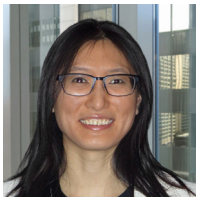
Examining The Evidence On VIX Manipulation

by Ran Wei, Edi Grgeta, Ging Cee Ng and Brendan Perry; Analysis Group, Inc.

Law360, Chicago (May 15, 2019, 4:50 PM EDT)


Ran Wei


Edi Grgeta


Ging Cee Ng


Brendan Perry

An ongoing multidistrict litigation alleges manipulation of the formula used to determine the settlement price for derivatives based on the Chicago Board Options Exchange's volatility index, known as the VIX. The litigation followed on an academic paper[1] suggesting that the value of derivatives based on the VIX could be manipulated on their settlement days through trades in underlying S&P 500 options.

In the VIX MDL, the court is examining the question of whether unnamed John Does illegally influenced the inputs to the formula Cboe uses to calculate the Special Opening Quotation, or SOQ, price on the third Wednesday of each month. The SOQ — which is often referred to by its ticker symbol, VRO — provides the settlement price for the VIX derivatives expiring on that date.

A key question in the MDL may be whether the plaintiffs can establish that the trading activity alleged to have "moved" the settlement price on the date in question was artificial, as opposed to reflecting an economically sensible trading or hedging strategy. In considering this question, the court may be able to take guidance from a different manipulation case, U.S. Commodity Futures Trading Commission v. Donald R. Wilson and DRW Investments LLC.[2]

The DRW decision turned on the question of whether the plaintiffs provided any evidence that the bid prices or the settlement prices were artificial, rather than the result

of the defendant's "superior knowledge." In ruling in favor of the defendants, Judge Richard Sullivan of the Southern District of New York wrote that it "is not illegal to be smarter than your counterparties in a swap transaction."

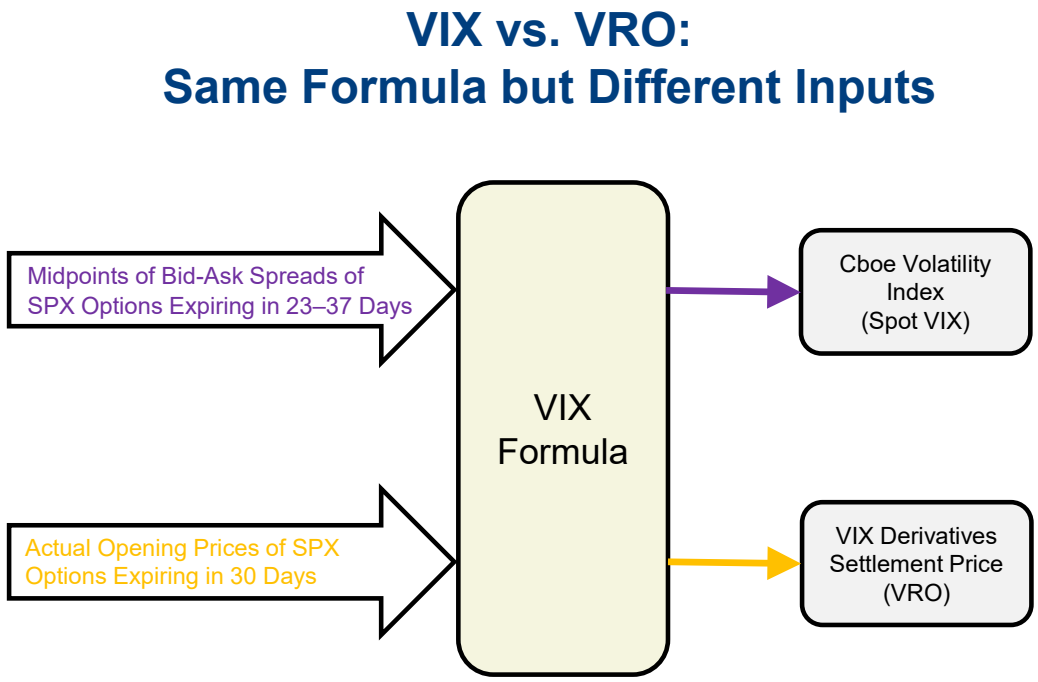
To provide context for the debate over the alleged manipulation of the VIX, this article presents an overview of the VIX derivatives settlement process and formula, and then offers a hypothetical example, using data from an actual VIX settlement auction, to illustrate the effects of trading activity on the settlement price.

The VIX Settlement Process

The VIX, familiarly known as the "fear index," measures the 30-day implied volatility of the S&P 500 Index, or SPX, based on SPX options trading. The spot (or intraday) VIX is calculated and reported throughout the day by a formula devised by Cboe, which uses qualifying SPX options as inputs.

The VIX is a statistic used to track volatility or uncertainty in the market. Although the VIX itself is not tradable, Cboe also offers tradable derivatives in the form of VIX futures and VIX options.

While these VIX-linked derivatives offer pure volatility exposure, at expiration their settlement price is determined by out-of-the-money[3] SPX options, in a manner similar but not identical to that of the intraday VIX. The similarity comes from the fact that Cboe uses the same formula to calculate VRO settlement prices as it does to calculate values for the spot VIX. However, the two calculations have different inputs to the formula, such as different SPX options underlying each calculation and the different pricing statistics used for the VIX versus the VRO. (See chart below.)



In addition, the VRO is calculated at a specified point in time (typically, 8:30 a.m. on the third Wednesday of every month), whereas the spot VIX is calculated continuously throughout the day. As determined by the set of rules published by Cboe, the out-of-the-money SPX options used as inputs in calculating the VRO once a month are different from the out-of-the-money SPX options used to continuously calculate the spot VIX.

Another departure is that the VRO is based on the opening trading prices of the SPX options comprising the derivatives, while the spot VIX uses the midpoints of bid and ask quotations of its own underlying assets. Importantly, these differences mean that, on any given settlement day, the VRO settlement price is almost certain to be different from the spot VIX value preceding or following it, even though the same formula is used to calculate the values for the VRO and the VIX.

The Math of Manipulation

Those who allege manipulation of the VIX settlement price see these differing values as evidence that bad actors are "banging the close" — that is, influencing the pricing of the underlying SPX options by making large trades during the period in which the settlement price is determined. They have suggested two main techniques for strategically placing SPX options orders during the preopening auction period on settlement mornings.

One technique involves manipulating which SPX options get included in the settlement price calculations. Cboe's rules for assembling the qualifying SPX options include cutoffs that delimit which out-of-the-money options are included. If two consecutive strike prices fail to attract any bids, then any SPX options with strike prices above (for call options) or below (for put options) those strike price cutoffs are excluded from the calculation of the VRO settlement price, as are all other options that fail to attract any bids.

To take advantage of this rule — or so the argument goes — a "bad actor" theoretically could make economically insensible bids that fall between the two consecutive "zero-bid" points, and so can change the cutoffs. If practicable, this strategy could provide some degree of control over which strike prices are included in the calculation of the VRO settlement price.

A second technique could involve manipulating the opening trade price of underlying SPX options by placing economically insensible orders on either the demand or supply side to tamper with the market clearing process. Placing arbitrary buy orders on an SPX option could increase its perceived demand, and so increase the opening trade price, whereas placing arbitrary ask orders could signal increased supply and therefore decrease the opening trade price.

To see how either of these techniques might affect the VRO, we obtained actual settlement data from Jan. 16, 2019, and changed relevant inputs. The January 2019 settlement consisted of 287 SPX options series, ranging from an 1100 put option to a 3100 call

option.[4] The application of Cboe's rules excluded options that fell outside of those two cutoffs, resulting in an actual January 2019 VRO of 18.87.

In our first analysis, we added back in six put options that had strike prices ranging from 1000 to 500 (i.e., lower than the lower bound cutoff). This allowed us to test the impact of trading (whether manipulation or legitimate) that increased the range of put options included in the calculation of the VRO. By including the six excluded put options, we estimated that the resulting VRO would have increased by 0.40 to 19.27.

To further test the impact of trading, we assumed that the Jan. 16 settlement included some SPX put options that would have been excluded but for manipulation, and then looked at what would happen if different sets of put options were taken out of the VRO calculation. For example, in this hypothetical scenario we found that excluding 20 of the furthest OTM put options would lower the settlement price to 18.35.

In short, we found that changing selected inputs could either raise the settlement price (by expanding the range of underlying SPX options) or lower it (by restricting the range of included options).

Next, we analyzed how changing the opening trade price of one of the cutoffs can alter the VRO. We picked the 1100 put option and changed its opening price from $0.15 (as it was during the Jan. 16 settlement) to be either lower or higher. The resulting calculations showed that any $0.05 change in the selected option's opening trading price in either direction would change the VRO by up to almost 0.03 points in the same direction.

These differences in the calculation of the VRO settlement price, which could result from changes to bids for constituent SPX options and the resulting changes in opening trade prices, could be perceived to have an impact on market participants holding expiring VIX derivatives. For every $0.01 change to the VRO in the desired direction, traders could hypothetically earn an additional $1 per VIX option contract, and an additional $10 per VIX futures contract.[5]

A Bad Actor, or a Smart Trader?

However, it is not immediately obvious that these techniques can be easily applied in real-world practice to "bang the close." First, high trading volume makes it more difficult and costly to implement these manipulation techniques reliably. In our example, data from the Options Clearing Corporation, or OCC, indicate that the total trading volume was large, with 2,080,222 trades in SPX options on Jan. 16, 2019. Large volumes like these may make it less feasible for any single "bad actor" to significantly influence the VRO settlement price.

Second, there could be a legitimate economic explanation for why trading volume in the underlying SPX options is large. Those with holdings in expiring VIX derivatives will want to hedge by purchasing the underlying SPX options in precise weights that mimic the VRO. This would naturally lead to high trading volume on far OTM options.

Finally, put options are often utilized as part of a hedging strategy for disaster protection, to shield a trader from the risk of an unexpected market crash in the future.

Historically, the stock market tends to be negatively correlated with its volatility, so that when the market goes down, volatility goes up, and vice versa.

As it turns out, the January settlement day we used in our example occurred in the midst of the longest government shutdown ever recorded in U.S. history. Consequently, it seems reasonable that high trading volumes on put options — which could have influenced the VRO settlement price — may simply have reflected traders' uncertainty over a potential market collapse.

Thus, we see that reasons other than manipulation may explain trading activity on any particular day. When examining trading activity, then, it is critically important to have a nuanced understanding not only of the actions that may influence the settlement price, but also of the motives behind those actions.

Ran Wei and Edi Grgeta are vice presidents, Ging Cee Ng is an associate, and Brendan Perry is an analyst at Analysis Group Inc.

Endnotes

1 Griffin, J., and Shams, A. "Manipulation in the VIX?", The Review of Financial Studies 31.4 (2017): pp. 1377-1417.

2 Analysis Group was retained by counsel for the defendant in the DRW matter to analyze the conditions under which the bids in question could be considered a legitimate trading strategy or manipulation.

3 An out-of-the-money, or OTM, option is either a call option with a strike price that is higher than the market price of the underlying asset, or a put option with a strike price that is lower than the market price. There is a larger gap between strike prices and the market price for far OTM options, and a smaller gap for near OTM options.

4 For reference, the S&P 500 was 2610.30 on Jan. 15, 2019, and 2616.10 on Jan. 16, 2019.

5 The contract multiplier in the VIX formula is 100 for VIX options and 1000 for VIX futures. Thus, a 0.01 change in the VRO yields a 0.01 x 100 = $1 change in cash settlement value for a VIX option, whereas the same 0.01 change yields a 0.01 x 1000 = $10 change in the cash settlement value for a VIX futures contract.