

## Is a VIX ETP an investment in the VIX?

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### Abstract

This article examines VIX-based ETPs (exchange traded products) and illustrates that both the return and risk of these products are not related to the return and risk of the VIX index. The authors note that VIX ETPs do not correlate well to the VIX index. In fact, these funds are not even designed to have a high correlation to the VIX index. Individual investors can often mistake VIX ETPs for an investment in the VIX index itself, which is incorrect and may lead to a costly mistake. © 2016 Academy of Financial Services. All rights reserved.

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### 1. Introduction

The VIX index measures volatility in the equity market and is a good measure of investors' overall sentiment and level of fear in the stock market. The VIX index is able to gauge market expectations of equity performance by tracking the demand for put and call options, through extracting the “price” of implied volatility in prices of S&P 500 index options. Copeland and Copeland (1999) even note that the VIX index can be used as an indicator to rotate between large cap and small cap portfolios as well as between value and growth portfolios.

There are a number of VIX-related terms in the financial press that individual investors may encounter. The authors of this article use care to distinguish between these terms, which

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may include: the spot “VIX index,” VIX-based Exchange Traded Products (“ETPs” or “funds”), VIX futures or options, and the S&P 500 VIX Short-Term Futures Index (“S&P ST Index”), among others. A common mistake that is often made by individual investors looking to gain exposure to the VIX index (or equity volatility in general) is to assume that VIX exchange traded products (ETPs) accurately track the VIX index. VIX-based ETPs are not structured to track the spot VIX index, but are designed to track the S&P ST Index or other related indices that themselves are not well correlated to the spot VIX index. The purpose of this article is to examine the differences between VIX-based ETPs and the VIX index and to serve as a guide and a possible warning to individual investors about how these products trade.

It is important to note that the VIX index is not a tradable asset. Investment products that are tradable include VIX futures, VIX options, and VIX-based ETPs (see Dzekounoff, 2010; Jones, 2011; Jones & Allen, 2015; Moran & Dash, 2007; and others for a discussion of VIX futures and options). The products that have been introduced over the years are designed to offer investors exposure to the volatility but to not mimic the performance of the VIX index. The typical way that these products gain exposure to volatility is to invest in VIX futures (and possibly VIX options, which most ETPs do not use). These VIX-based ETPs are created from complex strategies and investors must be aware of the risk involved in trading these particular assets.

In an effort to diversify their portfolio, individual investors may seek investment vehicles to hedge against downside moves in the equity market. Because volatility, and the VIX index specifically, tends to rise when investors become more pessimistic, an investment in volatility can be a good thing, especially as a short-term hedge. Thus, VIX-based ETPs can act as a good hedge against a drop in equities, as noted by Lydon and Chen (2014). Jones (2011) also notes that allocating a small portion of a portfolio to volatility could help investors better withstand a bear market. This research notes that a 10% allocation to nearby VIX futures (used in many VIX ETPs) can improve portfolio returns more than 15%, on average, when implemented after an increase in the VIX index that most often accompanies a decline in the S&P 500.

VIX-based ETPs have become more popular, and thus new ETPs are being created and issued. Before these products, individual investors and certain institutions were unable to gain exposure to volatility, because they may have been unable to invest in VIX futures. This could be because of restrictions placed on certain institutions and individual investment accounts. These same individuals and institutions can now invest in ETPs that have VIX futures held in trust.

Most VIX-based ETPs are designed to replicate the one-day return of the S&P 500 VIX Short-Term Futures Index (“S&P ST Index”). This underlying index is structured to provide a constant 30-day maturity futures position by rolling a long position in the first and second next to mature monthly VIX futures contracts. Thus, each day to provide this constant 30-day maturity, the S&P ST Index adds exposure in the second month to mature VIX futures contract and decreases exposure in the next to mature (or nearby) contract.

## **2. Literature review**

More and more academic research is being published examining VIX-based products, including VIX futures, options, and ETPs. Empirical evidence presented in Whaley (2013),

who is known as the “father of the VIX (see Whaley, 1993),” and others show that investing in VIX-based ETPs is not prudent for a buy-and-hold strategy. The VIX futures market is frequently in contango, meaning that the price curve for futures contracts slopes upward, resulting in a decay of the price of the VIX futures contracts as they near maturity. This reduction in VIX futures prices, thereby reduces the prices of the ETPs that hold these futures. Whaley (2013) found that the price curve for futures sloped upward “80% of all trading days for futures with 30-day maturities.” And that, “this erosion happens because the price of longer-dated futures contracts is almost always higher than the price of shorter-dated futures contracts.” Many companies that sponsor VIX-based ETPs note in the prospectus that these funds do not guarantee return of principle, especially if a buy-and-hold strategy is used over the long term. In fact, the prospectus from the Barclays (2015) iPath ETN (VXX, the largest of these ETPs) notes, “You (the investor) may lose some or all of your principal if you invest in the ETNs.” In addition, this prospectus notes, “Your ETN is not linked to the VIX Index.” Whaley (2013) notes that the prospectus of VelocityShares notes that, “The long term expected value of your ETNs is zero.” However, many individual investors may overlook these facts.

Jones (2011) discusses investing in the nearby VIX futures contracts and shows the damaging effects on a portfolio of a buy-and-hold strategy along with how poorly VIX futures track the VIX index. Lu, Wang, and Zhang (2012) examine leveraged and inverse ETFs and note how, over time, these products do not accurately track the leveraged or inverse return of the benchmark they are designed to mimic.

Copeland and Copeland (1999) review how changes in the VIX index are leading indicators of market performance. They show that, after the VIX index increases, portfolios of large cap stocks outperform small caps and portfolios of value stocks outperform growth, while the reverse occurs, after the VIX index decreases. Following Copeland and Copeland, Boscaljon, Filbeck, and Zhao (2011) examine a longer timeframe and note that the VIX index can be used to time changes in rebalancing between value and growth stocks for holding periods of longer than 30 days. Efremidze, DiLellio, and Stanley (2014) further the examination of this style rotation strategy and note that style rotations between value and growth using entropy measures appear to yield significant risk-adjusted returns.

Many studies also examine the performance of funds and whether these vehicles add value to investors’ portfolios. Chang and Krueger (2010) look at enhanced index funds, which include inverse and leveraged funds, and find that these funds, as a whole, perform worse than the pure index, with lower returns and higher risks. These authors note that investors should be wary of enhanced index funds. Along these lines, DiLellio, Hesse, and Stanley (2014) note that inverse and leveraged ETFs can provide diversification benefits. Annual rebalancing with a 10% allocation to an inverse stock fund reduced the coefficient of variation of terminal wealth under flat and rising returns but without an increase in the corresponding Sharpe ratio. Leveraged ETFs were noted to provide an increased Sharpe ratio but without a risk-reward benefit in terminal wealth. Prather et al., (2009) examine S&P 500 mutual funds against S&P 500 ETFs and note that when total annual costs of each are considered, using their model, that ETFs dominate the mutual funds for inclusion in individual investors’ portfolios. DiLellio and Stanley (2011) examine whether ETF-only strategies can outperform the S&P 500 and a buy-and-hold benchmark. They conclude that

these strategies may allow investors to capture inefficiencies in equity markets and that ETFs cannot be ignored as potential instruments to enhance portfolio returns.

### **3. Specifics of VIX-based ETPs**

ETPs include exchange traded funds (ETFs) and exchange traded notes (ETNs). This section discusses the similarities and differences of ETFs and ETNs and also notes which VIX-based ETPs are classified as ETFs and which are classified as ETNs. As shown in the next section, none of these funds precisely track the VIX index, since the assets underlying the ETPs are VIX futures contracts.

Most VIX-based ETPs are futures based, and the index they are replicating is usually the S&P ST Index, which is not the VIX index but an index created using VIX futures contracts. The VIX-based ETPs (to replicate the S&P ST Index) must then constantly sell the current month futures and buy the subsequent month futures, to keep the constant 30-day maturity. Because the VIX futures price curve tends to be in contango (i.e., slope upward and becoming more expensive with maturity), the value of the ETPs will deteriorate over time, because of the purchasing of higher priced second month out contracts and selling of the current month. Thus, there is usually a built in “buy high, sell low” trade embedded in these funds. One ETP in our sample (VXZ) replicates the return of the S&P 500 VIX Futures Mid-Term Index, which is constructed in a similar manner to the S&P ST Index, though uses a 5-month constant maturity, rather than a constant 30-day maturity.

While VIX-based products are not prudent for buy-and-hold strategies, Jones (2011) shows that investing in VIX futures in a tactical manner could lead to positive returns, if executed correctly. VIX-based investment vehicles, however, do have to be carefully monitored, and investors should determine individually if it is wise to invest in these products. Thus, since VIX-based ETPs are futures based, the investor in these products should understand, at a minimum, the relation between the ETPs and the VIX index, upon which these investments eventually settle upon. With this said, the intent of this study is not to suggest that individual investors should avoid investing in VIX-based ETPs entirely but to point out the characteristics of these products and caution investors and financial planners of the inherent risks, especially in the longer-term.

This study examines the question of how closely VIX ETPs really track the VIX index. The next section presents an examination of eight individual ETPs and notes the differences between each. What follows then compares the returns of these ETPs against the returns of the VIX index to determine if the ETP returns do in fact track the returns of the VIX index and to what extent.

### **4. VIX-based ETPs used in this study**

There are a variety of ETPs that have been introduced over the past decade that provide investors with an opportunity to invest in volatility. This study examines the VIX index returns compared to individual VIX-based ETP returns from October 4, 2011 through

December 31, 2014. This time period was selected because some of the ETPs included in the study were not listed for trading until October 4, 2011. The eight ETPs we choose to examine are examined in Whaley (2013). Four of these ETPs seek to yield the daily return of a VIX-based index. VXX, VIIX, and VIXY replicate the S&P ST Index, and VXZ replicates the S&P Mid-Term Index. Two funds (XIV and SVXY) seek to yield the inverse daily return of the short-term index, and two ETPs (TVIX and UVXY) seek to provide twice ( $2\times$ ) the daily return of the S&P ST Index. The specifics of each ETP are discussed below.

#### *4.1. VXX – iPath S&P 500 VIX Short-Term Futures ETN*

The first VIX-based ETP introduced and the most popular VIX ETN is VXX. VXX is an exchange traded note that attempts to replicate the S&P 500 VIX Short-Term Futures Index Total Return. The return of this ETN follows the mechanics of the S&P 500 VIX Short-term futures index, as noted above, by rolling long position in the first and second month VIX futures contracts each day. The VXX is an unsecured debt obligation of Barclays Bank, with tax treatment based on the capital gain for the holding period (short or long term) equal to the difference in the amount the investor receives at the time of sale and the amount paid (see Barclays, 2015).

#### *4.2. VXZ – iPath S&P 500 VIX Mid-Term Futures ETN*

VXZ is much like VXX but tracks the S&P 500 VIX Medium-Term Futures Total Return Index, which has an average settlement date of five months. The return of the iPath S&P 500 VIX Mid-Term Futures index continuously rolls long positions in the 4th, 5th, 6th and 7th next months to settle VIX futures contracts. The VXZ is also an unsecured debt obligation of Barclays Bank, with tax treatment based on the capital gain for the holding period (short or long term) equal to the difference in the amount the investor receives at the time of sale and the amount paid (see Barclays, 2015).

#### *4.3. VIIX – VelocityShares VIX Short-Term ETN*

Like the VXX, the VIIX seeks to replicate the return of the daily performance of the S&P 500 VIX Short-Term Futures index. The index was designed to provide investors with and unleveraged exposure in short-term futures contracts. The VIIX is an unsecured debt obligation of Credit Suisse AG, with tax treatment based on the capital gain (short or long term) equal to the difference in the amount the investor receives at the time of sale and the amount paid (see Credit Suisse, 2015).

#### *4.4. XIV – VelocityShares daily inverse VIX Short-Term ETN*

The XIV attempts to replicate the inverse performance of the S&P 500 VIX Short-Term Futures index and provides investors with ( $-1\times$ ) exposure to the short-term index. When the S&P 500 VIX Short-Term Futures index goes up, the XIV returns go down and vice versa. The XIV is also an unsecured debt obligation of Credit Suisse AG, with tax treatment based

on the capital gain (short or long term) equal to the difference in the amount the investor receives at the time of sale and the amount paid (see Credit Suisse, 2015).

#### 4.5. *TVIX – VelocityShares daily 2× VIX Short-Term ETN*

The TVIX is a leveraged ETN that is linked to a multiple (2×) of the daily return of the S&P 500 VIX Short-Term Futures index. The TVIX tries to replicate the performance of two times the short-term index. The leveraged component makes the TVIX a riskier investment than the VXX. The TVIX is an unsecured debt obligation of Credit Suisse AG, with tax treatment based on the capital gain (short or long term) equal to the difference in the amount the investor receives at the time of sale and the amount paid (see Credit Suisse, 2015).

#### 4.6. *VIXY – Proshares VIX Short-Term Futures ETF*

The shares comprised in the VIXY ETF make up what is called the “Matching Fund.” The Matching Fund attempts to match, before fees and expenses, the performance of the S&P 500 VIX Short-Term Futures Index. The VIXY holds VIX futures in the fund and is taxed as a partnership, generating a K-1 (see ProShares, 2015a).

#### 4.7. *UVXY – Proshares Ultra VIX Short-Term Futures ETF*

The shares comprised in the UVXY ETF make up what is called the “Ultra Fund.” The Ultra Fund attempts to achieve results, before fees and expenses, that are two times (2×) the performance of the S&P 500 VIX Short-Term Futures Index each day. The UVXY holds VIX futures in the fund and is taxed as a partnership, generating a K-1 (see ProShares, 2015b).

#### 4.8. *SVXY – Proshares Short VIX Short-Term Futures ETF*

The shares comprised in the SVXY ETF make up what is called the “Short Fund.” The Short Fund seeks results, before fees and expenses, that correspond to the inverse (−1×) of the performance of the S&P 500 VIX Short-Term Futures Index on a daily basis. The SVXY holds VIX futures in the fund and is taxed as a partnership, generating a K-1 (see ProShares, 2015c).

Five of these ETPs are exchange traded *notes* (ETNs) and three are exchange traded *funds* (ETFs). There are slight differences between the structures of VIX ETNs and VIX ETFs that individual investors, in particular, must be aware of. ETNs, in general, promise to match the return of the underlying index. Because they are notes, similar to bonds, the creditworthiness of ETN issuers is important. ETNs are structured as debt instruments with a maturity date. ETFs, on the other hand, pool together funds from investors and then use these pooled funds to invest in securities in an attempt to match the performance of an index. Shareholders do not directly own the underlying investments in the fund, but they own shares of the fund, so indirectly own the underlying assets.

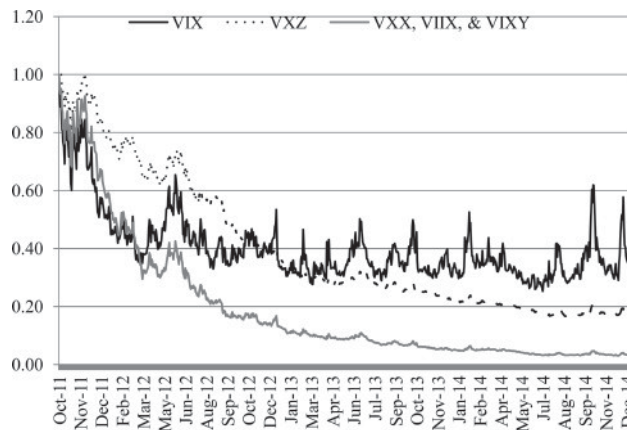


Fig. 1. VIX index versus short-term and midterm ETPs from October 2011 through December 2014.

## 5. Is a VIX ETP an investment in the VIX?

To determine if VIX ETPs truly replicate an investment in the VIX index, and if so how much, this section compares the daily returns of each ETP with the returns of the VIX index. Because the VIX index is not tradable, it is important to distinguish whether or not an investment in a VIX-based ETP is a true substitute for an investment in the index. Many investors may assume they are gaining highly correlated exposure to the VIX index when purchasing a VIX ETP, when they may not. As mentioned previously, our study analyzes data from October 4, 2011 through December 31, 2014.

Fig. 1 shows the VIX index, over the period of analysis, compared with the unlevered ETPs (VXX, VXZ, VIIX, and VIXY). One can see that none of these ETPs track the VIX index very well over time. All three ETPs that follow the S&P ST Index (VXX, VIIX, and VIXY) are very highly correlated with each other. In fact, the three series are not distinguishable from each other. Because of this, the return path of VXX, VIIX, and VIXY are combined for clarity. These funds begin at a base of 1.00 in October 2011 and end at a value of 0.04 in December 2014, while the VIX index goes from 1.00 to 0.47, during the period. Thus, a buy-and-hold strategy in these funds would be devastating to an investor. VXZ, the fund that follows the midterm index, fares a bit better than the short-term ETPs, going from 1.00 to 0.18 over the period, but still ended nowhere near the VIX index. In addition, one can see that the volatility of none of these funds matches that of the VIX index.

It is important to point out that there are periods where these ETPs had positive returns. As shown in Fig. 1, a buy-and-hold strategy is not what an individual investor would want to pursue. However, the periods of late-2011, April through May 2012, December 2012, and other short-term periods where the VIX index spikes would have proved very profitable if an investor chose to purchase one of these ETPs and sell it before its decline. Thus, for the short-term, these products can enhance portfolio returns.

Examination of Fig. 2, shows the two inverse ETPs (XIV and SVXY) versus the VIX index. One can see that these two funds performed very well over the period, going from 1.00 to 5.70 (XIV) and 5.81 (SVXY), while the VIX index goes from 1.00 to 0.47. This performance is in large part because of the contango effect of VIX futures, mentioned previously, and the fact that these funds are inverse, effectively shorting the S&P ST Index.

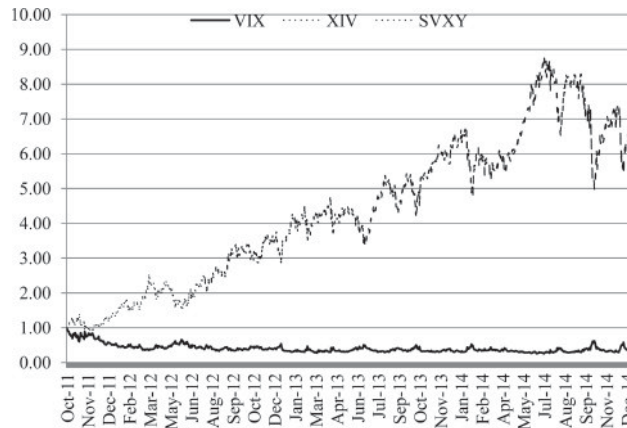


Fig. 2. VIX index versus inverse ETPs from October 2011 through December 2014.

Even though the returns of these ETPs were very high (around 71% compounded annual return), individual investors should use extreme caution when looking to invest in inverse VIX ETPs, because of their high volatility. As shown in Fig. 2, the VIX index did decline over this period, contributing to the increase in these funds. However, the VIX index does increase at times, which causes these inverse funds to decline significantly. Thus, a buy-and-hold strategy, would have proved very profitable for an investor, over the period examined. However, there were periods where buying these ETPs would not have worked in an investor's favor. For example, if an investor purchased either of these inverse funds in April 2014, they would still have a loss as of December 2014 and would have experienced tremendous volatility in between. Thus, individual investors should know this before investing in these products.

Fig. 3 presents the two twice-levered ( $2\times$ ) ETPs (TVIX and UVXY) against the VIX index. As one would expect, given the performance of the  $1\times$  funds, these levered ETPs performed even worse, going from a base of 1.00 to 0.0003 over the period. As is also evident from Fig. 3, these funds do not follow the VIX index either. Thus, an individual investor may choose to invest in one of these twice-levered funds but should definitely not do so with the intention of holding the fund over a long period of time. These funds can be

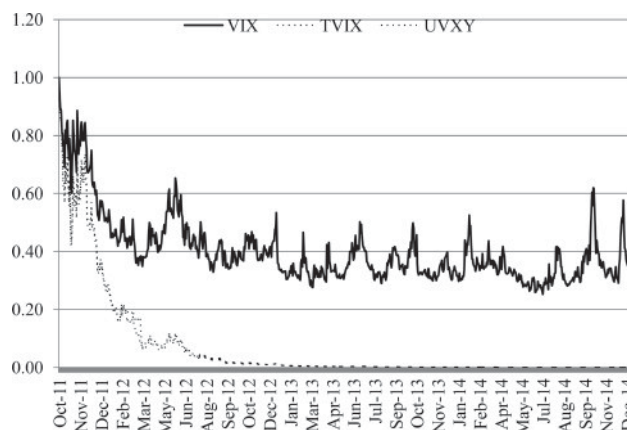


Fig. 3. VIX index versus twice-levered ETPs from October 2011 through December 2014.



Table 1 Daily return statistics of VIX Index vs. ETPs

	VIX Index	VXX	VXZ	VIIX	XIV	TVIX	VIXY	UVXY	SVXY
Panel A: All data									
Mean	0.15%	-0.33%	-0.19%	-0.33%	0.29%	-0.74%**	-0.33%	-0.70%**	0.29%
Median	-0.35%	-0.52%	-0.23%	-0.54%	0.51%	-1.08%	-0.52%	-1.08%	0.54%
SD	7.04%	3.81%	1.85%	3.83%	3.80%	7.00%	3.82%	7.60%	3.82%
Skewness	1.02	0.50	0.24	0.49	-0.51	0.35	0.50	0.48	-0.51
Correlation	n/a	88.41%	76.99%	88.56%	-87.89%	85.28%	88.55%	88.42%	-87.93%
Sharpe ratio	n/a	-0.88	-1.17	-0.88	0.97	-0.69	-0.88	-0.63	0.98
Tracking error	n/a	4.11%	5.75%	4.09%	10.54%	3.91%	4.09%	3.67%	10.56%
Panel B: Days when VIX was up									
Mean	5.60%	2.35%	0.97%	2.36%	-2.39%	3.95%	2.36%	4.63%	-2.39%
Median	3.85%	1.52%	0.72%	1.52%	-1.65%	2.54%	1.57%	3.05%	-1.62%
SD	5.91%	3.25%	1.59%	3.27%	3.25%	6.15%	3.26%	6.49%	3.27%
% Both up	n/a	78.99%	72.61%	77.66%	22.07%	78.99%	78.99%	77.39%	22.61%
Panel C: Days when VIX was down									
Mean	-4.60%	-2.65%	-1.19%	-2.66%	2.60%	-4.81%	-2.66%	-5.32%	2.61%
Median	-3.59%	-2.16%	-1.07%	-2.13%	2.11%	-3.80%	-2.15%	-4.25%	2.11%
SD	3.82%	2.56%	1.43%	2.58%	2.55%	4.86%	2.56%	5.10%	2.56%
% both down	n/a	90.28%	81.48%	90.05%	10.88%	90.05%	90.28%	90.05%	11.11%

*Notes.* Data from October 4, 2011 through December 31, 2014. All statistics are daily, except Sharpe ratio, which uses annualized data. VXX, VIIX, and VIXY replicate the S&P 500 VIX Short-Term Futures Index. VXZ replicates the S&P 500 VIX Mid-Term Futures Index. XIV and SVXY replicate the inverse, while TVIX and UVXY replicate 2× of the S&P 500 VIX Short-Term Futures Index. Double asterisks indicate statistical significance in mean from VIX index at the 1% level.

bought and sold over a short period to take advantage of an increase in volatility, but investors should know the risk—that these funds do not track the VIX index and have a strong downward tendency, because of the contango effect of VIX futures that is magnified with their leverage.

Table 1 provides statistics of the VIX index versus the eight ETPs over the examination period. Panel A considers all daily data; Panel B looks at only the days the VIX index goes up, and Panel C only the days when the index goes down. Table 1, Panel A, shows that the VIX index had a mean daily return of 0.15%. Even though the VIX index had a positive mean return, all of the VIX ETPs, except the inverse funds, experienced negative daily mean returns. The mean daily returns of VXX, VXZ, VIIX, and VIXY are not statistically significantly different from that of the VIX index, while the mean daily returns of the twice-leveraged ETPs (TVIX and UVXY) are significantly different at the 1% level. Most interestingly is that the mean daily returns of the inverse ETPs (XIV and SVXY) are not statistically different from that of the VIX index. These two ETPs are the only ones with positive mean daily returns, like that of the VIX index. The differences in the index returns and the returns of the ETPs demonstrate the effect of contango that that these ETPs experience and further illustrate why these ETPs are not suitable for a buy-and-hold strategy.

In addition to the differences in mean daily returns, Panel A also shows the median returns of the index and ETPs. The VIX index had a -0.35% median daily return over the period, while the three short-term ETPs (VXX, VIIX, and VIXY) had median returns of -0.52%, -0.54%, and -0.52%, respectively. The returns of these ETPs are correlated, but only about 88% correlated to the VIX index. The two inverse ETPs (XIV and SVXY), while replicating the inverse returns of the VIX short-term index had median returns of 0.51% and 0.54%,

respectively. The two twice-levered ETPs (TVIX and UVXY) both posted median returns of  $-1.08\%$  (or median returns of  $-0.54\%$  if they were unlevered), while the midterm ETN (VXZ) had a median return of  $-0.23\%$ . Individual investors must be aware that over time, the value of these VIX ETPs tends to significantly decline or decay.

As one might imagine, from examining the differences in the mean and median daily returns for the VIX index and each ETP, all of the non-inverse return series are positively skewed, with the inverse ETPs having negatively skewed return distribution. For comparison, the daily return distribution of the S&P 500, over the period examined, has a skewness of 0.04. The VIX index has a skewness of 1.02, with the ETPs that follow the S&P ST Index (VXX, VIIX, and VIXY) having a skewness of about 0.50, with the inverse ETPs having about the same amount of negative skewness. The Midterm ETP has the lowest skewness of 0.24, while the twice-levered products show a high degree of skewness, as well.

Table 1, Panel A also presents the Sharpe ratios of each of the eight ETPs, as described in Sharpe (1994). As one might guess, the ETPs that track the S&P ST Index (VXX, VIIX, VIXY, TVIX, UVXY), along with VXZ, have negative Sharpe ratios. It is interesting to note that the VXZ, the S&P 500 VIX Medium-Term Index ETP, has a larger negative Sharpe ratio than the S&P ST Index ETPs. This is because of the fact that this index has more of the negative returns with less of the volatility when compared to the S&P ST Index. The Sharpe ratios of the two inverse ETPs, XIV and SVXY, are positive at 0.97 and 0.98, respectively. These are both less than the Sharpe ratio of the S&P 500, over this period, of 1.25.

The tracking error of each VIX ETP is also noted in Table 1. This statistic measures which ETPs does a better job of tracking the VIX index. As one might expect, the two inverse ETPs, XIV and SVXY, have the highest tracking errors, 10.54% and 10.56%, respectively, indicating that these ETPs demonstrate more volatility around the VIX index. Even though these tracking errors are highest, these ETPs have a mean daily return that is not statistically different from that of the VIX index. The leveraged ETPs, TVIX and UVXY, resulted in the lowest tracking errors, 3.91% and 3.67%, respectively, signifying that these ETPs do a slightly better job of tracking the VIX index, relative to the other ETPs that were observed. The remaining S&P ST Index ETPs (VXX, VIIX, and VIXY) have tracking errors that range from 4.09% to 4.11%, with the VXZ having a tracking error of 5.75%. The high tracking errors exemplify how the VIX ETPs deviate from VIX index significantly.

Table 1, Panel B presents the statistics of the VIX ETPs relative to the VIX index on the days in which the VIX index had a positive return. When looking at the days in which the VIX index experienced a positive return, it averaged 5.60% daily, with a 3.85% median return. On the days the VIX index moved up, many of the VIX ETPs moved in the same direction, however none had average daily returns or median returns as high as the VIX index. For example, VXX experienced an average return of 2.35%, compared to the 5.60% for the VIX index. In addition, VXZ, the midterm ETN, only generated an average return of 0.97% on the days in which the VIX index had a positive return. The non-inverse ETPs that track the S&P ST Index (VXX, VIIX, TVIX, VIXY, and UVXY) only had positive returns 77% to 79% of days in which the VIX index had a positive return.

Table 1, Panel C reports the statistics the VIX ETPs in relation to the VIX index on days in which the VIX index experienced a negative return. These findings are telling and exemplify the issues related to investing in VIX ETPs. On the days in which the VIX index

had a negative return, it averaged a daily return of  $-4.60\%$ . For the days in which the VIX index had a negative return, only the twice-levered ETPs (TVIX and UVXY) experienced a greater downward average daily return than the VIX index of  $-4.81\%$  and  $-5.32\%$ , respectively. Not surprisingly, during these days, the inverse ETPs (XIV and SVXY), on average, moved in a positive direction. However, there were still trading days in which the inverse VIX ETPs moved in the same negative direction as the VIX. The non-inverse funds that follow the S&P ST Index (VXX, VIIX, TVIX, VIXY, and UVXY) were more highly likely to follow the VIX index when it was down; all were down over 90% of the days when the VIX index was down. Thus, Panel C illustrates that while, on average, many of these funds did not post as large of a negative return as the VIX index, when coupled with the negative average daily returns of these ETPs when the index went up, the overall performance was much worse than that of the index. This result is also shown in Figs. 1 and 3 (excluding the inverse funds).

Analyzing the returns in the VIX-based ETPs versus the returns in the VIX index is noteworthy. One might expect these VIX-based ETPs to act as fair substitutes for investing in the VIX index, but, as noted above, these funds do not accurately track the VIX index over time. Even though these investments do not track the VIX index well over time, they still generally move with volatility (but are more correlated with the appropriate S&P 500 VIX Futures Index). Thus, investors can use these ETPs to benefit from changes in volatility but should only invest for a short period. Because these funds are not prudent for a buy-and-hold strategy, timing in these investments is critical. Investors must consider the benefits, costs, and challenges of investing in VIX ETPs and must also realize that the VIX ETPs do not always move in the same direction as the VIX.

## 6. Conclusions

This article examines eight VIX-based ETPs that include exchange traded notes ETNs and ETFs and compares the performance and returns of these investment vehicles to that of the VIX index. Many investors may expect these ETPs to track the VIX index, which this article shows that they do not. In addition, many investors may expect that these funds are designed to replicate the returns of the VIX index, which they are not. These funds are structured to replicate the performance of any number of indexes comprised of VIX futures. This article looks at ETPs designed to replicate the performance of two different indexes, the S&P 500 VIX Short-term Futures Index and the S&P 500 VIX Midterm Futures Index. In addition, ETPs that track the inverse and twice the performance of the S&P 500 VIX Short-term Futures Index are examined.

The results of this analysis are crucial for individual investors looking to invest in VIX-based ETPs (or any other VIX-based products). Investors should realize that the returns of ETPs, while providing exposure to volatility, do not track the VIX index and are exposed to a decline in value, because of the large degree of contango priced into the VIX futures contracts used by these funds. Thus, VIX ETPs are not generally suitable for a buy-and-hold investment, but may provide return enhancement, if used judiciously and carefully monitored in a portfolio. As noted by DiLellio et al. (2014), using inverse and leveraged ETFs must be

considered under the appropriate risk-return tradeoff. Using the same assessment, financial planners and individual investors may choose to use VIX-based ETFs for return enhancement, but each must assess the risk and return benefits of these products.

VIX-based investment products are still relatively in their infancy, especially ETPs, and research into these products is just beginning. There are a number of questions that can be examined within the VIX-based investments space. This article adds to that literature and provides a general overview and caveat to individual investors of how VIX ETPs behave and some of the factors that must be considered before investing in these products. There is much more research to be done in this area and many more ways to examine using these types of products within an investment strategy, just not from a buy-and-hold perspective.

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