

Editor's Letter

You Could be Wrong Even When You are Right!

Suppose you discover an asset that has been losing money since inception (e.g., a mutual fund run by an incompetent manager). Further, you have every reason to believe that the asset will continue to lose money going forward. You wonder how good it would be if you could short this mutual fund. You could not only make some money but also help bring some discipline to the market, removing incompetent fund managers from the market. Well, today is your lucky day, and the SEC has announced that ETFs and inverse ETFs based mutual funds can be created. You immediately call your broker and take a \$1,000,000 position in the inverse ETF tracking the fund. The inverse ETF is guaranteed to match the period return on the fund but in opposite direction. So there will be no basis risk – if the fund is down 1% tomorrow, the inverse ETF will be up 1%. Even better, your broker tells you that there is absolutely no cost to buying the inverse ETF, and the broker is even willing to waive its fees. Can it get any better, you think. Yes, it can.

You are a long-term investor and decide to ignore your position completely for the next two years. One day by chance you read the headline that because of poor performance, that incompetent fund manager is about to be fired. It just got even better.

Elated from hearing the news, you login into your brokerage account after two years and notice that your net balance is about \$852,000! This cannot be right. You call your broker to find out if there were any mistakes, and you are told that there were no mistakes and that no fees or charges had been made to your account (the fund had not made any distributions during the last two years!). You check the online website to find out about the performance of the mutual fund. You had been correct in your evaluation of the fund manager, as its NAV had declined by 68% during the same 2-year period. The fund manager was indeed quite incompetent. Something must be wrong. How could you have lost \$148,000 when you had accurately predicted the poor performance of the fund?

It turns out that you were correct in your prediction, but you used the wrong instrument and were unlucky. The particular path taken by the fund's NAV was such that both long and inverse ETFs ended up losing money. You may think that this is impossible. How could both long and inverse ETFs lose money? After all, it is a zero-sum game, and if long ETF loses money, the inverse ETF must be making money. It turns out that long and inverse ETFs are NOT a zero-sum game. That is, no money is exchanging hands between the two ETF positions. The following simple example demonstrates this issue.

Suppose with equal probabilities our fund can increase by 30% or decline by 35% every six months. The expected semi-annual return on this fund is indeed negative:

$$50\%*30\% + 50%*(-35\%) = -2.5\%$$

Let us see what could happen to the value of \$100 invested in this fund after four periods (2 years).

				286
			220	
		169		143
	130		110	
100		85		71
	65		55	
		42		36
			27	
				18

The tree shows that if the fund had increased for four periods in a row, the value of the investment would have grown to \$286, while if it had declined every period, the investment would have declined to \$18. The last five values that we see represent all possible outcomes of the long position. Of course, they will not occur with the same probability. The following displays the probability tree associated with the above payoffs

				24
			34	
		49		46
	70		66	
100		95		89
	135		128	
		182		172
			246	
				332

For example, there is only 6.25% chance that the fund could grow to \$286 or decline to \$18. On the other hand, there is 37.50% chance that the fund could decline to \$71. The expected value of the above five outcomes is \$90.36. That is, the fund is indeed expected to lose money after four periods.

Let us now look at the tree for the payoff from inverse EFT.

			6.25%
		12.50%	
	25.00%		25.00%
50.00%		37.50%	
	50.00%		37.50%
50.00%		37.50%	
	25.00%		25.00%
		12.50%	
			6.25%

For example, if the fund were to increase during the first period, the inverse ETF would lose 30%, with its value declining to \$70. However, if the fund declines in the subsequent period, the inverse ETF will rise to \$95. The expected value of the payoffs from the inverse ETF is \$110.38. That is, it is expected to make money.

However, notice that there is one possible outcome where both long and inverse positions end up losing money (\$71 for long and \$89 for the inverse). In fact, this is the most likely outcome! There is 37.5% chance that both will end up losing money.

Two factors are contributing to this puzzling behavior. First, this is a very volatile investment. The high volatility and compounding work together to create highly skewed distributions for both long and inverse ETFs. The extreme positive outcomes are indeed very large for both, but they are less likely to happen than those that are close to the median. In this case, the median turns out to be lower than the initial investment of \$100. Second, many investors wrongly believe that an inverse ETFs is similar to a short position in the underlying asset. The above example shows that this is not the case. In fact, if you had shorted the fund at \$100, the position would have shown a profit of \$29 = \$100-\$71.

Is it likely to see a similar scenario in the real world? Yes, more often than you may think. Consider these two ETFs: VXX and XIV. VXX is a long volatility ETF while XIV is a short volatility ETF. Their daily returns are a mirror image of each other with only minor differences on a daily basis. However, both ETFs lost money during the last two years, and the loss is not due to fees or other charges. They both lost money because they are highly volatile and the realized price path during the last two years is rather similar to the price path that produced \$71 and \$89 in our example. In fact, if on August 25, 2014, one person had invested \$1,000,000 in VXX and the other person had taken a long position of \$1,000,000 in XIV, both would have lost money. The VXX and the XIV positions would be \$320,000 and \$852,000, respectively. Below is the chart of the two positions since August 2014.

Growth \$100 in VXX and XIV
August 2014-August 2016



Since a long volatility position provides a hedge against a long position in equity markets, one should expect the long position in VXX to lose money in the long-run; this is indeed the case as it can be seen from a similar chart covering a longer period, August 2011-August 2016. The value of \$100 in VXX declines to \$1.32 during this period.

Growth of \$100 in VXX and XIV
August 2011-August 2016



The lesson provided by this simple exercise is not confined to long vs. short positions. The important point is that volatility combined with compounding could lead to highly unexpected results. An investment that is expected to earn a positive rate of return could end up delivering a big loss after a few years, if its return is volatile enough, and as shown above, even the one with negative exposure to the asset could end up losing money as well. The other important lesson is that one has to be careful in using derivatives to make speculative or hedging decisions. In the above example, the investor could have selected the inverse ETF to hedge a long position in our hypothetical fund. At first glance, the inverse ETF appears to be the perfect hedging instrument as its rate of return is perfectly negatively correlated with the fund's return. Of course, as we just saw, such a hedging strategy would have backfired as both the long position in the fund and inverse ETFs lost money.

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