

NEWSLETTER

June 2018

IN THE NEWS:

An article, "[Inclusion of High-Fee Funds not Necessarily a Breach of Fiduciary Duty](#)," written by Atanu Saha and Alex Rinaudo of DSP, was featured in Pensions & Investments Commentary in May.

In this article, the authors discuss the implications of DSP's recently published research for the current set of ERISA litigations, which claim that high-fee actively managed funds were unsuitable for inclusion in retirement plans. Their finding suggests that inclusion of a higher-fee active fund in a retirement plan does not necessarily imply an inferior choice.

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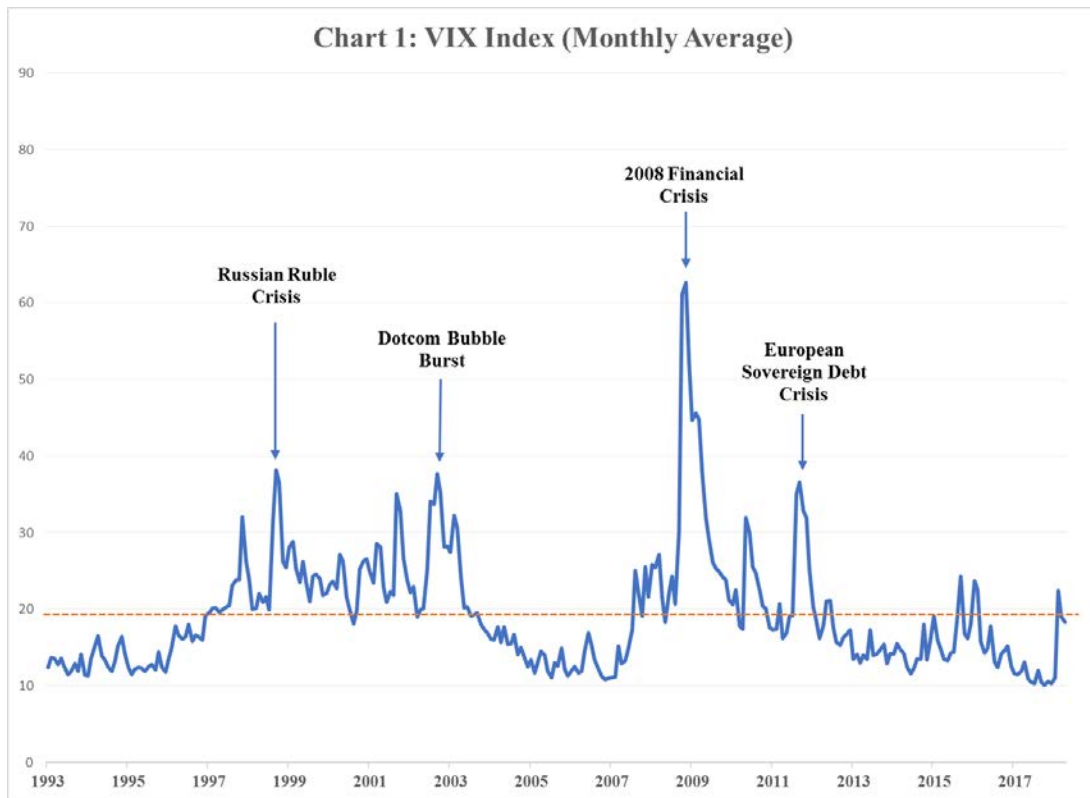


HAS THE VIX BEEN MANIPULATED? Economic Evidence Does Not Suggest So

The VIX, often referred to in the media as the "fear index," was introduced in 1993. It was designed to be a measure of the market's expectation of turbulence in the near future. A recent academic study suggested that the index has been manipulated since 2008.¹ This study has been cited in many recent lawsuits alleging manipulation of the VIX. The plaintiffs in these suits claim, for example, that "a select group of financial institutions and trading firms with sophisticated, expensive technology"² are engaging in "rampant manipulation of the VIX index."³ Twenty different VIX-related lawsuits have been filed in Chicago and New York. It is possible that some, if not all, will be consolidated into a class action in the near future.

The market for VIX-related financial instruments, such as futures, options and exchange traded funds, has risen steadily over the years. As of 2017, it had surpassed \$60 billion.⁴ Given the size and reach of numerous financial products linked to the VIX, any artificial inflation or deflation of the index can have widespread ramifications, including substantial damages suffered by various parties.

The goal of this newsletter is to examine whether economic evidence suggests that the VIX index has been manipulated from 2008 to the present, as asserted by several complaints. To address this question, we first briefly describe a general methodology for detecting artificiality in prices of commodities or financial indices. We then apply this methodology to the daily data on the VIX over the past two decades. Our analysis suggests that the movement of the VIX index in the post-2008 period is no different than it was in the ten years prior to 2008: in both periods, its movement is consistent with normal market forces and there is no indication of artificiality in the level of the VIX. In short, economic evidence does not support a claim of VIX manipulation.



The VIX: A Measure of Investor Sentiment

The level of the VIX index⁵ is designed to reflect investors’ expectation of the equity market’s volatility in the next 30 days. When uncertainty about the market increases, the VIX rises and as apprehension subsides, it falls.

Chart 1 displays the monthly average level of VIX from January 1993 to April 2018. The dotted horizontal line represents the average over that period, which is 19.4. As evidenced in this chart, the VIX spikes during times of pronounced market instability. For example, in each of the four periods of market turmoil listed in this chart, the VIX rose far above its long-run average level. In fact, during the financial crisis of 2008, the VIX spiked to its highest level ever recorded. Conversely, during bull market runs the VIX typically falls. For instance, it dropped below its average level during the market booms of the mid-1990s, mid-2000s and in 2016-17.

“We Are All Prisoners of Our Experiences”⁶

The VIX is a forward-looking measure of market sentiment. Yet, it turns out, stock market movements in the recent past are highly predictive of the VIX, despite the fact it reflects investors’ expectations of the near future. In other words, investors typically

extrapolate their experience from the recent past to the near future. As a result, the investors’ perceived need for protection against a market downturn—which is reflected in the VIX—rises when the market is experiencing or has recently experienced a period of turmoil.

Examples of this relationship are presented in Table 1, which shows monthly data during the four VIX spikes highlighted in Chart 1. The column titled “VIX Peak” denotes the highest level reached by the index during that month. “Market Return” represents the average monthly return of the S&P 500 index, and “Market Volatility” is a measure of S&P’s swings during that month. The final row of the table shows the long-term averages of these measures.

Table 1: VIX and SP500

Month	Year	VIX Peak	Market Return	Market Volatility
August	1998	44.3	-15.8%	9.7%
September	2002	40.7	-11.7%	9.4%
October	2008	80.1	-18.6%	25.7%
September	2011	43.0	-7.4%	13.8%
Average 1993-2018		19.4	0.6%	4.5%

Table 1 shows that each of the VIX peaks marked in Chart 1 occurred *concurrently* with a period of market downturn and outsized volatility, despite the fact VIX is a *forward-looking* measure of investor sentiment. As discussed later, this relationship between market turmoil in the recent past and the VIX will be crucial in examining the VIX manipulation claim.

The Benchmark Approach in Detecting Price Artificiality

There are various economic models to detect market manipulation, as discussed in a coauthored journal study by Dr. Saha.⁷ In this newsletter, we will adopt the benchmark approach, explained below.

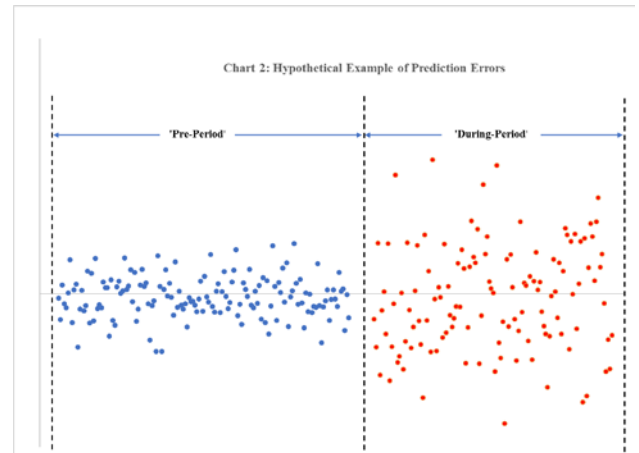
This method of detecting price artificiality has three steps. The first is to determine a suitable benchmark for the price at issue. Consider the following hypothetical: we wish to know whether commodity A's prices have been manipulated and suppose we choose the price of another commodity B to be the benchmark. For it to be a suitable benchmark, it must have three characteristics: (i) the benchmark is free from any manipulation claim. (ii) The benchmark price and the price of the commodity at issue are correlated. (iii) The benchmark is unaffected by the price at issue, i.e., B's prices are unaffected by A's. If not, artificiality in A's price will manifest itself in B's, rendering detection of artificiality using the benchmark impossible.

The second step is estimation of the relationship between the prices of the benchmark and the commodity at issue. Typically, the relationship is estimated using data from a period of time before the manipulation allegedly occurred or the "pre-period." The estimated relationship is then used to predict prices at issue in the "during period," i.e., when alleged manipulation occurred.

The final step of the benchmark approach is the comparative analysis of the prediction errors in the "pre-period" and the "during period." Going back to our example, if the price of A were artificiality distorted, then the price of B, the benchmark, will not be as accurate in predicting the price movements of A during the period of manipulation; this is because the price of A was affected by the manipulation, but the price of B was not. As a result, the prediction errors of the "during period" will be larger than those in the "pre-period." A hypothetical example of this pattern of prediction errors is shown in Chart 2. The prediction errors in the "during period" are in red, while those in the pre-period are in blue.

Note, however, the pattern depicted in Chart 2, where the "during period" errors are generally larger, does not necessarily prove price manipulation. The economist must determine whether the difference in the two periods' prediction errors are statistically significant and also conduct further analysis to confirm that the

price of A was not affected by factors other than manipulation in the "during period." By contrast, if the range of the prediction errors remains constant or even shrinks in the "during period," then one can conclude that economic evidence does not suggest manipulation.

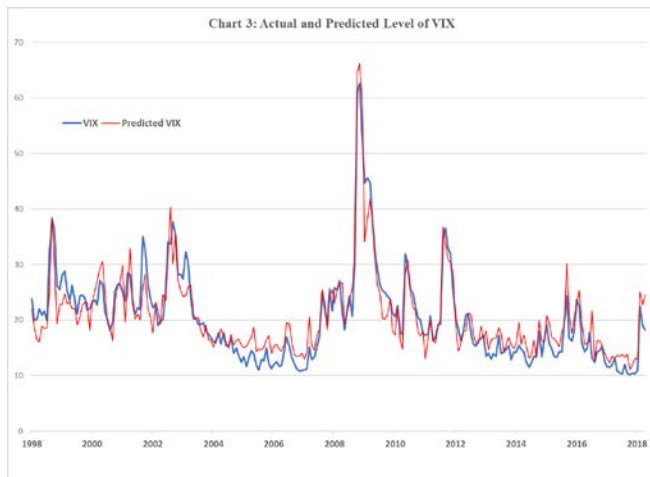


Application of the Benchmark Approach to VIX

As discussed earlier, the market's volatility in the recent past is an excellent predictor of the VIX. Therefore, as the benchmark for the VIX on any given day, we have used the *preceding* 20-day's volatility of the S&P 500's daily return. Because the benchmark's data are from the preceding 20-days, that day's level of VIX cannot influence the benchmark (barring time travel, the present cannot affect the past).

We then estimated the relationship between the benchmark and the daily closing levels of the VIX index for the period 1998-2007, which is the "pre-period." The estimated relationship was then used to predict the VIX index for the two periods, 1998-2007 and 2008-present. The actual and the predicted levels of VIX are shown in Chart 3 below. It is evident from the chart that the actual and the predicted VIX are extremely close to each other, demonstrating the efficacy of the chosen benchmark.

Finally, we compared the prediction errors, which are the difference between the actual and predicted VIX, in the "pre-period" (1998-2007) to those in the "during period," 2008 to the present. If the VIX were manipulated since 2008, then the divergence between the actual and predicted levels (i.e., the prediction errors) would be significantly higher in the post-2008 period. We found, however, that the average prediction errors⁸ were, in fact, *lower* since 2008 relative to those in the prior ten-years.



We also tested whether the difference in the average levels of the prediction errors in the two periods was statistically significant; rigorous statistical tests showed that it was not.

Concluding Comments

A full-fledged rigorous analysis of the VIX manipulation claims is beyond the scope of this newsletter. DSP leaders are working on a peer-reviewed journal article on this issue. That article undertakes a thorough and detailed analysis of the various facets and issues of the VIX manipulation claim.

Referenced DSP Research:

["Detecting Price Artificiality and Manipulation in Futures Markets: An Application to Amaranth"](#)

¹ John M. Griffin and Amin Shams, "Manipulation in the VIX?" SSRN Electronic Journal, May 2017.

² Jeffery Tomasulo v. CBOE et al, Illinois Northern District Court, 2018.

³ Siegel v. CBOE et al Complaint, Illinois Northern District Court, 2018.

⁴ Christopher R. Cole, "Volatility and the Alchemy of Risk", Artemis Capital Management, October 2017.

⁵ The VIX estimates expected volatility by using the weighted average prices of S&P 500 Index put and call options.

⁶ Edward R. Murrow (1908-1965), a radio and TV journalist.

⁷ Atanu Saha, Hans-Jürgen Petersen, "Detecting Price Artificiality and Manipulation in Futures Markets: An Application to Amaranth," Journal of Derivatives & Hedge Funds, May 2012.

⁸ We use average absolute value of the errors so that the positive and negative errors do not cancel out in the calculation of the average.

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