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INVERSE ETFS AND VOLATILITY DRAG

There are times when some investors would like to be able to profit from a decline in the market or market segment. Large institutions would typically sell futures contracts in these circumstances. Traders comfortable with options might buy puts, sell calls, or both. However, many investors shun the use of these derivative instruments, either because they believe that they are too risky or simply because they are unfamiliar with them.

Another alternative for some investors would be to sell short an ETF, such as the SPDR S&P 500 (SPY). However, for many investors, short selling has the same problems of unfamiliarity and perceived riskiness as futures and options. Some account types, such as IRAs, are prohibited from selling short.

Short selling involves selling a security first and buying it back later in the hope that the price will have declined. The initial sell order must be facilitated by borrowing the security from a broker, whose fee for this service will depend upon the supply/demand conditions for the borrowed security.

These restrictions leave long-only investors searching for investments that will benefit from a market decline. Given their popularity, it appears that many long-only investors have turned to inverse ETFs to implement a negative market viewpoint. Based upon coverage in the popular press, it also seems that some investors mistakenly assume that they will perform exactly like short positions even if held for longer than the one-day investment horizon for which they are designed. Over some long time periods, inverse ETFs have shown a tendency to underperform a short position, sometimes dramatically so. The popular press has seized upon this as another example of Wall Street fleecing the investing public, and in response the regulatory authorities have put pressure on the issuers to very clearly spell out the risks of inverse ETFs and on professional advisors to ensure their suitability for clients.

The purpose of this article is to empirically analyze how closely inverse ETFs mimic the performance of short ETF positions and suggest a methodology for estimating the shortfall (called "volatility drag") for a one month holding period.

One of the most popular short ETFs is ProShares Short S&P 500 ETF (SH). As the issuer makes clear in many places within their materials, this ETF "seeks a return that is -1x the return of the index ***for a single day***" (their emphasis). The ETF's portfolio consists of futures and swaps with various investment banks. These positions are reset on a daily basis in order to keep the hedge at -100%.

Nearly all inverse ETFs (and nearly all leveraged ETFs) have this daily reset feature, although a few have a monthly reset. All of the inverse ETFs mentioned in this article use a daily reset.

It is this daily reset of the hedge that can cause what has come to be called "**volatility drag**" (or alternatively "volatility loss"). This effect applies not only to inverse ETFs, but also to leveraged ETFs. For example, ProShares Ultra S&P 500 (SSO) aims to provide twice the daily return of the S&P 500. The table below provides a simple but extreme illustration of volatility drag:

	Price			DailyReturn			Cumulative Return		
Ticker	S&P 500	SH	SSO	S&P 500	SH	SSO	S&P 500	SH	SSO
Type	Index	-1x Fund	2x Fund	Index	-1x Fund	2x Fund	Index	-1x Fund	2x Fund
Day 0	100	100	100						
Day 1	120	80	140	20.00%	-20.00%	40.00%			
Day 2	150	60	210	25.00%	-25.00%	50.00%	50.00%	-40.00%	110.00%
Day 3	100	80	70	-33.33%	33.33%	-66.67%	0.00%	-20.00%	-30.00%

Assume that the S&P 500 Index, the -1x ETF SH, and the 2x ETF SSO all start at the same price of $100 at the end of Day 0. If the S&P 500 goes to $120 at the end of Day 1, that's an increase of 20%. The move in SH will be exactly the opposite, -20%, so its price declines to $80. The move in SSO will be exactly twice, 40%, so its price increases to $140. If at the end of Day 2, the S&P 500 is at $150, it returned 25% for that day. Following the same pattern, SH falls 25% to $60 and SSO climbs 50% to $210. If on Day 3 the S&P 500 falls 33.33% back to $100, SH and SSO would follow their daily pattern with returns of +33.33% and -66.67% respectively.

However, **on a cumulative basis, both SH and SSO have lost considerable money** over this three day period! **Even though the cumulative return of the S&P 500 was zero, SH is down 20% and SSO is down 30%!**

Sometimes volatility drag turns out to be a gain rather than a loss. Note that at the end of Day 2, although the cumulative return for the S&P 500 was **50%**, the total return for SH stood at **-40%** ($60/$100 – 1), and the return of SSO was **110%** ($210/$100 – 1).

How is that possible? It has to do with the "buy high/sell low" nature of the daily reset of the hedging positions. At the end of Day 1, at a price of $80, the hedge position of SH was reduced by 20%. On the other hand, SSO ended Day 1 at a price of $140, or 40% more than the $100 price on Day 0, so its hedge positions were increased by 40%. Because the returns in Day 2 were in the same direction as the Day 1 returns, SH lost less because it had reduced its positions and SSO gained more because it had increased its positions.

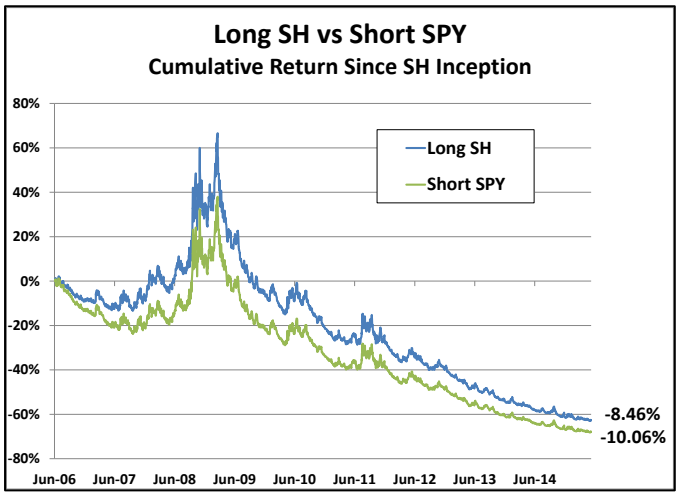
The volatility drag problem for inverse and leveraged ETFs arises from daily return **reversals**, as illustrated by the Day 3 ending prices and cumulative returns. Because SH had reduced its positions by 40% at the end of Day 2 (since its price was $60 compared to the starting price of $100), when the reversal came on Day 3, the price increase was applied to the Day 3 starting

value of $60 (not $100). On the other hand, because SSO's price had increased to $210 at the start of Day 3, the 66.67% price decline applied to that starting value (rather than $100).

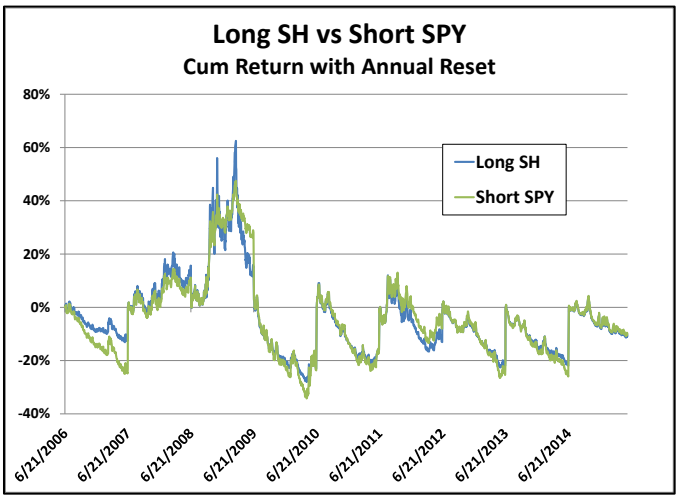
This simple illustration shows how it is possible for volatility drag to cause inverse and leveraged ETFs to **both** lose money over the same time period, even if they are based on the same index and move in opposite directions on a daily basis.

But how significant has volatility drag been in reality, using **actual** daily returns? In many cases, it turns out to be rather tame. Sometimes, the inverse ETF outperforms a short position in the long version.

The graph at right illustrates the volatility drag of SH by comparing it to a short position in SPY. The time period covers the June 21, 2006 inception of SH through May 31, 2015. The short SPY position includes a stock loan borrow cost of 0.26%. In this case, the cumulative return of a long position in SH (blue line) was consistently somewhat above a short position in SPY (green line).



A test using a single time period may be dependent upon the particular beginning point and ending point chosen. A much more robust methodology would be to calculate volatility drag over rolling time periods. For example, what if we chopped the time period into annual chunks? In the graph at right, the comparison between long SH and short SPY is repeated, except that the test is re-started on each anniversary of the fund's June 21, 2006 start date. Note that although the two track very closely, they cross back and forth a bit at times, depending upon the circumstances prevailing in the period tested. During more volatile periods (e.g., 2008), they tend to diverge more dramatically.



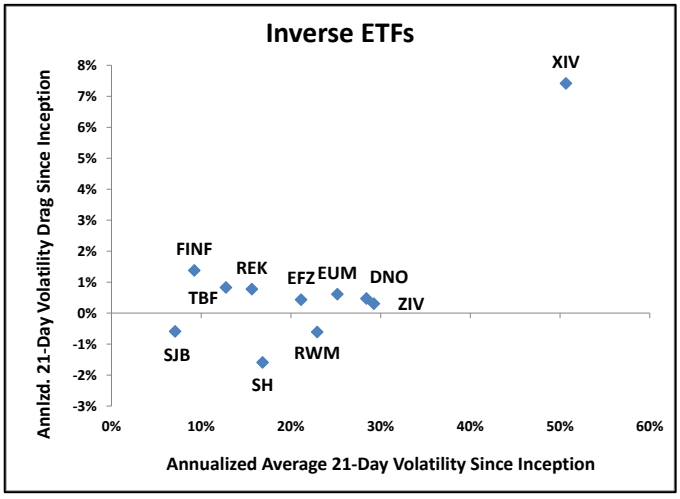
A year may still be quite a long time to hold an inverse ETF. My holding period is typically less than a year, sometimes quite a bit less. My return forecasts are for one-month holdings periods. This roughly corresponds to a 20-day holding period (using trading days rather than

calendar days). Consequently, for the balance of the article I will focus my attention on rolling 20-day holding periods.

Although broad U.S. stock market risk is the most important risk in my portfolios, it is not the only risk that I may want to hedge. Fortunately, a wide variety of inverse ETFs allow investors to express a negative viewpoint on many different indexes and market segments. In the table below, I provide average volatility drag estimates for rolling 20-day periods on a variety of inverse ETFs from their inception dates through May 31, 2015.

Long Inverse ETFs						Short ETFs (with Borrow Cost)				
Fund Name	Ticker	Inception Date	Annlzd Avg 21-Day Rolling Return	Annlzd Avg 21-Day Rolling Volatility	**Annlzd Avg 21-Day Volatility Drag**		Ticker	Annlzd Avg 21-Day Rolling Return	Annlzd Avg 21-Day Rolling Volatility	**Current Borrow Cost**
PROSHARES SHORT S&P500	SH	6/21/2006	-9.3%	16.8%	**-1.6%**	SPDR S&P 500 ETF TRUST	SPY	-10.9%	16.7%	**0.26%**
PROSHARES SHORT RUSSELL2000	RWM	1/25/2007	-11.5%	22.9%	**-0.6%**	ISHARES RUSSELL 2000 ETF	IWM	-12.1%	22.8%	**1.07%**
PROSHARES SHORT MSCI EAFE	EFZ	10/25/2007	-6.2%	21.1%	**0.4%**	ISHARES MSCI EAFE ETF	EFA	-5.7%	21.0%	**0.36%**
PROSHARES SHORT MSCI EMR MKT	EUM	11/1/2007	-10.0%	25.2%	**0.6%**	ISHARES MSCI EMERGING MARKET	EEM	-9.4%	25.2%	**0.27%**
PROSHARES SHORT REAL ESTATE	REK	3/18/2010	-16.2%	15.6%	**0.8%**	ISHARES US REAL ESTATE ETF	IYR	-15.5%	15.6%	**1.10%**
PROSHARES SHORT VIX ST FUTUR	XIV	11/29/2010	69.6%	50.7%	**7.4%**	IPATH S&P 500 VIX S/T FU ETN	VXX	77.0%	50.3%	**2.63%**
VELOCITYSHARES INV VIX MEDIU	ZIV	11/29/2010	31.6%	29.3%	**0.3%**	IPATH S&P 500 VIX M/T FU ETN	VXZ	31.9%	29.2%	**2.63%**
PROSHARES SHORT HIGH YIELD	SJB	3/22/2011	-8.8%	7.1%	**-0.6%**	ISHARES IBOXX HIGH YIELD COR	HYG	-9.4%	6.9%	**3.50%**
PROSHARES SHORT 20+ TREASURY	TBF	8/20/2009	-10.0%	12.8%	**0.8%**	ISHARES 20+ YEAR TREASURY BO	TLT	-9.2%	12.8%	**0.75%**
UNITED STATES SHORT OIL FUND	DNO	9/24/2009	4.8%	28.4%	**0.5%**	UNITED STATES OIL FUND LP	USO	5.2%	28.4%	**1.64%**
PROSHARES SHORT 30Y TIPS/TSY	FINF	1/12/2012	0.2%	9.2%	**1.4%**	PROSHARES 30 YR TIPS/TSY	RINF	1.6%	8.5%	**1.25%**

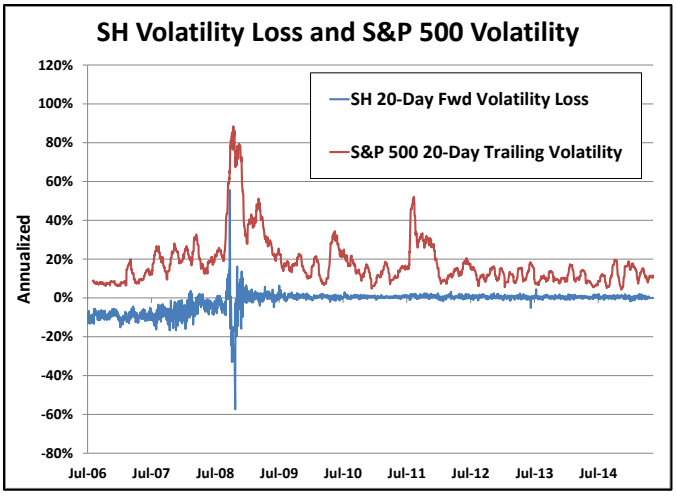
We saw above that volatility drag is caused by daily price reversals. Therefore, it should not be surprising to find that volatility drag generally increases as daily volatility increases, with XIV being the extreme example.



The volatility drag of inverse ETFs based on high volatility indexes, such as short-term VIX, may be so large that can be dangerous to hold them for more than a single day. For example, ProShares Short VIX Short-Term Futures ETNF (XIV) has had an annualized volatility since inception of 50.7%, and an annualized volatility loss of 7.4%. Granted, the return of XIV was an eye-popping 69.6%, but an investor who was able to short would have been better off with a short position in iPath S&P 500 VIX Short-Term Futures ETN (VXX) for a return of 77.0%.

Is it possible to forecast when volatility loss for a particular ETF might be large, small, or even turn into a gain? At least for some inverse ETFs, such as SH, the answer is a qualified yes. Historically, **the trailing daily volatility of the S&P 500 has had a strong statistical relationship with SH's volatility drag in the immediate future.** The graph below illustrates the relationship between trailing 20-day S&P 500 volatility (red line) and 20-day future SH volatility loss (blue line). When trailing volatility in the S&P 500 Index spikes up, future volatility loss in SH also

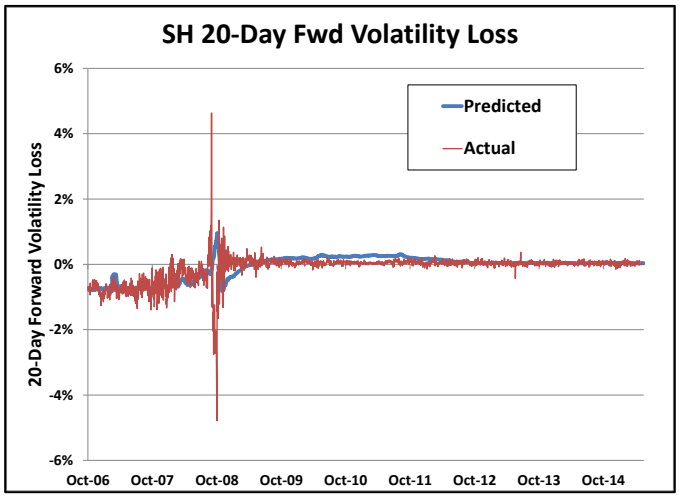
spikes up. However, during periods of market calm since 2008, volatility drag has been only modest. (Before 2008, SH had an extended period of volatility gain that is somewhat puzzling.)



My conclusion is that although the risk of volatility drag can be avoided by using inverse ETFs only for holding periods of one day or less, there may be circumstances in which the risk of volatility drag might be low enough to warrant a multi-day holding period. **Depending upon the size of the expected market decline, and the level of confidence in the decline forecast, it may make sense to use SH (or other inverse ETFs) as a hedge during low market volatility periods.** However, once the index has started to decline, its volatility has probably also started to spike, and by then it is probably too late to hedge risk with SH (or any other inverse ETF) because of the likely increased cost of volatility drag.

My testing of the other inverse ETFs listed in the table above indicates that there is a general tendency for future 20-day volatility drag to be positively related to the trailing 20-day volatility of the reference index. In addition, future 20-day volatility drag is also positively related to the trailing long-term average volatility drag. (I use the 1000 day average.)

Using these two simple factors in a regression model provides decent forecasts of future 20-day volatility drag in most cases. For example, the graph at right compares predicted and actual 20-day volatility loss (not annualized) for SH. The average correlation between predicted and actual has been about above 35%, so the two factors are somewhat predictive. However, when volatility spikes, volatility losses can arise very quickly, so caution is advised. Only a modest amount of the variability in volatility drag is captured in the model.



My inverse ETF volatility drag forecasting model helps me to decide between buying the inverse ETF (and risking the cost of volatility drag) or shorting the long ETF (and paying the borrow cost) in accounts that allow shorting. For accounts that prohibit shorting (such as IRA accounts), these forecasts help me to gauge the likely volatility drag of owning an inverse ETF compared to the expected return, risks, and transaction costs.

Volatility drag is real but somewhat hazy. It is path-dependent and arises because of daily return reversals. The size of these reversals will determine the size of volatility drag, and the size of daily reversals is in turn closely related to the volatility of the ETF and its underlying index.

Avoiding inverse ETFs altogether because of the prospect of volatility drag may be overly simplistic and suboptimal. The occasional use of inverse ETFs, particularly if the underlying index has low volatility, may make sense for some investors if held for short periods of time.

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SELECT ALTERNATIVE INVESTMENTS LLC

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