SPIKES vs VIX: a comparison study

Anna Dubinova[1], Xiaotian Zheng[1], Svetlana Borovkova[1,2]

Introduction

A new volatility index - SPIKES has been launched last year on Miami International Securities Exchange, LLC ("MIAX Options"). SPIKES is a disruptor in the market that inherited a lot of features from the famous VIX volatility index, but a few new tweaks have been added.

VIX, widely known as a 'fear gauge', traces back to the seminal work by Brenner and Galai (1989). Since 1993, VIX has been disseminated by CBOE, although its methodology changed in 2003. The popularity of the volatility index was intensified during and after the financial crisis of 2007-2009.

VIX index is a measure of the expected annualized volatility of US stock market over the next month. It can be also interpreted as the price of the variance swap (quoted in volatility units), which can be statically replicated with vanilla puts and calls.

SPIKES by design is very similar to VIX, including the derivatives that are traded on them. Last year, a white paper by Peter Carr concluded that the differences between the two indices are negligible on average, and short-term differences are due to dividends in the underlying stock indices. In this white paper, we delve deeper into this issue and find that there is more to the differences between VIX and SPIKES than just dividends. We summarize the main differences between the indices and show examples of their divergence.

Differences between SPIKES and VIX

Both SPIKES and VIX measure the expected 30-day volatility of the US stock market. Specifically, VIX is an estimate of the implied volatility of the S&P 500 (GSPC) index, whereas SPIKES measures the implied volatility of SPDR (SPY) – a famous and extremely liquid "Spyder" ETF's designed to track the S&P 500 index. Since both indices have essentially the

---

[1]School of Business and Economics, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands

[2] Probability & Partners, Amsterdam, The Netherlands

same origin, the differences between them are expected to be limited and stem primarily from the nuances of their construction.

Update frequency

While VIX is updated four times per minute, SPIKES is updated every 100 milliseconds. Besides, the option weights used in SPIKES are re-calculated in order of seconds, but for VIX they are updated every minute. It is therefore natural to assume that SPIKES reacts more quickly to sudden changes in the equity market.

Options used for the estimation

The indices are calculated using bid and ask quotes for the options on the underlying indices. VIX is based on SPX options, which are European style, while SPIKES is based on the SPY options having American-style features, which leads to SPIKES having a slightly higher average historic level because of extra premium embedded into American-style options (the so-called early exercise premium). As noted by Carr, the average bias is also due to the SPDR paying quarterly dividends, while SPX options do not take dividends into account.

A portion of SPIKES and VIX differences can be explained by SPIKES using monthly SPY options, while VIX uses weekly SPX options (usually 4th and 5th weeklies). Not being able to switch from monthly to weekly options can lead to extrapolation issues in the calculation of SPIKES. Sometimes this can result in a significantly lower SPIKES value relative to VIX. This, for example, happened on January 16th, 2020, see Figure 1.
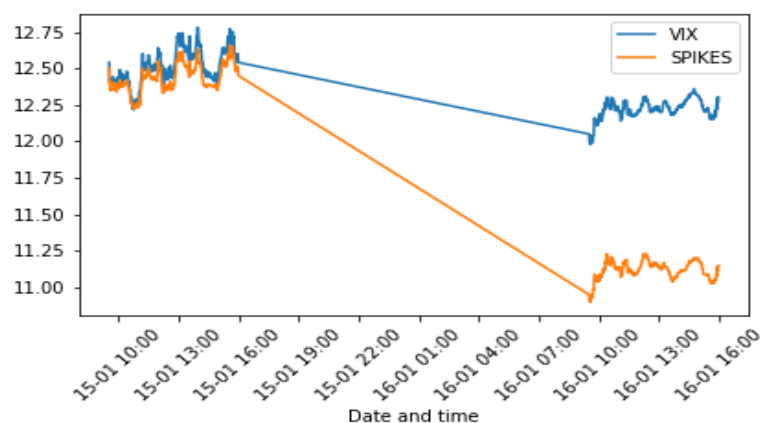

Figure 1: SPIKES and VIX per minute chart for January 15-16, 2020. On January 16, 2020 SPIKES dropped while VIX remained more stable

The possibility of using weekly SPY options for SPIKES is open but due to poorer liquidity of the 4th and 5th SPY weeklies and a smaller strike range of weekly options, it was so far decided not to use them – something that might change in the future.

Robustness of the indices

The designs of both SPIKES and VIX include techniques to stabilize the indices. This becomes relevant in times of uncertainty when market makers widen their bid and ask quotes. The

average of the bid and ask quotes can be considered as the 'fair' option value. In some cases, while the mid-quote fairly does reflect the option quotes at that time, it does not fully reflect the expected 30-day volatility.

In the VIX filtering algorithm, options previously included into VIX estimation can be excluded if they have a zero-bid price. Furthermore, there is a mechanism to restrict the drop in the VIX value to the maximum of 0.49 volatility points per two minutes. However, there is no filtering applied to restrict the sudden upward spike of VIX, while this is exactly the situation that would arise at times of stress.

For SPIKES, a proprietary 'price dragging' technique is designed to improve the robustness of the index. Essentially, it gives preference to actual trade prices, which are seen as the true 'fair values'. This technique is very powerful and can greatly stabilize the index. For example, on January 14th, 2020, when the equity index suddenly dropped, VIX spiked while SPIKES remained stable (see Figure 2). When the option quotes widened, offers retreated more aggressively, causing mid-price to inflate artificially and so causing VIX to spike for several minutes. SPIKES prioritizes the most recent trades, hence it is less vulnerable to outages when either bid or offer price is missing. The last traded price takes precedence until the highest bid (respectively lowest offer) crosses it from below (respectively above).
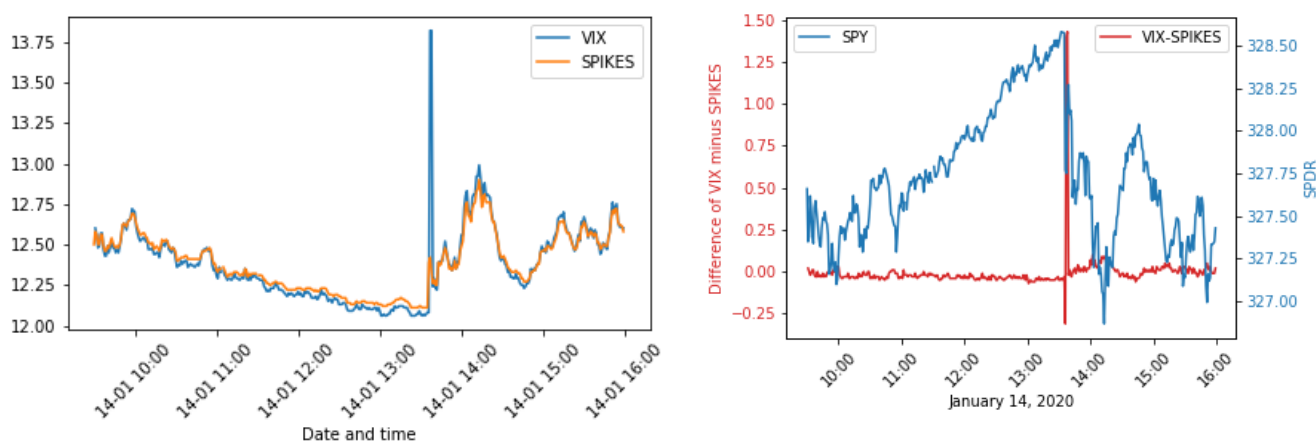

Figure 2: SPIKES and VIX per minute chart for January 14th, 2020. At about 13.30 p.m. ET, VIX spiked while SPIKES remained stable.

Average characteristics and futures

If we compare average statistics of VIX and SPIKES on daily and minute horizons (see Table 1), we see that indeed the differences are not large. On average, SPIKES has a slightly higher level than VIX, but as we seen above, there are times when VIX can be higher than SPIKES. The volatility of (per minute) SPIKES is, however, lower than that of VIX, signaling the effectiveness of the price dragging incorporated in SPIKES.

	Minute VIX	Minute SPIKE	Daily VIX	Daily SPIKE
MEAN	14.05	14.17	15.69	15.93
STD	0.51	0.44	3.65	3.66
MIN	13.14	13.45	10.85	11.45
MAX	15.62	15.81	36.07	35.82
SKEWNESS	0.31	0.60	1.64	1.55
KURTOSIS	3.37	3.95	7.71	7.19

Table 1: VIX and SPIKE descriptive statistics. Minute data: 2020-01-03 to 2020-01-07. Daily data: 2018-04-26 to 2020-01-07.

Both VIX and SPIKES can be used for diversification or as a protection against market decline (for example, using 1X2 call spreads), as these volatility indices are negatively correlated with their underlying stock indices (S&P500 for VIX and SPY for SPIKES). Furthermore, SPIKES volatility futures (just like VIX futures) allow to take long or short volatility positions according to your beliefs about or forecasts of future volatility. The SPIKES futures are available for the nearest six consecutive months (recall that, for VIX futures, the following expirations are available: six near-term expiration weeks, nine near-term serial months and, after that, five months on the quarterly cycle).

An example of SPIKES (synthetic) futures term structure is shown in Figure 3. The irregularities in the futures term structure are presumably due to the liquidity issues.
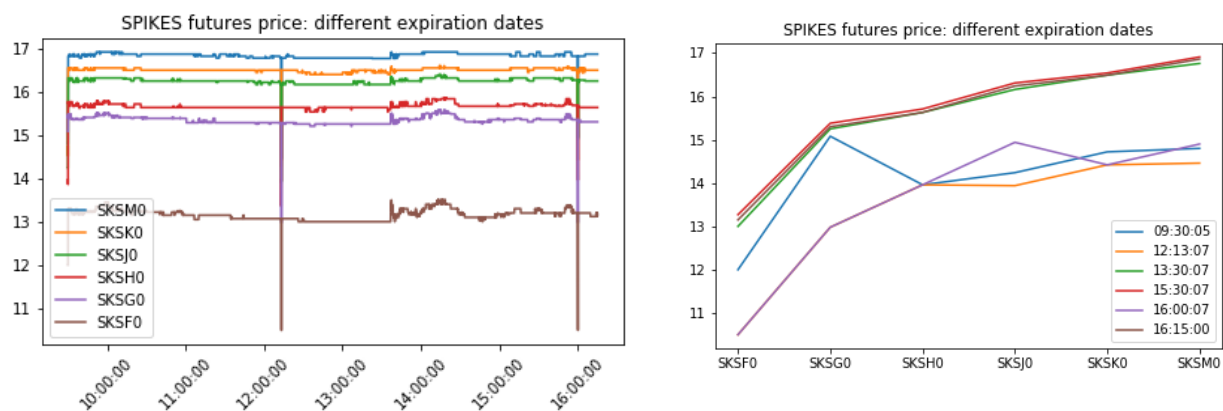

Figure 3: Example of SPIKES futures term structure, Jan 14, 2020.

Advantages of SPIKES

While VIX is a well-established volatility index, SPIKES can be considered as a disruptor in the volatility market offering innovation and cost savings. Besides a better robustness of the index and its being disseminated 150 times more frequently than VIX, SPIKES options are priced tighter and (i.e., 1 cent wide option prices), whereas VIX has a tick size of 5 cents wide. Moreover, SPIKES futures cost is a fraction of VIX futures. The overall features of the SPIKES derivatives are designed to be similar to those of VIX, perhaps to target the same market participants that trade in VIX-related strategies.

Conclusion

Since SPIKES and VIX aim at measuring essentially the same market volatility, the indices are overall similar, as noted previously. However, we find that, on an intraday scale, the indices can differ significantly, due "price dragging", especially when the market is in a sudden distress. There are clear advantages of SPIKES, such as a higher frequency of updates, a stabilizing feature embedded into its design, greater liquidity of the underlying options and lower costs.

References

[1] M. Brenner and D. Galai, "New financial instruments for hedge changes in volatility," *Financial Analysts Journal*, vol. 45, no. 4, pp. 61–65, 1989.
[2] MIAX OPTIONS, "Spikes volatility index options."

Anna Dubinova   Dr Svetlana Borovkova
Xiaotian Zheng