VOL. 8, NO. 12 • DECEMBER 2013

DALLASFED

Economic Letter

Volatility-Selling Strategies Carry Potential Systemic Cost

by Jiaqi Chen and Michael Tindall

Investors have increasingly turned to stock market volatility-selling strategies based on the idea of selling implied volatility and buying it back later when it falls to a level more consistent with realized volatility.

Price volatility in financial markets has been around as long as the markets themselves. And financial innovation in recent decades has created opportunities for volatility itself to be bought and sold. Various volatility-selling strategies have produced high returns on paper.

History provides a warning, however. Volatility trading was among the strategies that the Long-Term Capital Management (LTCM) hedge fund engaged in before its spectacular collapse in 1998. One book examining the firm's decline noted that, of the trades bringing down LTCM, one of the "killer blows" was "equity index volatility trades at $1.314 billion"—that is, large-scale bets on swings in the value of a basket of stocks.[1]

The "volatility gap" is an important component of volatility selling. A volatility gap is the difference between the implied, or estimated, volatility of a security or index and its actual, or realized, volatility at a specified time. Implied volatility for stock market indexes is frequently greater than realized volatility, creating positive volatility gaps. Over time, investors have increasingly turned to stock market volatility-selling strategies based on the idea of selling implied volatility and buying it back later when it falls to a level more consistent with realized volatility.[2]

These strategies, as with many others, offer possibilities and potential pitfalls. A seemingly profitable volatility gap frequently exists in the U.S. stock market. Moreover, there is empirical evidence of increased volatility speculation. But potential systemic risks can arise from volatility selling. The breakdown of one or a few important market agents could lead to marketwide failures.

Volatility Index Gap

The CBOE Volatility Index, the VIX—a weighted blend of volatilities for a range of options tied to the Standard & Poor's 500 Index and traded on the Chicago Board Options Exchange (CBOE)—is an often-used measure of implied stock market volatility. The implied price volatility of an asset is one of the determinants of the price of an option on that asset. The implied volatility of the underlying asset can be computed with the well-known Black–Scholes formula, which is frequently used to calculate the intrinsic value of an option. Other things being equal, the greater the implied volatility, the higher the price of a call or put option—the right to buy or sell at a given price on or by a specified date.

Realized volatility may be calculated as the annualized standard deviation of S&P 500 Index daily returns—the range of the S&P's daily moves around the index's average daily return—over the last 21 trading days (the average number of trading days in a month). The VIX gap is defined as the difference between the value of VIX and

realized volatility (*Chart 1*). The gap averages 4.33 percent and has a positive value 89.74 percent of the time, meaning that realized volatility usually turns out to be less than what the VIX implies.

Frequent positive gaps in the chart suggest recurring trading opportunities for selling implied volatility. Indeed, research firm Cambridge Associates reports that "there are underlying reasons to believe the returns realized by a volatility-selling strategy are repeatable, and that such strategies may therefore deserve a place in investor portfolios." BlackRock Inc., the world's largest asset manager, has adopted various strategies for selling volatility.[3]

VIX Futures' Heightened Popularity

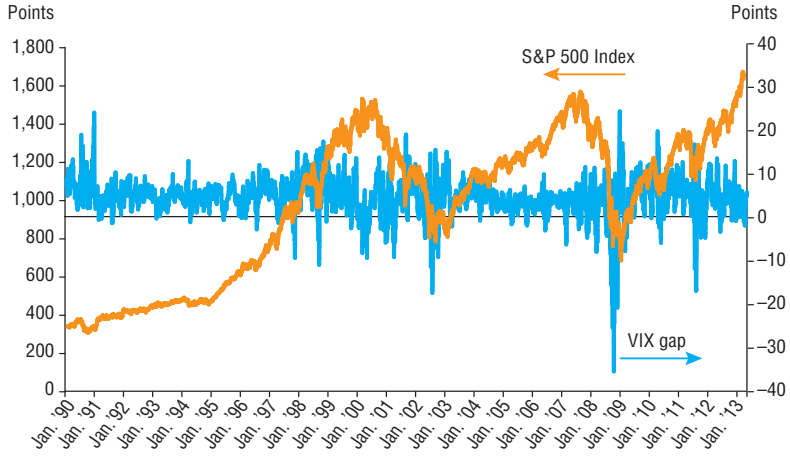
Volatility-selling strategies can be executed using either VIX futures contracts or options. VIX futures contracts on the CBOE are used in a variety of volatility-selling strategies.[4] The open interest—the number of outstanding contracts for VIX futures for all expirations—increased greatly from 2004 to 2013 (*Chart 2*). This may have been driven by increased trader appetite for volatility selling.

Many volatility-selling strategies call for exiting the trade when the VIX gap is negative for some time—that is, when the VIX is likely to understate realized volatility. During the August–October 2011 period, when the U.S. experienced a downgrade of its sovereign debt and the European debt crisis intensified, the VIX gap turned negative.[5] To the extent that volatility sellers were using VIX futures and were an important share of VIX futures trading, one would expect open interest to decline—and, indeed, open interest almost halved over this period.

Volatility-Selling Performance

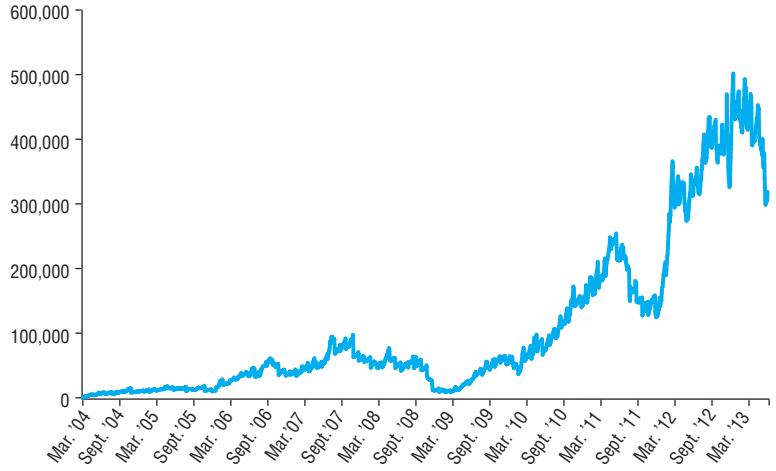
Various strategies are used for stock market volatility selling, aside from those employing VIX futures contracts. One of them involves a "straddle"—a trader selling an S&P 500 Index call option and put option with the same strike price and expiration. There is no bet on the direction of the stock index; as long as the S&P 500 Index does not go up or down too much, the straddle will be profitable. The value of the straddle diminishes as the two option contracts approach expiration. The trader, who earlier sold the options, anticipates buying them back at cheaper prices later or holding them to expiration.

Chart 1 S&P 500 and VIX Trailing Gap



SOURCES: Haver Analytics; authors' calculations.

Chart 2 VIX Futures Open Interest Declines as Gap Turns Negative



SOURCE: Chicago Board Options Exchange.

A Federal Reserve Bank of Atlanta study examined this strategy for 1990–95 and showed it produced an annualized return of 38.5 percent and a standard deviation of return of 23.9 percent.[6] That compares with a return of 12.9 percent and a standard deviation of 10.9 percent for the S&P 500 Index over the same period. Performance can be measured as the ratio of return to standard deviation, called "efficiency." In this case, the efficiency for the volatility-selling strategy is 1.61, which compares favorably with 1.18 for the S&P.

The study details some of the risks of volatility selling. Large changes in stock prices—high realized volatility—will make volatility selling unprofitable. To provide some recent perspective on volatility, Table 1 shows the S&P 500's 10 largest one-day percent changes from 2003 to present.

While fairly large one-day changes were not uncommon over these more recent years, one-day price moves never exceeded 12 percent. Traders with short memories might find strategies that would be profitable, as long as volatility stays within the range suggested by Table 1. But a longer perspective reveals that volatility could be much higher. Table 2 shows the

Table 1 Largest One-Day Percent Changes in S&P 500 Index Since 2003

Rank	Date	Close	Net change (in points)	Percent change
1	Oct. 13, 2008	1,003.35	104.13	11.58
2	Oct. 28, 2008	940.51	91.59	10.79
3	Oct. 15, 2008	907.84	–90.17	–9.03
4	Dec. 1, 2008	816.21	–80.03	–8.93
5	Sept. 29, 2008	1,106.39	–106.62	–8.79
6	Oct. 9, 2008	909.92	–75.02	–7.62
7	March 23, 2009	822.92	54.38	7.08
8	Nov. 13, 2008	911.29	58.99	6.92
9	Nov. 20, 2008	752.44	–54.14	–6.71
10	Aug. 8, 2011	1,119.46	–79.92	–6.66

SOURCES: Haver Analytics; authors' calculations.

Table 2 Largest One-Day Percent Changes in S&P 500 Index Since 1928

Rank	Date	Close	Net change (in points)	Percent change
1	Oct. 19, 1987	224.84	–57.86	–20.47
2	March 15, 1933	6.81	0.97	16.61
3	Oct. 28, 1929	22.74	–3.38	–12.94
4	Oct. 30, 1929	22.99	2.56	12.53
5	Oct. 6, 1931	9.91	1.09	12.36
6	Sept. 5, 1939	12.64	1.34	11.86
7	Sept. 21, 1932	8.52	.90	11.81
8	Oct. 13, 2008	1,003.35	104.13	11.58
9	Oct. 28, 2008	940.51	91.59	10.79
10	June 22, 1931	14.61	1.39	10.51

SOURCES: Haver Analytics; authors' calculations.

index's 10 largest one-day changes over its reported history, with daily data going back to Jan. 2, 1928.

A large one-day stock market change could be devastating to a volatility seller. Consider the effect of a 10 percent, one-day change (up or down) in stock prices. Assuming that the trader followed CBOE trading rules, under option pricing mathematics, a 10 percent one-day stock market change can generate a loss to the volatility seller of more than 40 percent. Under the same assumptions, a 20 percent one-day change can generate a loss exceeding 100 percent.

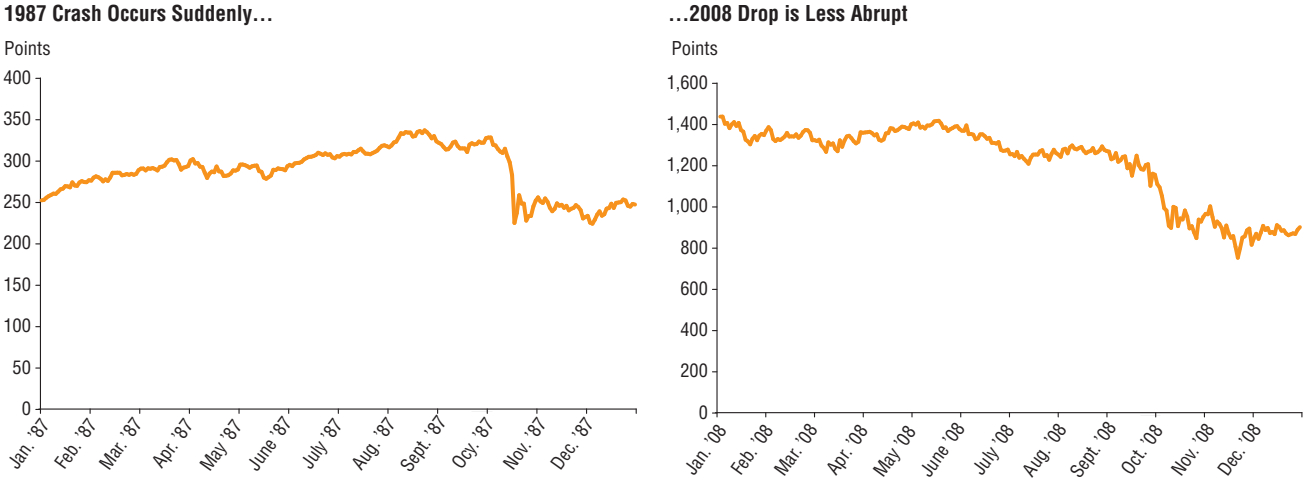
Some may argue that traders could detect the approach of a large stock price change and exit the volatility-selling strategy beforehand. Some strategies contain circuit breakers intended to do this.

The stock market's 1987 crash took place with little warning, moving much more quickly than the 2008 downturn. The 1987 drop is reflected in the S&P 500 (*Chart 3*). It might be impossible to devise effective circuit breakers. With many traders trying simultaneously to exit a tumbling market, liquidity could dry up—stock sellers far exceeding the number of buyers—leading to the possibility of a systemic event.

Could volatility selling bring the financial system to the brink of a systemic event? No one can say for sure. In the LTCM collapse, the hedge fund was battered by equity-index volatility trades in international markets. The Federal Reserve stepped in to encourage private

A 10 percent one-day stock market change can generate a loss to the volatility seller of more than 40 percent. Under the same assumptions, a 20 percent one-day change can generate a loss exceeding 100 percent.

Chart 3 S&P 500 Index's Downward Movements in 1987 and 2008 Illustrate Differing Patterns



SOURCE: Standard & Poor's.

funding for LTCM so that it could be liquidated in orderly fashion, avoiding contagion with its many trading counterparties and lenders.[7]

LTCM is not the only example of a large investment operation getting in serious trouble with volatility-selling trades. In 1995, trader Nick Leeson at the former Barings Bank generated huge losses traced to volatility trading on Japan's Nikkei as that stock index suddenly plunged in response to the Kobe earthquake.[8] U.K. authorities were able to contain systemic effects of Barings' collapse, arranging its sale to Dutch bank ING Groep NV.

Although selling volatility may seem like a simple, profitable idea, it carries risks that could potentially spread throughout the financial system. Given the growing popularity of this strategy, further investigation may be warranted to examine systemic issues arising from volatility selling.

Chen is a financial industry analyst and Tindall an alternative investments specialist in the Financial Industry Studies Department at the Federal Reserve Bank of Dallas.

Notes

[1] *Inventing Money: The Story of Long-Term Capital Management and the Legends Behind It*, by Nicholas Dunbar, New York: John Wiley and Sons, 2000.

[2] *Expected Returns: An Investor's Guide to Harvesting Market Rewards*, by Antti Ilmanen, New York: John Wiley & Sons, 2011, and "Short Volatility Strategies: Identification, Measurement, and Risk Management," by Mark Anson and Ho Ho, *Journal of Investment Management*, vol. 1, no. 2, 2003, pp. 30–43.

[3] See "Highlights from the Benefits of Selling Volatility," Cambridge Associates LLC, 2011, www.cboe.com/micro/buywrite/Cambridge-2011-HighlightsfromSellingVolatility.pdf, and "BlackRock: Volatility Is an Asset," by Steven M. Sears, *Barron's*, July 6, 2013.

[4] *Trading VIX Derivatives*, by Russell Rhoads, New York: John Wiley and Sons Ltd., 2011.

[5] Open interest also declined about 80 percent from early November to late December 2008 in reaction to a negative VIX gap.

[6] "The Risks and Rewards of Selling Volatility," by Saikat Nandi and Daniel Waggoner, Federal Reserve Bank of Atlanta *Economic Review*, First Quarter, 2001.

[7] *When Genius Failed: The Rise and Fall of Long-Term Capital Management*, by Roger Lowenstein, New York: Random House, 2001. Lowenstein writes, "But more than any other, 'equity vol' was Long-Term's signature trade, and it set the fund ineluctably on the road to disaster."

[8] *Value at Risk: The New Benchmark for Managing Financial Risk*, Philippe Jorion, New York: McGraw-Hill, 2000.

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Federal Reserve Bank of Dallas
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