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Editor's Letter

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Volatility is back! Or is it? My last Editor's Letter was written at the beginning of February 2018, just after the stock market had experienced a mini-crash, with the Dow setting an intraday record drop of over 1,100 points, that led to a 2-day fall of 1,840 Dow points, or -6.1% on the more representative S&P 500 index. At the time it seemed appropriate to wonder if this marked the end of the long period of unusually low volatility that had been a puzzle for years given the high uncertainty about the economy overall. On February 5, 2018, the Chicago Board Options Exchange (CBOE) Volatility Index (VIX) went from 17.31 the day before to close at 37.32. Then, in after-hours trading, it rose into the high 40s, as VIX-based funds were desperately trying to rebalance their portfolios. Whether or not this was a volatility regime-shift, it certainly was a game-changer for the strategy of selling volatility. Market volatility had become so persistently low, and each month seemed to take the VIX to an ever lower low, that the trade of going short on the VIX, through futures, VIX options, and VIX-based exchange-traded funds (ETFs) and exchange-traded notes (ETNs) with negative exposure to the VIX, was being touted as almost a no-brainer. Internet ads proliferated: "This 18-year-old high school senior made over \$3 million with a simple trade that anyone can do!" Experienced investors understood the danger in this trade, but risk worries are often overcome by apparently easy profits. But the VIX is different from other financial variables, which creates a special danger not shared by derivatives tied to physical assets. While it is not conceivable that a stock index like the Dow or a major exchange rate or the price of an important commodity like oil could double overnight, the VIX is not tied to anything tangible. It measures the willingness of investors to buy or sell options, and if sellers simply back away from the market, the VIX can soar.

The XIV issued by Credit Suisse was one of the "inverse" VIX ETNs, designed to mimic a short position in the VIX. Around noon on Friday, February 1, the XIV was priced at about \$119. By 4 p.m. on Tuesday, February 6, it had fallen to \$7.35. This extreme price drop triggered a liquidation clause that specified that the ETN would be terminated if its value fell below 20. The "closing indicative value" for the shareholders on Tuesday was \$5.32. The moral, of course, is that it is dangerous to sell short something that has a long right tail, like deep out-of-the-money puts, or the VIX index when it is at 10%. The trade may make money 95% of the time and still be a fatal mistake.

So, with three months hindsight, was February 5 a volatility regime-shift? It is still too early to tell. So far, however, the market has behaved since then much as it has in the past. If a big negative return shock occurs, market volatility and the VIX shoot up immediately. And then the effect gradually dissipates, with maybe a couple of hiccups along the way. This seems to be the progression since February. There have been seven two-week periods since the beginning of February, and the average VIX values in those periods have been 24.9, 19.1, 16.8, 21.3, 19.7, 16.3, and 14.7. What now? Well, the U.S. has just pulled out of the Iran nuclear deal, trade disputes with most of our major trading partners seem to be heating up, and the domestic situation in the U.S. seems more unsettled than ever. Naturally, the stock market's response has been to go up sharply on reduced volatility. So maybe we are still in a low-volatility-that-no-one-can-explain regime.



While we continue trying to establish our current location on the financial GPS, let us turn to this issue of *The Journal of Derivatives*. We begin with a look at the behavior of stock index volatility indexes around the world. The VIX in the U.S. has spawned a remarkable number of new derivatives and trading vehicles, all based on implied volatility from index options. The volatility index technology has also spread to non-equity markets like commodities and currencies. Velez, Payne, Tresl, and Toledo, find first that the standard result in U.S. markets of volatilities going up when stock prices fall is in fact universal. It is seen in every market. But they also find different dynamics following positive and negative return shocks, along with other interesting results. The second article is also about the response of implied volatility to economic factors, but the focus is on how the shape of an individual stock's volatility smile responds to positive or negative news about the macroeconomy. The overall tone of a news article, positive or negative, is determined by textual analysis of the words it contains. Uhl finds that "sentiment" matters. Its effects differ in interesting ways for positive and negative news, and

across moneyness and option type. For example, out-of-the-money puts are particularly sensitive to good news, which makes their implied volatilities go down sharply. Our third article, by Feng, Pu, and Zhang, also looks at variations in the slope of the volatility smile. What they are exploring is the effect of heterogeneous expectations among investors. The process of information aggregation in an options market has not been studied in much detail, partly because it is hard to measure expectations at all, much less to reliably discern differing expectations within the investor population. Here the authors use the dispersion of earnings forecasts in the IBES database to proxy for the spread of beliefs among option traders. They find that holding other factors constant, more heterogeneous earnings forecasts are associated with sharper smiles. Demand for out-of-the-money options, both calls and puts, is increased by wider differences of opinion.

In the next article, Kim, Stoyanov, Rachev, and Fabozzi, take a fresh look at the Ho-Lee bond option model. This was the first "arbitrage-free" model for bond options. Rather than specifying a data-generating process for the short rate, which led to an implied term structure of longer rates, Ho and Lee built a kind of binomial lattice, in which the nodes were not bond prices but yield curves. The model starts with the current term structure and models how it could change over a single period, with strong constraints to limit the next period term structure to just two possible curves. The resulting pricing structure is consistent with current yields in the market and does not allow any current or future profitable arbitrage trades within the model. The problem is that the basic lattice allows rates to go negative in some conditions, or to explode toward infinity in others. The authors show how to eliminate the problem by modifying the model to allow time-varying probabilities. Next is an article by Wu and Liu that takes a look at the methodology for calculating the VIX and similar indexes using a broad range of traded option prices. The problem with the calculation is that the available strike prices for all but the most liquid markets can be quite truncated, which induces a bias in the estimated volatility. They offer a clever way to adjust for the bias using a pricing model for corridor variance swaps.

Our last article is a review and extension of a classic early paper on options and market completeness by Steve Ross. Ross died unexpectedly last year, and many tributes and memorials have been offered. This paper is also due to appear in a special issue of *The Journal of Portfolio Management* featuring articles related to Ross's work. Ross's 1976 article presents a very simple model that shows how a set of put options with strike prices covering the possible future prices of an underlying stock can be the equivalent of a full set of Arrow–Debreu state claims in terms of completing the market. Martin reviews Ross's work and then shows how it can be extended to multiple stocks while still creating options on only a single linear combination of the underlying stock prices.

At this time of year, graduation is in the air. I am seeing increasing numbers of young people in the streets dressed in long robes and funny hats (which are bright purple in the case of New York University). We congratulate all graduates, and especially their parents, on their major accomplishment, and wish them all the best for the future.

Stephen Figlewski
Editor