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## Asset Allocation

# WHAT DOES A LOW VIX TELL US ABOUT THE MARKET?



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### KEY POINTS

- The financial press has been paying considerable attention lately to the Chicago Board Options Exchange Volatility Index (VIX), with many financial pundits citing recent low readings on the VIX as evidence of investor complacency and rising equity risk.
- Media coverage often implies that a low current VIX is a strong signal of expected future volatility and will be followed by a sell-off in U.S. equities and other risk-seeking assets.
- Historical evidence shows that, over the near term, investors typically overestimate the next 30-day volatility of the S&P 500 Index.
- Further, when the VIX has been low, U.S. equities have outperformed U.S. bonds on average over the next 12 months, regardless of the change in the VIX over that horizon.
- Without a meaningful and prolonged catalyst, we do not believe a low level of the VIX alone implies investor complacency or an immediate danger of a risk-off event.

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### BACKGROUND

There has been much discussion in the financial press recently about the danger of investor complacency—with a low VIX frequently cited as compelling evidence that equity investors have grown too relaxed about potential risks. The problem is that it is difficult to determine whether markets are truly complacent or not; we can't survey all investors and, even if we could, how many investors would admit that they were complacent? Instead, we take a mental shortcut and presume that something we can measure is a good proxy for the thing we actually care about. Enter the VIX. In this article, we try to determine the usefulness of the VIX as a forward indicator for both market risks and market returns.

### UNDERSTANDING THE VIX

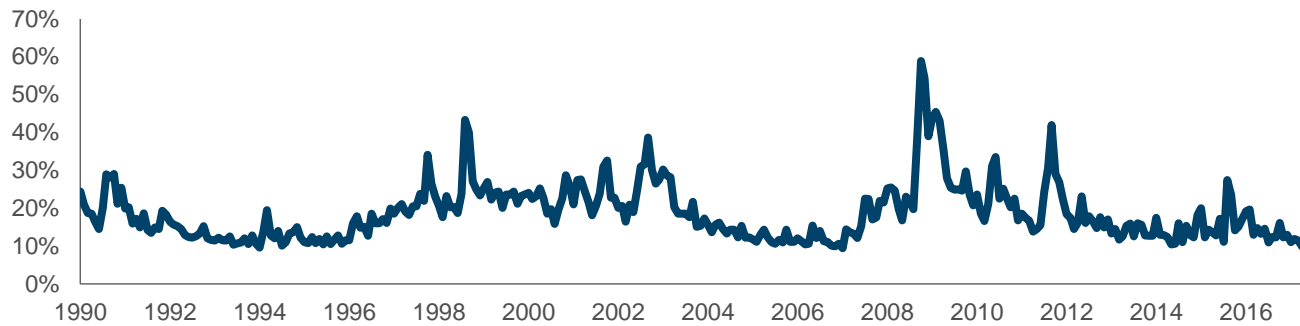
The VIX can be interpreted as the market expectation for realized volatility over a forward 30-day period (Figure 1).<sup>1</sup> While it is true that the VIX tends to be mean-reverting and it

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<sup>1</sup>For a technical explanation of these concepts and their relationship to the VIX, see the appendix on page 5.

## Figure 1: The VIX Index

As of April 28, 2017



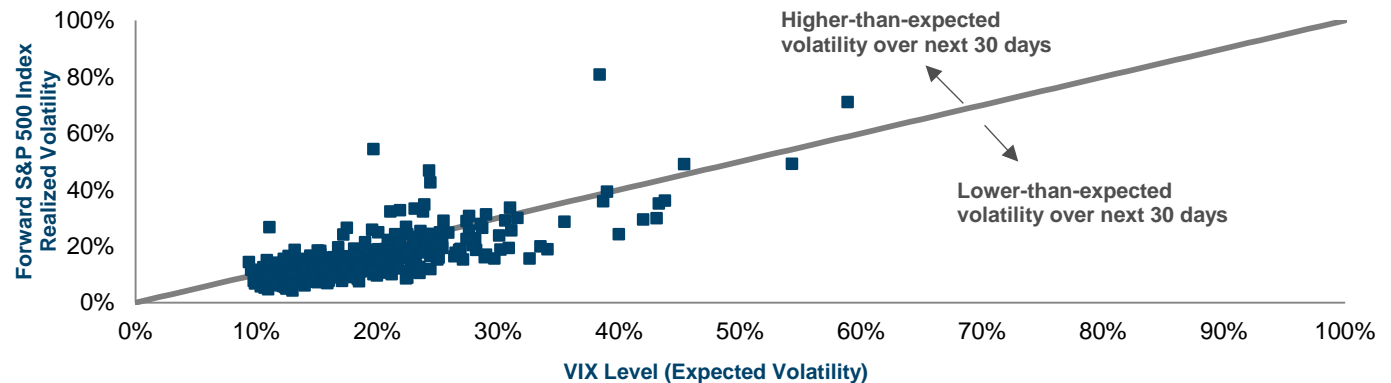
Source: CBOE.

occasionally spikes following long periods of calm, it is more often the case that calm follows calm. It is very tempting to look at a time series of the VIX and assume that you want to “buy the VIX” when it’s low and “sell the VIX” when it’s high. Unfortunately, the VIX is not a stock that you can buy and hold, it is the strike price of a 30-day variance swap. When you buy a 30-day variance swap, the only thing that matters is the forward realized volatility of the underlying asset, not what the price of a similar 30-day swap will be at some point in the future.

If a low VIX were actually a good measure of investor complacency, there would be a corresponding relationship between a low VIX today and higher-than-expected volatility over the forward 30-day period. However, this is not the case. Consider the scatterplot shown in Figure 2, which compares expected volatility (VIX level) with forward realized volatility. Points above the line (with slope equal to 1) reflect investor complacency, while points below the line reflect the opposite. In the majority of cases, investors actually overestimate 30-day volatility,<sup>2</sup> and even when they don’t, it is not a function of the prior level of the VIX but other factors that impact the underlying asset, the S&P 500 Index.

## Figure 2: Expected Volatility Versus Forward Realized Volatility

As of April 28, 2017



Source: CBOE. Each data point represents a month. The level of the VIX or expected volatility (X axis) is observed on the last day of the previous month and the “Forward SPX Realized Volatility” (Y axis) is the annualized standard deviation of daily total returns over the current month. The gray line has slope 1 with intercept at 0.

## HISTORICAL RELATIONSHIP BETWEEN THE VIX AND U.S. EQUITY PERFORMANCE RELATIVE TO U.S. BONDS

The complacency argument implies that the forward performance of traditional risk-on asset classes will be negative when the VIX is too low. Although past performance cannot predict future performance, we evaluated the historical relationship between the VIX and the forward 12-month performance of the Russell 3000 Index (U.S. equities) relative to the Bloomberg Barclays U.S. Aggregate Bond Index (U.S. bonds). We looked at:

- The level of the VIX versus forward 12-month equity returns relative to bonds and
- The level and change in the VIX versus forward 12-month equity returns relative to bonds.

<sup>2</sup>A phenomenon known as the variance risk premium.

We compared the level of the VIX with subsequent 12-month relative returns on the Russell 3000 Index versus the Bloomberg Barclays U.S. Aggregate Bond Index over rolling 12-month periods running from January 1990 through December 2016 (Figure 3). Relative returns were sorted into three buckets based on initial VIX levels: A “low” VIX was defined as being in the bottom quartile of all readings over the period, “medium” VIX levels fell in the middle two quartiles, and top-quartile readings were considered “high” VIX levels.

### Figure 3: Historical Scenario Analysis

Average 12-Month Relative Returns on U.S. Equities Versus U.S. Bonds by VIX Category  
January 1990 Through December 2016

	Total Periods = 312		
Russell 3000 Index Versus Bloomberg Barclays U.S. Aggregate Bond Index	Low VIX (<25th percentile) [10.3 to 13.9] 78 periods	Medium VIX (≥25th percentile & ≤75th percentile) [13.9 to 24.3] 156 periods	High VIX (>75th percentile) [24.3 to 65.5] 78 periods
<b>Relative Return</b>	8.4%	3.9%	3.1%
<b>Hit Rate</b>	88%	69%	63%
<b>10th Percentile Return</b>	-1.4	-24.8	-28.7
<b>90th Percentile Return</b>	21	22.1	27.4

At Least 80% Positive Hit Rate

Past performance is not a reliable indicator of future performance.

When the VIX was in the bottom quartile—corresponding with index readings of 10.3 to 13.9, U.S. equities outperformed U.S. bonds by an average of 8.4 percentage points over the next 12 months, with -1.4% as the 10th percentile return and 21% as the 90th percentile return. Further, U.S. equities outperformed U.S. bonds 88% of the time, while 12% of the time U.S. equities underperformed U.S. bonds. (For additional information on the study methodology, please see the appendix on page 5.)

Considering both the level and the next 12-month change in the VIX may provide additional information. As shown in Figure 4, when the VIX was in the lowest quartile and increased by over 100 bps over the following 12 months (the scenario feared in the investor complacency argument), U.S. equities outperformed U.S. bonds by an average of 7.6 percentage points, with a 10th to 90th percentile return range of -3.4% to 21.6%. The overall hit rate—the percentage of the time that U.S. equities outperformed U.S. bonds—when the VIX was in the lowest quartile and rising was 81%, which means there was negative relative performance 19% of the time.

However, when the VIX has been in the two medium quartiles (25th to 75th percentile) and increased by more than 250 bps over the next 12 months, it historically has signaled negative relative performance over those next 12 months. In this type of environment, U.S. equities underperformed U.S. bonds by an average of -3.5 percentage points with a 10th to 90th percentile return range of -36.8% to 22.1%. The overall positive hit rate in the medium two VIX quartiles was 49%, which means 51% of the time there was negative relative performance.

#### Figure 4: Level and Change in the VIX Versus Forward 12-Month Relative Performance

Average 12-Month Relative Returns on U.S. Equities Versus U.S. Bonds by VIX Category  
January 1990 Through December 2016

Total Periods = 312				
LOW VIX [10.3 to 13.9]				
Russell 3000 Index Versus Bloomberg Barclays U.S. Aggregate Bond Index	Change <-100 bps 14 periods (4.5%)	Change -100 bps to 100 bps 23 periods (7.4%)	Change >100 bps 41 periods (13.1%)	Entire sample 78 periods (25%)
<b>Relative Return</b>	9.6	9.2	7.6	8.4
<b>Hit Rate</b>	100%	96%	81%	88%
<b>10th Percentile Return</b>	1.9	2.6	-3.4	-1.4
<b>90th Percentile Return</b>	18.2	20	21.6	21
MEDIUM VIX [13.9 to 24.3]				
	Change <-250 bps 52 periods (16.7%)	Change -250 bps to 250 bps 52 periods (16.7%)	Change >250 bps 52 periods (16.7%)	Entire sample 156 periods (50.0%)
<b>Relative Return</b>	10.3	4.9	-3.5	3.9
<b>Hit Rate</b>	91%	67%	49%	69%
<b>10th Percentile Return</b>	0.5	-4.1	-36.8	-24.7
<b>90th Percentile Return</b>	20.8	22.4	22.1	22.1
HIGH VIX [24.3 to 65.5]				
	Change <-500 bps 40 periods (12.8%)	Change -500 bps to 500 bps 25 periods (8.0%)	Change >500 bps 13 periods (4.2%)	Entire sample 78 periods (25.0%)
<b>Relative Return</b>	16.4	-3.6	-24.7	3.1
<b>Hit Rate</b>	86%	51%	13%	63%
<b>10th Percentile Return</b>	-4.2	-24.7	-41.4	-28.7
<b>90th Percentile Return</b>	33.2	18.8	4.3	27.4

At Least 80% Positive Hit Rate

At Least 80% Negative Hit Rate

Past performance is not a reliable indicator of future performance.

#### CONCLUSION

While the empirical evidence shows there have been times when a low level of the VIX has underestimated forward realized volatility and U.S. bonds have outperformed U.S. equities, the number of occurrences has been relatively low. As a result, without a meaningful and prolonged catalyst, such as increased geopolitical concerns, unexpected global central bank policy changes, or negative economic data, we believe there is a low historical likelihood that the current level of the VIX implies investor complacency and/or an immediate risk-off event. While we claim neither that correlation is causation nor that history will repeat itself, we do not believe there is sufficient quantitative evidence today to argue this time will be different.

## APPENDIX

Technically, the VIX is the arbitrage-free<sup>3</sup> price of a 30-day variance swap, which is itself a weighted combination of implied volatilities of short-term S&P 500 Index options.<sup>4</sup> A variance swap is a financial contract that pays out  $N * (\sigma_{realized}^2 - \sigma_{strike}^2)$  where  $N$  is some notional amount,  $\sigma_{realized}$  is the realized volatility over the period (30 days, for example) and  $\sigma_{strike}$  would be strike of the swap, or the numerical value of the VIX at a given point in time.

In evaluating the VIX and relative asset class returns on a monthly basis from January 1990 through December 2016, we created three buckets, focused on the absolute level of the VIX. We defined initial conditions for the VIX as follows:

$$IC(f)_t = \begin{cases} \text{"low"} & x_L \leq f_t < x_{(25\%*f)} \\ \text{"medium"} & x_{(25\%*f)} \leq f_t \leq x_{(75\%*f)} \\ \text{"high"} & x_{(75\%*f)} < f_t \leq x_U \end{cases}$$

Where  $f_t$  is the level of the macro factor at time  $t$ , and  $x_L$  and  $x_U$  are the lower and upper bounds that determined the initial conditions, based on long-term percentile ranks:  $x_{(25\%*f)}$  is the lowest quartile value of the factor, while  $x_{(75\%*f)}$  is the cutoff for the third quartile.

Next, we defined scenarios ( $S_{t+1}$ ) similarly:

$$S(f)_{t+1} = f_{t+1} - f_t$$

where the scenarios are predefined ranges in the forward returns that are meaningful to the practitioner (such as a 100 bps rise in the VIX) and the subscript  $t + 1$  denotes one-year forward returns.

Then we calculated the conditional pair trade return ( $R_{t+1}^C$ ) as:

$$R_{t+1}^C = \mathbb{E}(R_{t+1} | IC_t, S_{t+1})$$

which is the average historical return of the pair trade when initial conditions are in the same range (low, medium, or high) and the factor subsequently moves according to the scenario. We also included the 10th to 90th percentile range and identified when the sign was the same as the average (hit rate) at least 80% of the time.

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<sup>3</sup>“Arbitrage-free” refers to the fact that if you traded a variance swap at any price other than the arbitrage-free one at a point in time, you would be able to create a replicating portfolio that would exactly offset the risks of the variance swap, creating the potential for risk-free profits.

<sup>4</sup>There are some details, approximations, and caveats here, but these do not impact the broad statement.

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