



Is Volatility as an Asset Class the Missing Link?

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Abstract

The financial crisis and bear markets of the last decade have shown that the traditional asset allocation techniques which were created based on financial theories like MPT aren't as effective as they used to be. We are living in a new normal where the globalization of the financial world diminished the value of geographic diversification significantly, while new financial innovations such as ETFs led to increased correlations across local markets. Under these conditions, diversifying to less traditional asset classes like commodities, hedge funds and emerging markets would help a portfolio of local stocks and bonds. However, in a market crash like the one of 2008, even this amount of diversification is not sufficient for the average investor.

In this paper, we propose to use volatility through VIX derivatives and ETNs as a diversification and hedging tool. Volatility has unique and desirable properties as a portfolio hedge and backtested results show that such a diversification may significantly improve the Sharpe ratio of a traditional portfolio.

Introduction

The recent financial crises of 2008 and 2011 and the overall performance of US equity and bond markets this past decade are eye opening moments for investors holding the traditional 60/40 portfolio (will be referred as traditional portfolio or TP throughout the paper). The prospects going forward are no better; welcome to the “new normal”, as coined by Bill Gross (1).

We are witnessing the limits of the portfolio management tools and models developed throughout the 20th century; diversification is not what it seems. As we know from experience and the literature (2), the correlation of asset returns increases significantly across all asset classes during extreme down movements of equity markets, which implies that the risk of a portfolio increases significantly more than anticipated by traditional risk models. In other words, diversification does not provide the risk mitigating effects expected from it when it is most needed.

The Problems with Financial Theories and Their Implications in Today's Markets

The financial theories on which modern finance is founded have some major practical flaws which create problems, especially during bear markets. In particular, we would like to look at the flaws related to Modern Portfolio Theory, which is fundamental to other financial theories like the CAPM, to show how using these theories to manage a portfolio has been especially problematic since 2008.

Modern Portfolio Theory suggests that to achieve the best risk return trade-off, investors have to allocate their capital between a risky market portfolio and a risk-free asset. This suggestion assumes that the markets are efficient (3), implying that it is not possible to gain excess returns by investing in particular assets based on analysis of their prices and other publicly available information. According to MPT, no single investor can out-smart the market, short term gains or losses are due to random developments which will cancel each other in the long run and as such, in the long run, the only return an investor can expect to make is the overall market return. Therefore, investing in a portfolio comprised of each investable asset held in proportion to its market capitalization will give us the return and volatility of the market without the price volatility due to firm specific randomness and by definition, this portfolio will be the optimal portfolio. Furthermore, by borrowing or lending money at the risk free rate, an investor can adjust the amount of market risk he/she wishes to assume based on his/her risk appetite.

MPT is considered by many to be one of the most important developments in modern finance. It is one of the first mathematical models that neatly described some of the key concepts that investors must deal with. The creator was awarded the Nobel Memorial Prize in Economic Sciences and the model is widely used in practice in the investment industry.

However, MPT has been criticized especially in recent years both from a theoretical and practical stand point. Some of the theoretical criticisms are that markets are not perfectly efficient and it may be possible to beat the markets by accessing better information and resources, that investors may not be rational and risk averse, that empirically asset returns are not necessarily jointly normally distributed and their variance, mean and correlations may change over time (especially during bear markets when asset returns are highly correlated).

Some other problems related to the practical usage of the model are that investors cannot hold all the assets in the world including illiquid assets, and that there is no such thing as a risk-free asset. In practice investors started to use the stock market indices as a proxy for the risky market portfolio and treasury bills as the risk free asset.

Despite these criticisms, since its conception, MPT has been taught in business schools, as a useful tool to teach basic concepts in finance and widely applied in the investment management industry and until recently, seemed to work relatively well. Its success was partly due to the fact that the model popularized the idea of diversification, which in itself is a valuable concept that is independent of the validity of MPT. Using MPT as a construct, many investors created a long only stock portfolio to replicate the performance of the stock market and a bond portfolio to stabilize their returns and to preserve their capital. In addition, starting in the 1950s when the model was first introduced up until the beginning of the 2000s, developed countries and their markets grew in a relatively stable fashion. The baby boomers created a demographic advantage for the developed countries, which further bolstered equity market returns.

Figure 1 below is the equity curve of the S&P 500 since 1950.

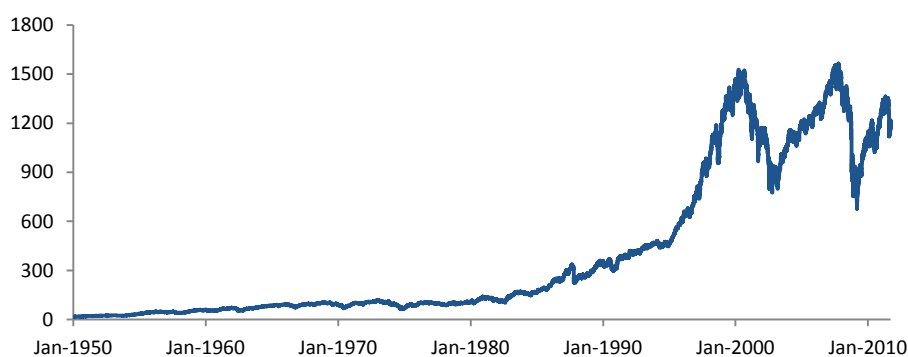


Figure 1: S&P 500 (FROM 1950 TO PRESENT)

It is clear that there was a trend until the early 2000s and it is also clear that since then the trend has been broken (Figure 1). The situation is not expected to change in the near future because the problems seem to be more structural than cyclical (aging baby boomers, contracting middle class, elimination of jobs through technological innovation and relocation of jobs to emerging markets, etc).

Since the early 2000s, holders of a traditional portfolio of stocks and bonds have not done well. Interest rates have been at historically low levels during most of this period (in the last few years real interest rates are even negative), and stock market indices, such as the S&P 500, have experienced increased volatility with no real returns.

From 1950-2000, a typical diversified portfolio of stocks and bonds (Traditional Portfolio) proved to be a good investment as both asset classes grew relatively steadily throughout the period. In that environment, the assumptions of MPT held up relatively well and diversification paid off. However, as we have seen when markets experience negative shocks many assumptions of modern financial theory break down, especially the assumptions related to cross-sectional

correlations and diversification. Unfortunately, MPT breaks down when it is most needed.

Due to this unfortunate reality, it seems that for all practical purposes, using MPT in the same way it has been used for the past 50 years makes little sense going forward. Instead of using the broad equity market indices as a proxy for risky assets, investors should try to incorporate more sources of diversified risk into their portfolio - sources that do not depend on local equity markets. The simple addition of emerging/foreign market bonds and equities, commodities and hedge funds can greatly improve a portfolio's risk and return profile. Given the new financial instruments and technologies which allow investors to invest in a larger number of asset classes than ever, they must seek new asset classes that will truly add diversification to a portfolio, both in good and bad times.

However even the addition of these asset classes does not, especially during bear markets, solve the problems related to higher asset class correlation and fat tails. While financial innovation and technological developments now provide investors the tools to diversify into very different asset classes, most of which were previously out of reach of even the largest institutional investors, they also make all kinds of asset classes much more correlated than ever. In this paper, we will investigate a new asset class which possesses appealing diversification benefits, which might even mitigate the theoretical problems of MPT: volatility.

The Coming of Volatility as an Asset Class

Volatility has been traded via the options market since the introduction of exchange traded options in the 70s. In the early 90s, volatility swaps appeared and large players, such as hedge funds started trading volatility through these instruments. It was not until the mid 2000s that the average investor had access to volatility derivatives, namely options and futures on the VIX index (4). In recent years, with the introduction of ETNs based on VIX derivatives, portfolio hedging using volatility has gained momentum. In figure 2 you can see the change in the average volume of VXX, iPath VIX short-term futures ETN (5) and the change in the average volume of SPX put options, two popular instruments used to hedge stock portfolios.

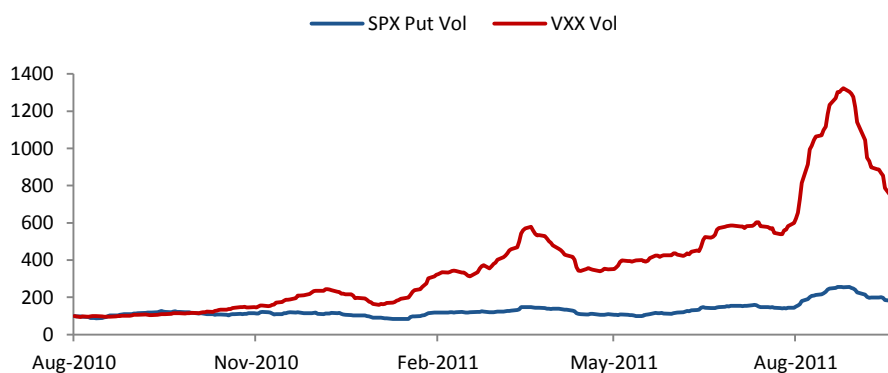


Figure 2: TRADE VOLUME FOR SPX PUTS AND VXX

Despite the recent rise in popularity amongst investors, VIX-based derivatives and ETNs are not well understood by most investors. In this paper, we will explain these instruments, their uses

and characteristics, and we will discuss how investors can benefit from adding a dynamic allocation to volatility in their portfolios of stocks and bonds.

What is the VIX?

The VIX is the Volatility Index calculated and published by the CBOE. Its goal is to determine the short-term expected volatility of the market as implied by option prices. It is calculated from the implied volatilities of actively traded options on the S&P 500 Index. The VIX is widely regarded as a proxy for market uncertainty and is appropriately nicknamed the “fear index”.

Table 1 shows the cross correlation of major asset classes and the VIX. Here DBLCIX is DBIQ Optimum Yield Diversified Commodity Index Excess Return, a popular commodities index by Deutsche Bank. It is tracked by PowerShares DB Commodity Index Tracking ETF (DBC). LBUSTRUU is Barclays Capital US Aggregate Bond Index, which is tracked by iShares Barclays Aggregate Bond ETF (AGG). SPTR is S&P 500 Total Return Index, which is tracked by SPDR S&P 500 ETF (SPY). RMS_G is MSCI US REIT Gross Total Return Index, which is tracked by Vanguard REIT Index ETF (VNQ). Finally VIX is CBOE S&P 500 Implied Volatility Index.

We can see that the VIX is highly negatively correlated with the S&P 500 and with most other asset classes.

	<i>DBLCIX</i>	<i>LBUSTRUU</i>	<i>SPTR</i>	<i>RMS_G</i>	<i>VIX</i>
<i>DBLCIX</i>	1	-0.086	0.1690	0.1408	-0.1347
<i>LBUSTRUU</i>	-0.0862	1	-0.1512	-0.1144	0.1242
<i>SPTR</i>	0.1690	-0.1512	1	0.6458	-0.7417
<i>RMS_G</i>	0.1408	-0.1144	0.6458	1	-0.4464
<i>VIX</i>	-0.1347	0.1242	-0.7417	-0.4464	1

TABLE 1: CROSS CORRELATION OF ASSET CLASS ETFS BASED ON DAILY RETURNS SINCE JAN 1995

Furthermore, it has very different risk and return characteristics when compared to other asset classes, and this, in part, explains why volatility is considered to be an asset class of its own. Most importantly, the VIX is not only negatively correlated with the market, but it also bolsters an asymmetric return distribution; it increases, both in magnitude and speed, to a greater extent during crises and slowly decreases when normality returns. This unique property makes it an extremely attractive hedge for the equity investor.

Unfortunately, the VIX is not directly tradable, and up until 2004, when the first derivatives on the VIX were introduced, it was not possible to take advantage of its valuable properties. In 2004, the first futures on the VIX started trading, and in 2006, the first options on the VIX began trading. These instruments allowed retail investors to gain exposure to volatility through VIX derivatives. It is important to note that these derivatives do not replicate the exact return profile

of the VIX index, and as such, the hedging benefits offered by the VIX are not directly obtainable.

These instruments do not replicate the exact movement of the VIX index values because they only allow investors to bet on the future value of the VIX as opposed to its current value. Since VIX index values are range-bound, and mean reverting, if a derivative could exactly replicate the price changes of the spot VIX Index, it would be possible to buy (sell) the VIX when it is low (high) and wait until an increase (decrease) to achieve predictable profits. This is why it is not possible to have an instrument (ex: an ETN) that tracks the VIX Index values, as in the case with many other indices. Fortunately, using combinations of ETNs based on VIX futures, it is still possible for retail investors to take advantage of the valuable properties offered by the VIX.

Tradable Securities on the VIX

The primary instruments used to trade the VIX are futures and options. There are also ETNs based on these instruments that have been available since 2009. The problem with both futures and ETNs based on the VIX is the roll yield. When the spot VIX value is very low the expectation is that, in the future, the VIX value will increase to the long term average, and as such, the price of the back month VIX futures will be higher than their front-month counterparts. When this occurs, the term structure of VIX futures is upward sloping and is said to be in contango.

Conversely, when the VIX index is high, the market expects the VIX to decrease and revert back to its historical mean, so the back month futures trade at lower levels than the front month contracts. This leads to a downward sloping term structure, and when this occurs, the curve is said to be in backwardation.

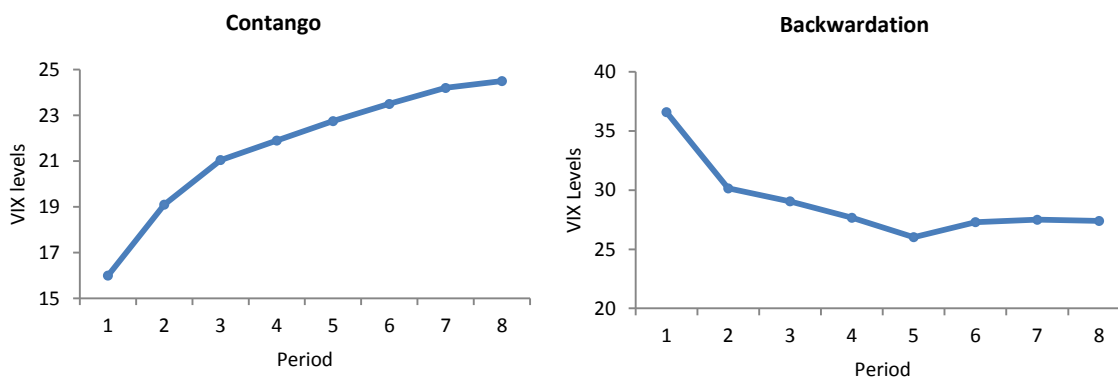


Figure 3: VIX TERM STRUCTURE EXAMPLES

The VIX exhibits asymmetric mean reverting behaviour (Figure 4); more specifically, the VIX tends to jump up abruptly from low levels and slowly revert back down to its mean following a sudden rise. With this in mind, we can interpret the situations in the previous paragraph as follows: When the term structure curve is in contango, the VIX is low and the markets are calm. Anyone buying VIX futures is actually buying insurance against a big jump in the VIX, and is poised to profit if the VIX suddenly increases. Conversely, anyone shorting the futures will

essentially be selling “crash insurance”, and as such, will collect the insurance premium when the markets are calm and will lose when the VIX jumps. A similar situation arises once the VIX has reached elevated levels. Since the VIX is expected to revert downwards to its mean, investors who short the futures when the term structure curve is in backwardation should pay a premium to investors who are willing to take the other side of the trade and go long the futures.

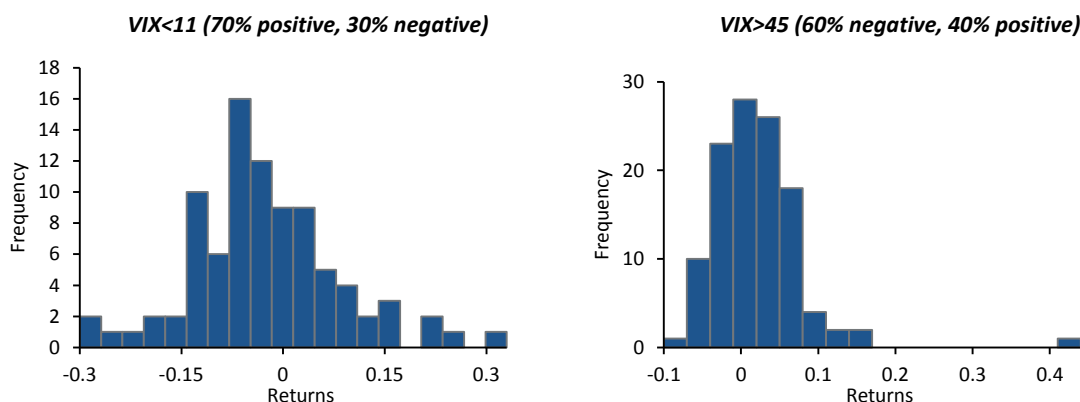


Figure 4: VARIATION OF RETURNS FOLLOWING DIFFERENT VIX LEVELS

The roll yield of VIX futures is an important issue which prevents futures or ETNs based on these futures to be effective buy and hold portfolio hedges. The price one must pay to maintain a long position in VIX futures, known as the roll yield, is usually high enough to offset gains made during market crises. One obvious solution to this problem would be to hedge the portfolio only when the risk of the markets is high, but due to the way the VIX is calculated, it is usually too late to buy the VIX once a major market move has occurred.

Fortunately, different strategies and new instruments based on VIX futures and options may allow investors to effectively hedge their portfolios constantly while minimizing or even eliminating the roll yield problem.

Trading Strategies with the VIX

One obvious trade is trading VIX futures themselves. One may speculate about the changes in the VIX index value and take a position based on his/her view. The investor may buy and hold a constant maturity futures portfolio of VIX futures. We can replicate this strategy using the VXX and VXZ ETNs.

The VXX tracks the S&P 500 VIX Short-Term Futures Total Return Index (SPVXSTR). This index invests in the first month and second month VIX futures with daily rolling between the two, in order to maintain a constant short-term maturity. VXZ (6) tracks S&P 500 VIX Mid-Term Futures Total Return Index (SPVXMTR), which invests in fourth, fifth, sixth and seventh month VIX futures on a daily rolling basis, thereby creating a constant mid-term maturity VIX futures portfolio.

Based on the value of SPVXSTR and SPVXMTR, a buy and hold strategy of these ETNs would result in the equity curves shown in figure 4.

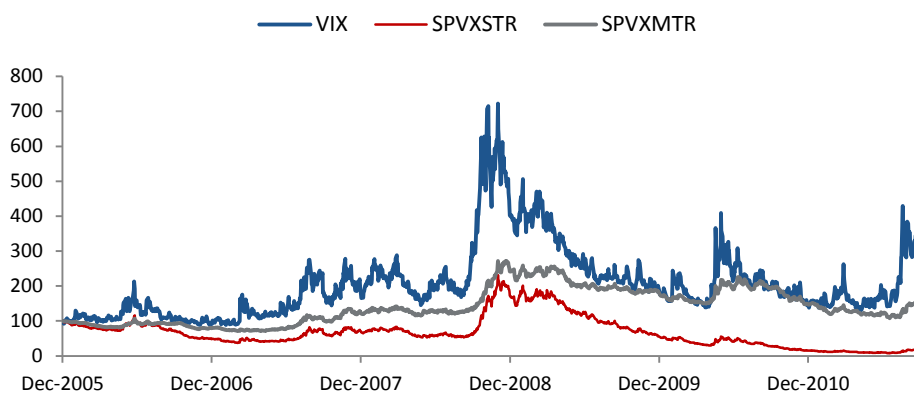


Figure 5: INDEX EVOLUTION FROM 2005 TO PRESENT

It can be seen from figure 4 that if we were to consider this as a stand-alone strategy, the mean reversion characteristics of the VIX index makes this an unattractive bet because if our investment always comes back to its original value, there is no value in holding the product for the long-term. Such a strategy would only make sense for someone who is trying to time the market. If one buys these instruments just before a market crash and exits the position after the crash, then he/she can profit from such a trade, but every experienced investor would accept the fact that market timing is very hard if not impossible to accomplish.

In addition, the roll yield makes this buy-and-hold strategy even more unattractive, especially in the case of the VXX. We can see from the graph above that even though SPVXSTR, the index which determines the value of the VXX increased by more than 300 % in less than 3 months during the peak of the 2008 crisis, it has lost nearly 90% of its initial value since 2005. Therefore, a buy-and-hold strategy in constant maturity futures on the VIX does not make sense. As a stand-alone investment, these instruments should only be used for short-term trading when one expects sudden increases or decreases in volatility.

Another way to invest in VIX futures is to go long the futures in addition to a traditional portfolio. Here we would like to take advantage of the negative correlation between the VIX and traditional asset classes. First let us show a traditional portfolio made up of 60% stocks and 40% bonds and rebalanced monthly. In order to construct this portfolio we will use two ETFs; for stocks we will use SPDR S&P 500 ETF (SPY), which tracks S&P 500 Total Return Index (SPTR), and for bonds we will use iShares Barclays Aggregate Bond ETF (AGG), which tracks Barclays Capital US Aggregate Bond Index (LBUSTRUU). We used the price data of the indices tracked by these two ETFs from January 1988, the date since the data for SPTR is available. In figure 5 you can see the equity curve and some statistics for this strategy.

	TP	SP500 TR
Sharpe	0.93	0.65
Max DD	-32.54%	-51.95%
Mean	0.72%	0.81%
Std Dev	2.69%	4.29%
Skew	-0.54	-0.59
Kurt	1.15	1.03

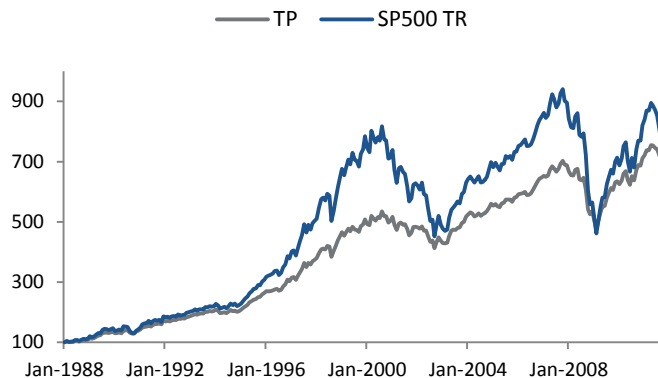


Figure 6: S&P 500 TR AND TRADITIONAL PORTFOLIO RETURNS SINCE 1988

Now, consider a portfolio that invests one third of its assets in the VXZ and two thirds in the TP and rebalanced monthly. As shown in figure 6, here is the equity curve and the statistics for the new portfolio. We can see that the Sharpe ratio is more than 2.5 times greater than that of the initial portfolio.

	TP	TP + SPVXMTR
Sharpe	0.35	0.90
Max DD	-32.54%	-8.93%
Mean	0.31%	0.58%
Std Dev	3.04%	2.24%
Skew	-0.89	0.73
Kurt	1.67	0.30

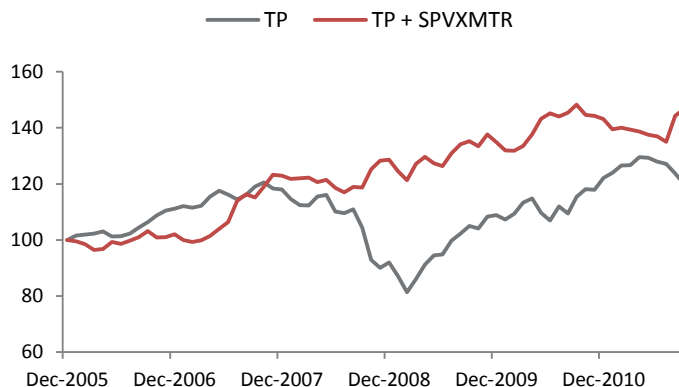


Figure 7: TRADITIONAL PORTFOLIO AND PROPOSED TP + SPVXMTR PORTFOLIO RETURNS SINCE 2005

The same strategy using the VXX does not work because the roll yield is high for short-term futures and the hedging benefit is relatively small in comparison to the roll yield.

At this point, we have seen that despite roll yield costs, the addition of VIX futures to a traditional portfolio can be extremely beneficial. However, instead of a simple long-only strategy, if one were to devise a more sophisticated investment approach that utilizes the characteristics of VIX futures, one could benefit from the general exposure to the VIX while minimizing some of the costs associated with such a position.

One such strategy is dynamically changing the exposure to short and mid-term futures based on the shape of the term-structure curve. Since short-term futures suffer the most from the roll-yield

when the curve is in contango, it is preferable to buy mid-term futures. Although these futures are less sensitive to moves in the spot index, and therefore, provide less protection against extreme market events, the amount of protection that investors will receive per unit of roll-yield they pay far exceeds that of short-term futures.

Another strategy employed by some ETNs is shorting a small amount of short-term futures when the curve is in contango to cover the roll yield of a larger amount of long mid-term futures. This strategy aims to achieve free or low cost protection against big upwards moves in volatility.

In our backtesting, we have seen that the combination of these two strategies provide good protection against market crashes while avoiding many of the costs usually associated with a long volatility position. Therefore, simple strategies such as these would be a valuable addition to a traditional portfolio of stocks and bonds.

Additionally, this strategy is readily available to retail investors by purchasing dynamic ETNs, and is also possible to implement using ETNs like VXX (long short-term VIX futures ETN), VXZ (long mid-term VIX futures ETN), XIV (short short-term VIX futures ETN), or even directly trading the futures, although the latter may not be easy to implement for everyone.

Finally, by employing the concepts discussed throughout this paper, the nimble and astute investor can construct far more sophisticated trading strategies that can profit in a wide variety of market regimes. As long as one understands the dynamics of the futures curve, one can devise strategies that provide exposure to volatility while minimizing costs associated with such positions. The addition of such strategies to a portfolio is the “secret sauce” so many seem to be missing in this volatile environment.

Conclusion

In this paper, we have shown that the addition of volatility as a new asset class to a traditional portfolio of stocks and bonds dramatically increases the Sharpe ratio of the portfolio and even though the VIX itself is not directly tradable we have also outlined concrete ways that investors can use to gain exposure to volatility.

What makes the VIX such an attractive hedge is because volatility is not only an asset class that is negatively correlated with other asset classes, but because it is also an asymmetric, mean reverting index with range-bound values, meaning that when equity markets crash, the VIX spikes up providing protection, and as markets recover, volatility slowly reverts back to its mean. Furthermore, since it has a lower bound (it cannot go to zero and the lowest value it has so far is 9.31), the volatility index does not lose its value over time, as opposed to other hedges. These two properties make volatility an excellent hedge which dramatically smoothes out the returns of a traditional portfolio.

Of course, these benefits do not come for free, and any investor who wants them needs to pay a price. However, using some clever combinations of futures, one can minimize and in some cases, even eliminate the costs. As demonstrated in our paper, even the simple addition of a long position in mid-term futures can improve the Sharpe ratio of a traditional portfolio of stocks and bonds. Some dynamic ETNs seem promising, but we will have to wait and see if their ability to track their proposed indices is adequate.

Finally one may raise the issue of what happens if all investors who hold a traditional portfolio buy volatility for protection? Wouldn't this drive up the price of the hedge to make it economically unattractive to hedge?

We believe markets are reflexive and investors influence the markets and vice versa in a double feedback effect. As a result it is hard to assess the effect of an increase in demand for VIX futures. But we can assume that like other futures markets, the market for volatility consists of hedgers and speculators. An investor who holds a portfolio of stocks is actually exposed to the risk of spikes in volatility just like an airline company is exposed to the risk of spikes in oil prices and would like to hedge its portfolio against such a risk. On the other hand speculators are willing to profit from the roll yield effectively paid by the hedgers for the insurance they provide. So an increase in demand for more hedge will initially increase the price for hedging but it will also attract more speculators to the market and eventually a balance will be reached. Several studies have shown that hedging in the commodities markets resulted in much smoother returns for the hedgers (7) and we believe that this will also be the case for a traditional stock market investor. In this paper we presented volatility, which has unique properties as a portfolio hedge and unlike other hedging instruments like options, it is much easier to understand and trade for smaller investors.

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