

INTELLECTUAL AMMUNITION

Inside the VIX Engine of Destruction

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Here's how contagion from volatility derivatives transmits to the equity markets.

On Tuesday we argued that this week's global stock market spasm was "without a cause" – in the sense that it is not a proportionate reaction to any new fundamental development, but rather an inevitable random correction after too long without one, aggravated by algo-driven strategies (see "[Crash Without a Cause?](#)" February 6, 2018). [Opinion seems to be coalescing](#) around something like that, with [much of the focus](#) on derivatives on volatility. We've heard lots of theories that fit the facts. *But we have seen no explanation for how contagion leapt from bets on the volatility of equities to the equities themselves. Here is our theory about that, which fits the facts, and may even be true – or at least part of the truth.*

- *We offer the theory that the answer lies in a way market insiders use broad equity markets to hedge excess exposures arising from narrow volatility-related products. Our conjecture is that their methods, when under stress, have the same self-reinforcing positive-feedback loop properties of "portfolio insurance," the "dynamic hedging" strategy that wrought similar chaos in the Crash of 1987.*

Securitized products that enable direct betting on volatility include [futures](#), [options](#), [exchange-traded funds](#) (ETFs) and [exchange-traded notes](#) (ETNs) on the [CBOE's VIX Volatility Index](#) on the S&P 500 (and other similar volatility benchmarks).

- As we pointed out Tuesday, markets were spooked by the possibility of a 2008-type systemic event in this sector.
- *These volatility products themselves have undergone a great deal of stress over the last week, and anyone using them to bet against volatility has taken large losses. But these are relatively small niche markets, which we don't believe are systemically important in the way CDOs and SIVs were in 2008.*
- Each has acceptably robust failure-modes – including, for ETNs, which are counterparty obligations of an issuing bank – call provisions that limit losses at known and acceptable levels.

Update to strategic view

US STOCKS: Volatility derivatives are being cited as a technical explanation for the equity market spasm otherwise "without a cause." We think this small market presents no systemic risk in and of itself. But we offer a theory for how it does set up runaway trading dynamics that transmit contagion from bets on the volatility of stock indices into the stock indices themselves. We theorize that the hedging strategies of volatility dealers – who until now faced a lopsided market in which most participants wanted to be short volatility – have all the same positive-feedback loops as "portfolio insurance." So do "target-volatility" and "risk parity" strategies. All are subject to predatory "bag runs" by front-runners, who deliberately make matters worse. There is no natural end-point, so we expect further oscillations, damping down over the coming days. We see this cause-free scare a test of the revival of animal spirits and risk tolerance.

[\[Strategy dashboard\]](#)

The issue is not that a systemically important issuing bank might be imperiled. The more important problem may be how dealers in these volatility derivatives markets use equity derivatives markets to hedge.

- Dealers have had to adapt to the fact that over the last several years volatility has been strangely low compared to long-term norms, especially over the last year. This has led to an asymmetric demand by investors to bet against volatility, and that in turn has led to the need for dealers to hedge their exposure that arises from supplying derivatives that meet that demand.
- Consider the case of the VelocityShares Daily Inverse VIX Short Term ETN (XIV), issued by Credit Suisse. Coming into the crisis, it was the largest exchange-traded VIX product with assets of about \$1.8 billion. Its mandate was to deliver to shareholders, on a daily basis, a return equal to the inverse of the return of the VIX index, as represented by the two forwardmost VIX futures contracts. For example, if VIX declined from 10 to 9 on a given day, a 10% negative return, the ETN would return about 10%, the exact amount depending on the reaction of the VIX futures. If VIX goes up by 10%, the ETN would return a loss of about 10%. In order to deliver these returns, the underwriter hedges with a portfolio of various instruments designed to increase in value when VIX goes down, and decrease in value when VIX goes up.
- On Monday, February 5, VIX climbed from 17.31 at the previous close to 37.32, more than doubling. The weighted return of the futures contracts used to calculate the return for the XIV ETN was 114.7% – a more-than-total loss that would have more than erased the entire value of the inverse ETN. This leaves Credit Suisse on the hook, because for every \$100 in notes, its hedge portfolio generates \$114.70 in losses – as much as \$280 million that day.
- Credit Suisse had the right to call the notes when the loss hit 80%, and it did so the next morning – but on Monday most of the surge in VIX happened in the final hour, so it's highly unlikely that it was able to get away without losses. We don't see how it's possible, but the bank claims it "experienced no trading losses."
- Inexplicably, XIV traded around \$100 per share in the final hour on Monday, and closed at \$99 – even though it was demonstrably worthless. This remains a mystery.
- When the derivatives markets re-opened several hours later for the night-session – which proved to be even more volatile – XIV opened for trading at about \$6. We think Credit Suisse and other dealers were scrambling to limit their losses.
- We think this was the point at which the crisis was transmitted from the small volatility markets into the larger equity markets. We think that Credit Suisse and others, likely the entire dealer community – for that matter, as well as investment managers overseeing various short-volatility strategies – used equity derivatives as proxies for volatility derivatives, and found themselves in a scramble to limit their losses in those markets.
- The challenge for dealers in volatility derivatives is that, unlike a dealer in crude oil futures, there is no physical market that can be used for hedging. In order to hold a long WTI futures contract, a

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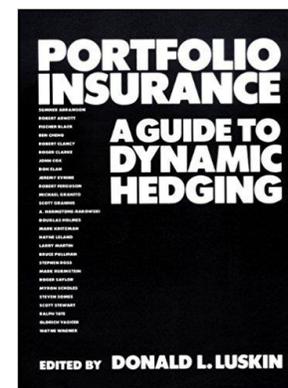
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Recommended Reading



[Portfolio Insurance: A Guide to Dynamic Hedging](#)

Donald L. Luskin, editor

Robert Arnott, Fischer Black, John Cox, Hayne Leland, Stephen Ross, Mark Rubinstein, Myron Scholes and others

Wiley & Sons
1987

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dealer can just sell 1,000 barrels of physical oil. But to hold a long VIX futures contract, a dealer can't just sell some volatility, because volatility isn't a thing. So he has to create a proxy – something that will decline in value when volatility does, to offset the losses in his futures contract.

- The thing that best fits the bill is a short position in S&P 500 options (because, all else equal, options decline in value when volatility declines – indeed, the VIX index is calculated based on the volatility implied by options prices). At-the-money options are the best, because they have the greatest sensitivity to volatility. That sensitivity is called *vega* (although that's not really a Greek letter).
- Such a position is an imperfect and risky hedge, because it's not a pure bet on volatility, but also exposes the dealer to risk in the S&P 500 index itself. If the dealer sells a put, he bears losses if the S&P 500 declines, and if he sells a call, he bears losses if the S&P 500 rises. His best bet, then, is to sell both – that is to say, he will sell a “straddle” – so that the gain in one will offset the loss in the other, because the put has a negative sensitivity to changes in the S&P 500 – that is, a negative *delta* – and the call a positive *delta*, giving the position a net *delta* of zero.
- But that's imperfect, too. The *vega* of the straddle decays over time as it gets closer to expiration. So the position constantly has to be tweaked over time to maintain the correct hedge.
- In normal times this, while complicated and high-maintenance, would just be a cost of doing business. We conjecture that large positions like this may have built up during the good times for the volatility derivatives business, when hedges were necessary to accommodate a market imbalance in which more customers wanted to bet against volatility than for it.
- Problems arise when the dealer needs to adjust his options position in response to moves in the S&P 500. For small moves, the dealer can sit tight because the short put and the short call will offset each other. But when the move is large enough, whichever option has gone in-the-money will start generating losses faster than the one that went out-of-the-money will generate offsetting gains. At that point the hedge would need to be adjusted.
- That change in the net delta of the position – its gamma – generates losses for the dealer. If the index falls, to restore the net delta to zero, he must cover some short puts at a loss; if it rises, he must cover some short calls at a loss.
- And in thin and volatile markets, every attempt to cover just moves the options deeper into loss – because the dealer will be buying puts in a falling market and calls in a rising market – and with every trade, the net delta further away from zero, necessitating even more trading, and more losses.
- At the same time, because the options are both away from at-the-money, they have both lost some of their *vega*. That, too, must constantly be adjusted by even more trading, adding new short options with more *vega*, which makes the position larger and more complex.
- When the market is in stress, many volatility dealers will likely all be doing this at the same time, which in turn puts stress on

the S&P 500 options dealers. They, in turn, would find themselves having to hedge in S&P 500 futures markets, or physical stocks – doing just what the portfolio insurance investors did in 1987: selling stocks when the market is falling in a self-reinforcing positive-feedback loop.

- This would complete the circuit and enable contagion to pass from the volatility market to the equity market.
- It cuts both ways. Every down-move in the index would set off a self-reinforcing cascade of index futures or physical stock selling, or put buying that would transmit into futures and stock selling. And then any up-move would set off a self-reinforcing cascade of futures or stock buying, or call buying which transmits into futures and stock buying.
- By the way, it would be no relief to the dealer that, while all this is going on, his customer who had shorted volatility in the first place is suffering terrible losses. That doesn't make the dealer a winner. It would have, had he not hedged his position – but he did hedge it, and the problem for him is that in these conditions the hedge is generating losses faster than gains are generated from the position that had to be hedged in the first place. In this game, everyone in the volatility bet is a loser.
- So where does it end? In the case of portfolio insurance in the Crash of 1987, the aim was to produce a “synthetic put” on the S&P 500 by continuously shorting index futures, as the market fell, in an increasing amount designed to emulate the increasing *delta* of the put to be synthesized. Once the self-reinforcing cascade of sell orders had finally produced a large enough short position in futures to completely hedge the underlying equity position – that is, the “synthetic put” had reached its maximum *delta* of 100 – then the operation was complete and trading could stop.
- In this case there is no analogous natural end-point. The exposure to VIX created by the dealers' initial long futures positions lasts for the life of the futures contracts, or until all the unstable – and, by now, enormously complex – positions in short puts and calls can be unwound in an orderly matter. In markets like these, nothing is orderly.
- There's one additional pernicious element at work here. While we have seen no public discussion of the dynamics we have just outlined, it is well known in the dealer and market-maker communities. They are able to anticipate price levels at which these mechanistic strategies will predictably take losses by covering shorts – which is to say they know where the stop-loss limit orders are. In this volatile environment, front-running moves markets to where the stop-loss orders are triggered, at which point the front-run positions are unwound at a nearly riskless trading profit. It's an old scam. When we traded on the CBOE in the 1980s, it was called a “bag run.”
- With the natural ongoing instability of these options positions, their self-reinforcing dynamics, and incentives by front-runners to keep the volatility alive, this is likely to go on for a while. Even if all these positions have been closed out already, the experience has left markets thin and jittery. So we would expect a series of continuing

wild oscillations, exhibiting a damping pattern as the next several days play out.

Even assuming we've captured an important truth here, that's not all that's going on, and not the only element with the same self-reinforcing crazy-making dynamic. There are also other ways the panic of the last several days can be understood as a portfolio insurance-like algo-driven pathological reaction to an unexpected run-up in volatility, coming at a time when the crowd was betting against it.

- “Target volatility” strategies, such as “risk parity,” formulaically reduce holdings of assets for no reason other than that they have become more volatile, in order to rebalance the portfolio to its target. Because volatility in equity markets seems to be inversely correlated to direction – that is, volatility tends to go up when stocks go down – these strategies, too, operate just like portfolio insurance in exaggerating downside moves.
- And even without an algo, most equity investors bet against volatility all the time without even realizing it. For many, an equity investment is subject to a tacit upper limit on volatility, above which they will panic and sell. The prolonged recent history of low volatility has likely lowered that limit for many investors, and when volatility suddenly re-emerged, they sold – and once again, like portfolio insurance – it only made matters worse.

It will be an interesting test of sentiment to see how soon and how robustly markets heal from these self-inflicted wounds. We continue to believe strongly that this correction is not a rational discounting of negative developments in the real economy. The often-heard explanation – before volatility derivatives started taking the blame – was that stock markets feared [higher yields](#), [higher inflation](#) and [a tighter Fed](#). We think every part of that is wrong (see [“It’s Just the Reflation Trade, People!”](#) February 5, 2018).

If we’re right, then this will be a pure test of our proposition that [animal spirits](#) and risk-tolerance have reawakened in the global economy (see, among any, [“2017: It’s Bigger than The Donald”](#) December 30, 2016). If they have, then this cause-free scare will just make investors feel silly for having been frightened by nothing – and we’ll be back to new highs much more rapidly than anyone now dares to expect.

- We’re optimistic about it. Stress in the volatility derivatives markets spread to the US equity market, and other world equity markets reacted, but there is little sign on stress anywhere else. For example, we note that the US investment grade corporate spread made a new cycle tight in the midst of the beginning of the crash on Friday, and is only 1 bp wider now, even after all the seeming risk in equity markets.

Bottom line

Volatility derivatives are being cited as a technical explanation for the equity market spasm otherwise “without a cause.” We think this small market presents no systemic risk in and of itself. But we offer a theory for how it does set up runaway trading dynamics that transmit contagion from bets on the volatility of stock indices into the stock indices themselves. We theorize that the hedging strategies of volatility dealers – who until now faced a lopsided market in which most participants wanted to be short volatility – have all the same positive-feedback loops as “portfolio insurance.” So do “target-volatility” and “risk parity” strategies. All are subject to predatory “bag runs” by front-runners, who deliberately make matters worse. There is no natural end-point, so we expect further oscillations, damping down over the coming days. We see this cause-free scare as a test of the revival of animal spirits and risk tolerance. ▶

This report includes new information and analysis added February 25, 2018.