 2, 2009, to May 8, 2009, of 2X and –2X ETFs vs. the S&P 500 Index



Source: Total returns calculated from Bloomberg daily price data.

EXHIBIT 2

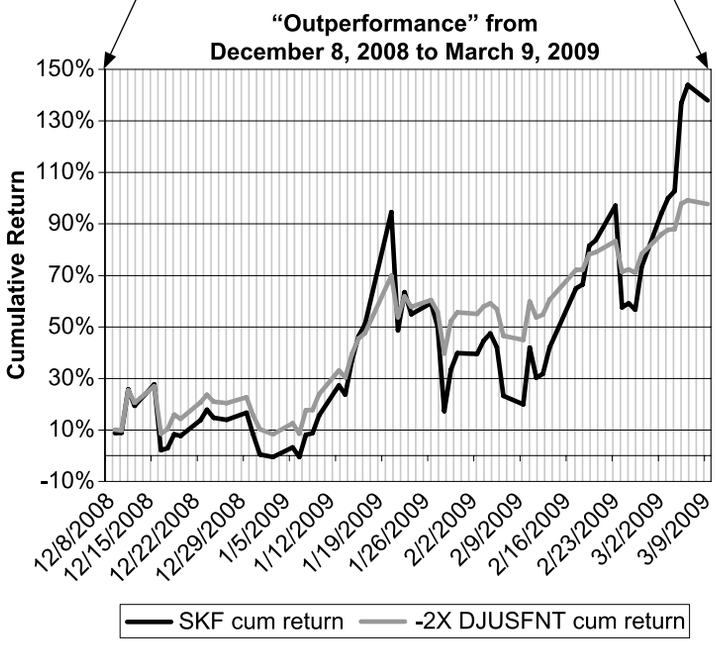
Performance of –2X ETF Relative to –2X the Cumulative Return of its Index (ProShares UltraShort Financial Index ETF (SKF) vs. –2X Financial Index (DJUSFNT))



Source: Returns calculated using Bloomberg daily price data.

EXHIBIT 3

Periods of "Outperformance" Relative to –2X the Cumulative Return of its Index



Source: Returns calculated using Bloomberg daily price data.

THE ISSUE

Exhibit 1 shows how any investor who bought and held leveraged S&P 500 ETFs for the January to May 2009 period was the recipient of massive cumulative underperformance relative to stated target multiples. Likewise, any investor who bought leveraged, inverse financials ETFs and held them through the volatility spikes shown in Exhibit 2 suffered cumulative underperformance. Although Exhibit 3 identifies an extended holding period with *ex post* outperformance, it was not easily identifiable *ex ante*.

The exhibits showing underperformance describe *not* cases of ETF mismanagement but cases of what can happen if the product is misunderstood or misused. The key issue is the automatic daily rebalancing (releveraging) 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 leveraged ETFs returned approximately its target MX multiple. Over multiple days, weeks, or months, however, these ETFs underperformed and outperformed 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 percentage 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

The analysis of leveraged 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 leveraged ETFs. 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

$$\text{Value with Static Leverage} = M\,(1 + r_1)\,(1 + r_2) - (M - 1) \quad (1)$$

The index has a cumulative two-day return of $(1 + r_1)(1 + r_2) - 1$, 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 leveraged ETF case, the investor uses his one dollar to buy shares in a leveraged 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 leveraged ETF with rebalancing at the end of day 2 is

$$\text{Value with Leverage Rebalanced Daily} = 1\,(1 + M \cdot r_1)\,(1 + M \cdot r_2) \quad (2)$$

The leveraged 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 leveraged ETF underperforms or outperforms the statically leveraged alternative. After collecting terms and simplifying, the difference is

$$\text{Difference between Daily Rebalanced and Static Leverage} = (2) - (1) = (M^2 - M)\,(r_1 \cdot r_2) \quad (3)$$

The term $(M^2 - M)$ is always positive given that M is greater than 1 for leveraged long ETFs (and less than –1 for inverse leveraged ETFs). Therefore, the second term $(r_1 \cdot r_2)$ determines whether the leveraged 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, $r_1 \cdot r_2 > 0$, so the leveraged 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 leveraged 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 static leverage were employed.
2. If the index falls both days, $r_1 \cdot r_2 > 0$, so the leveraged ETF returns more than M times the index return (outperforms). The explanation mirrors that of case 1.
3. If the index is unchanged both days, the leveraged 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 leveraged 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, equations become complicated and results very sensitive to the path of daily index price changes. For a thorough multi-period analysis and understanding of the consequences of rebalancing, we recommend the papers by Cheng and Madhavan [2009] and Co [2009]. Cheng and Madhavan developed a continuous time model assuming that index prices follow a geometric Brownian motion and investigated the valuation problem, potential market impacts, and policy implications. Co approximated the basic effect of rebalancing on cumulative value using a Taylor Series expansion and related it to the gamma losses associated with option trading strategies.

We expand on the four outcomes above by generalizing the multi-period results developed by Cheng and Madhavan:

- If the index has an upward trend and low volatility, the leveraged 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 leveraged 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 it loses less than a statically leveraged position. The inverse ETF experiences a rising NAV, so it increases leverage (short exposure)—that is, it 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 leveraged 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, leveraged ETFs can return less than M times the index return (underperform).
- If the index has high volatility and little trend, leveraged ETFs are likely to return less than M times the index. This is exemplified by the S&P 500 ETFs shown in Exhibit 1. Even with definite trending, high levels of volatility can cause leveraged 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 sizable management fees, cumulative outperformance faces a headwind even with favorable price-trending and low volatility.

ETFs WITH MONTHLY REBALANCING

Although we know of no inverse or leveraged ETFs with other than daily rebalancing, they are apparently being developed. Akin to these are recently introduced inverse and leveraged open-end mutual funds, which have already been approved for monthly rebalancing. For example, as of September 30, 2009, investors could purchase monthly-rebalanced leveraged long and inverse mutual funds from Direxion. Direxion changed the terms of its leveraged equity index mutual funds from +2.5X (or −2.5X) with daily rebalancing to +2X (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 +2X (or −2X) the index return closely, of course, with the ever-present reduction due to fees and expenses.
- 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 leveraged 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.

CONCLUSION

The day is long past when 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 that 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 leveraged ETFs for holding periods longer than one day. It seems obvious that the planned creation of new leveraged 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 article 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 leveraged 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 leveraged ETFs, such as equitizing cash and accrued cash, hedging other long or short positions in the portfolio, and maintaining market exposures during portfolio transitioning—all of which can be accomplished easily and with low transaction costs. Of course, it is also true that leveraged 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 leveraged 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.

ENDNOTES

Any opinions expressed in this article are those of the author and do not necessarily represent the opinions of, nor should they be attributed to, Hammond Associates.

[1]Traditional ETFs settle most trades by receiving and delivering securities rather than cash. The IRS has ruled 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 at least 90% of realized capital gains, meaning that shareholders frequently incur annual capital gains tax liabilities even though they themselves engage in no selling.

[2]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.

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

[4]Cheng and Madhavan [2009] make this point clear. They show how both the long and inverse leveraged 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 market volatility.

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

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