

Creating Long VIX Exposure in the Current Market Regime

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Fault Lines for a Market Crisis

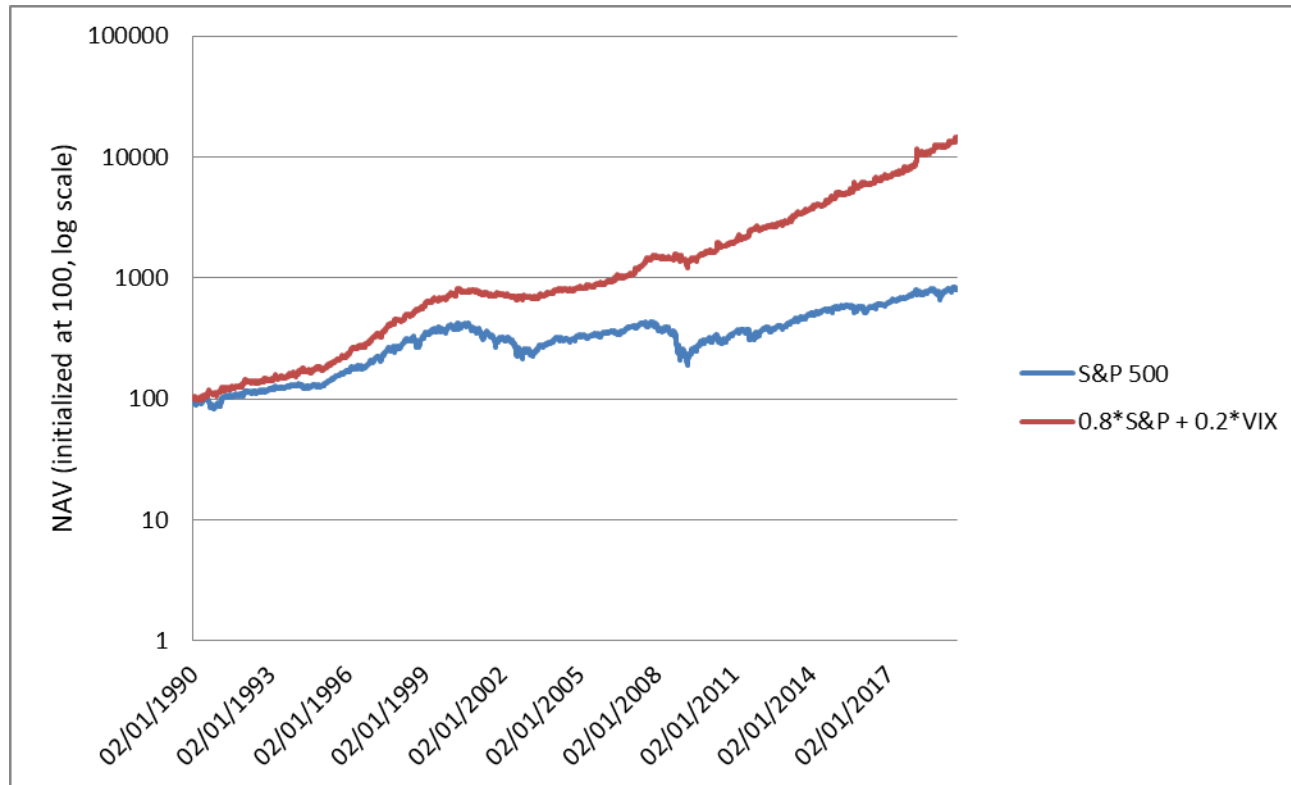
What to do after a crisis hits.



Identifying pre-conditions for a crisis.

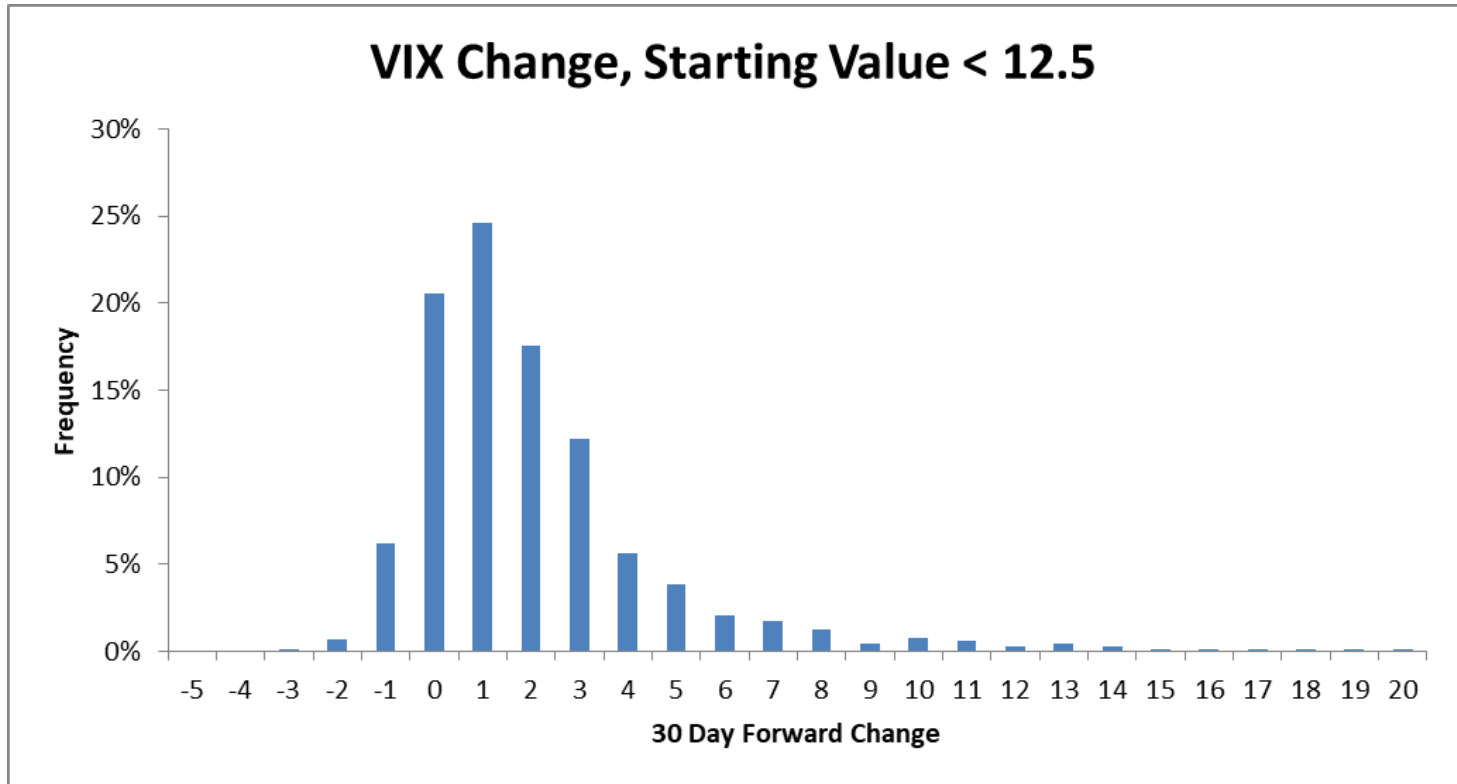


Impact of the Spot VIX on an Equity Portfolio



Data: Yahoo! Finance

The Spot VIX as a Value Play



data: Yahoo! Finance

Spot VIX Inaccessible to the Buy Side

5% monthly
contango can
eat into
returns like no
other!



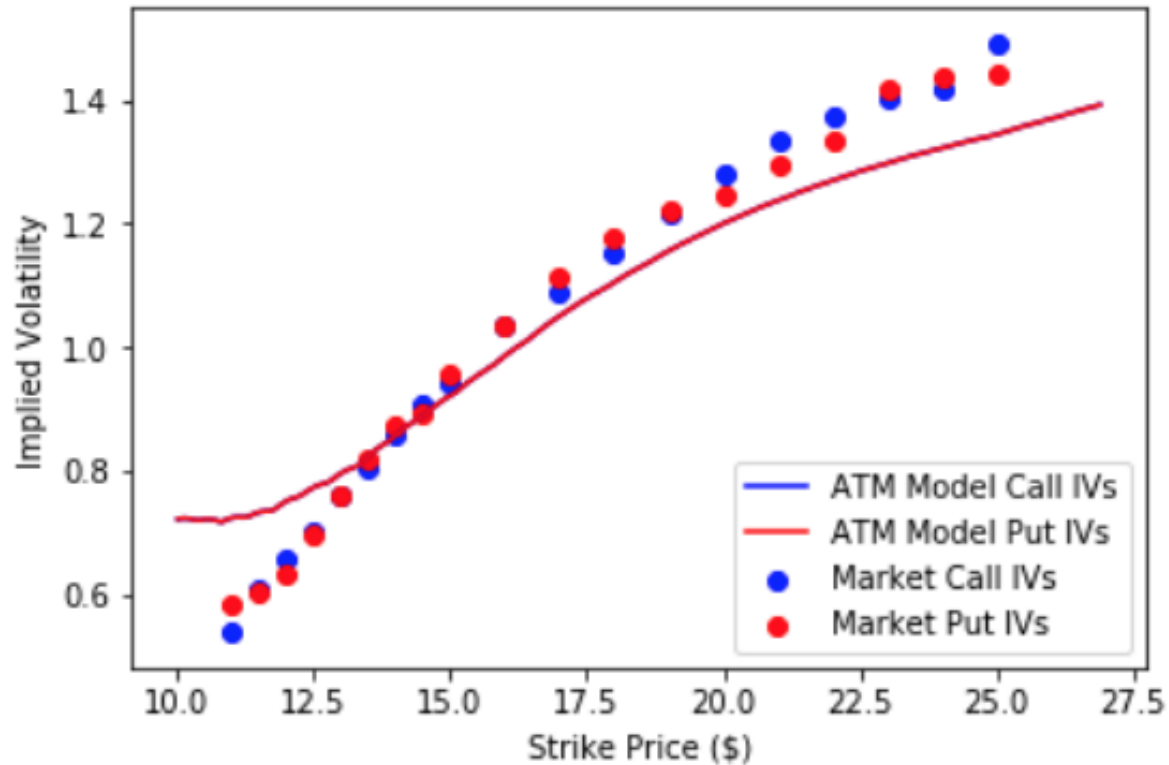
How Close Can We Get?

rolling
VIX
futures
strategy



spot VIX

Long Term Fair Value Calculations, VIX Low

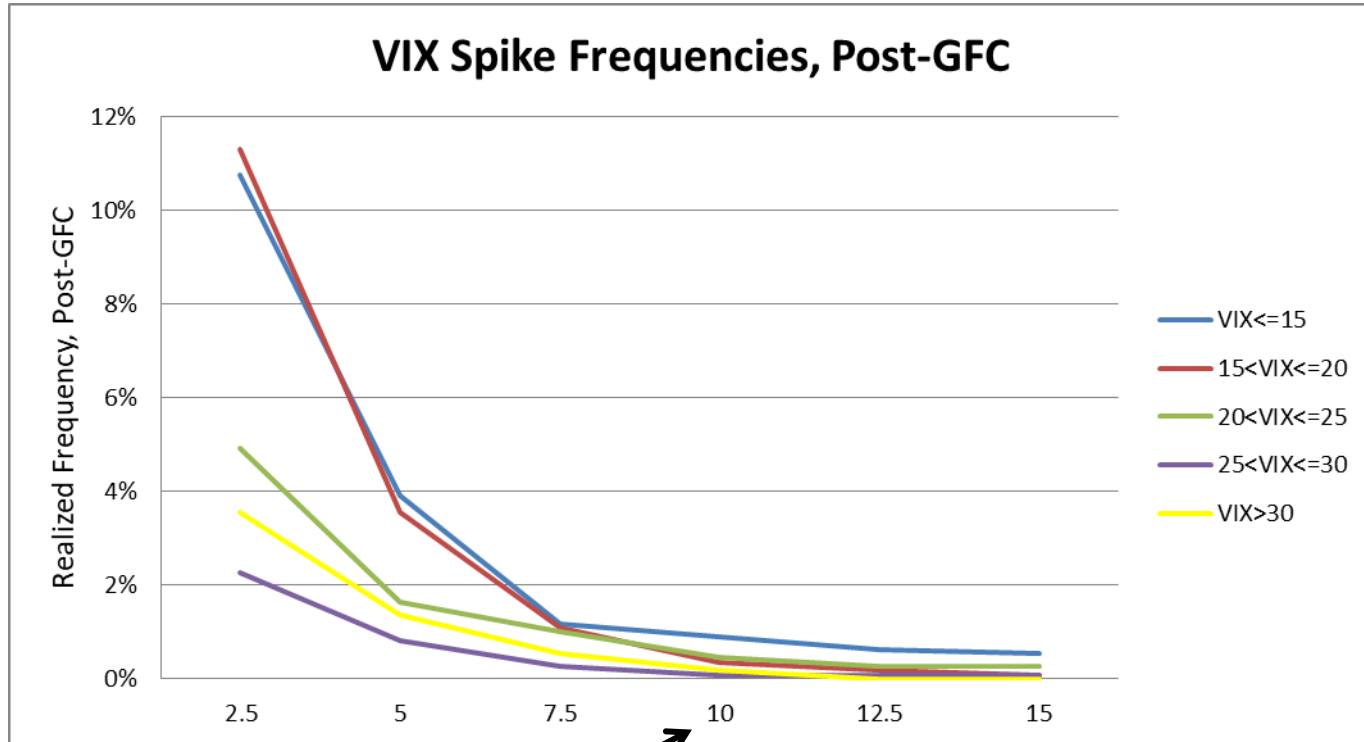


data: Bloomberg

Methodology

- Research with S. Sturm (WPI), applying Derman and Zou's method to VIX options
- Implied distribution generated for the VIX
- Expectation matches relevant futures contract, ATM option prices also match
- Then, use smoothing ("entropy") techniques to find a distribution that is close to the historical one but makes as few other assumptions as possible
- Price options using distribution: puts structurally cheap, calls rich

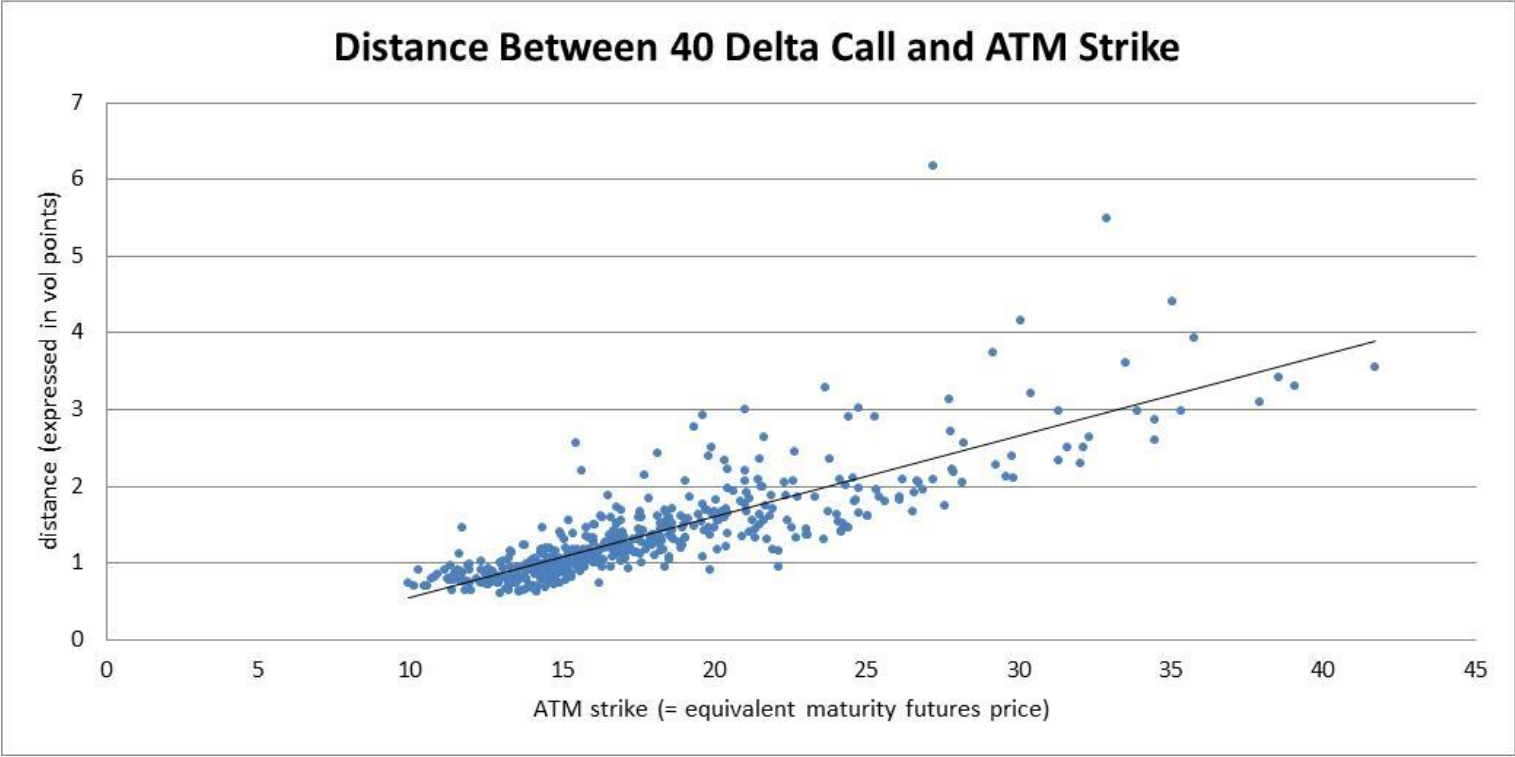
Increasing Probability of Spikes From Low Levels



5 day forward jump size

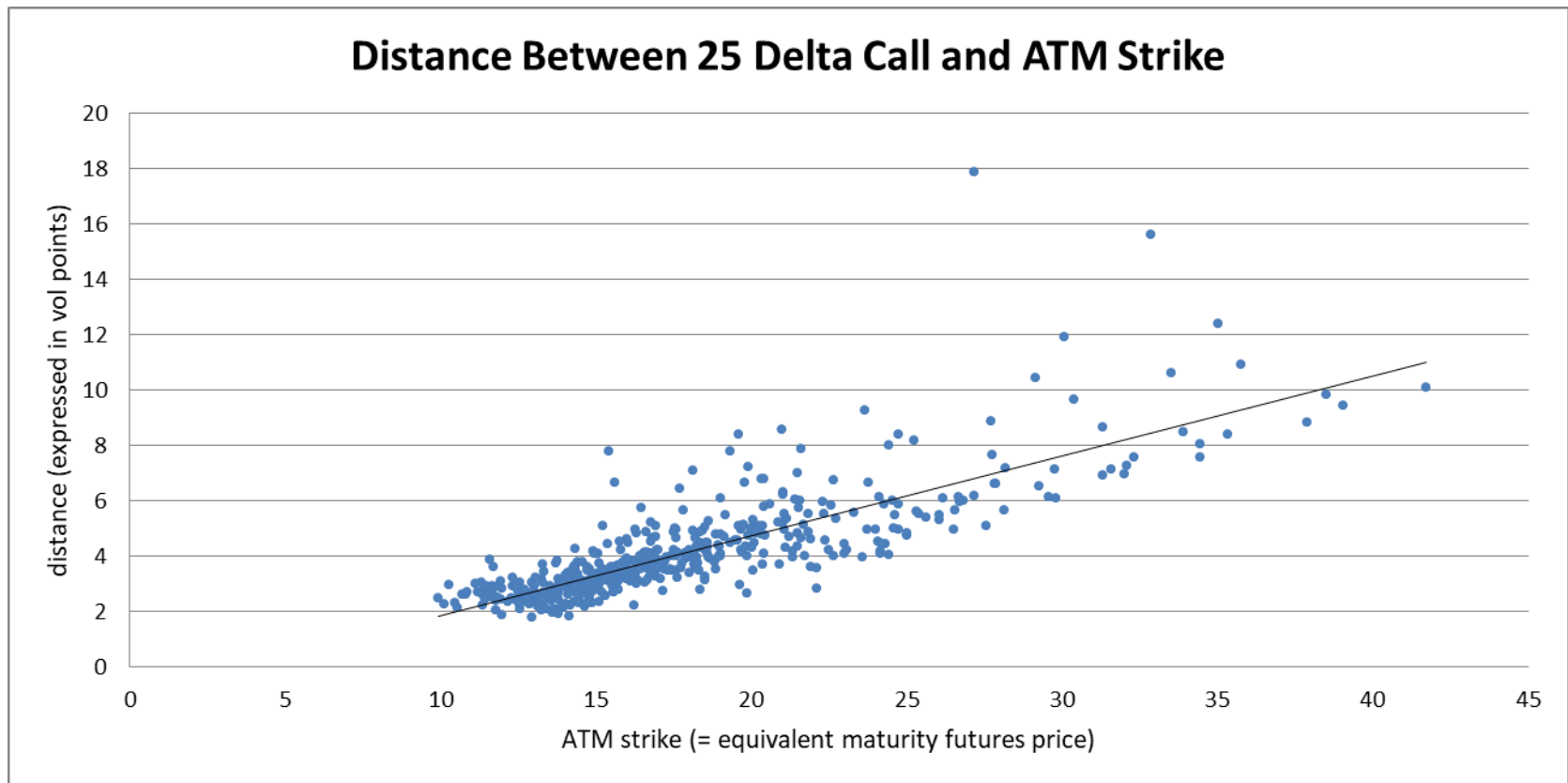
data: Yahoo! Finance

40 Delta Strike as a Function of VIX Futures Level



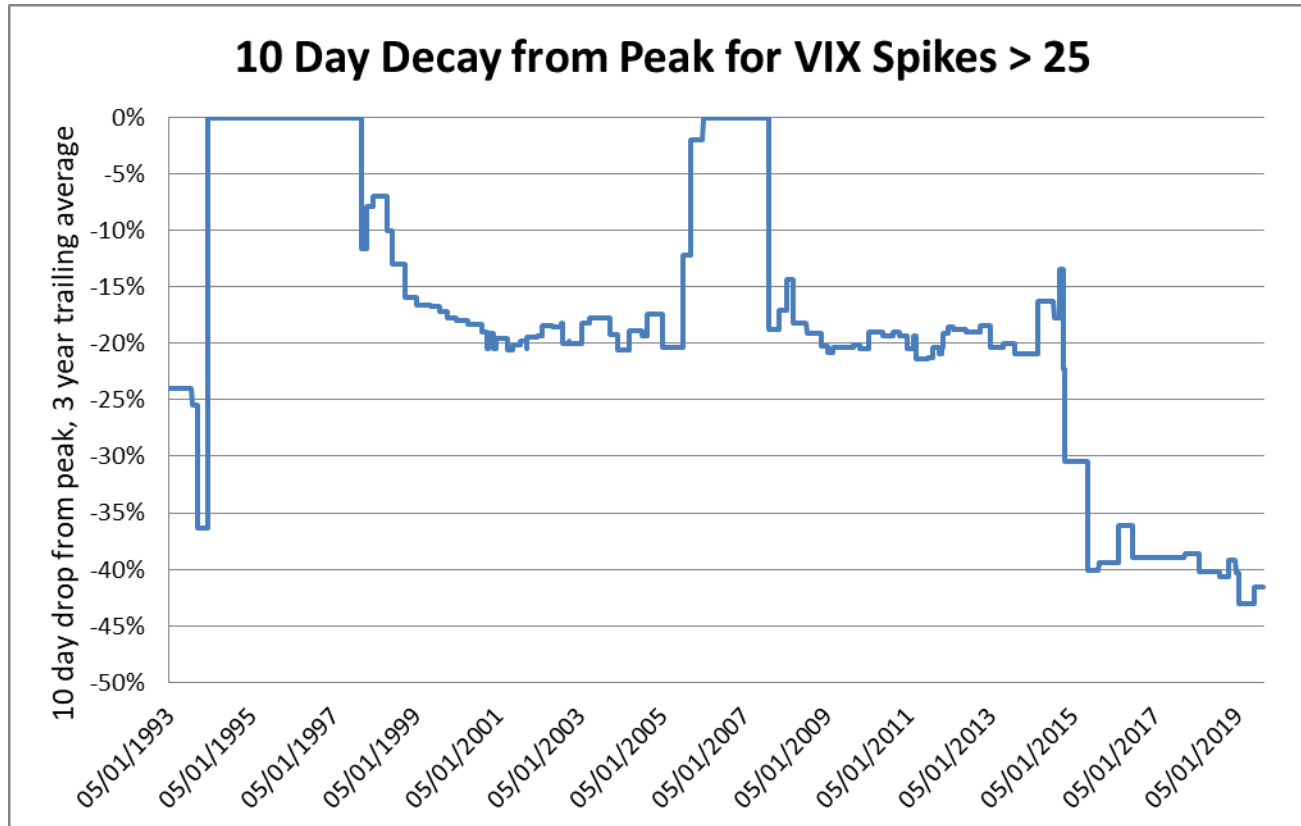
data: Bloomberg

25 Delta Strike as a Function of VIX Futures Level



data: Bloomberg

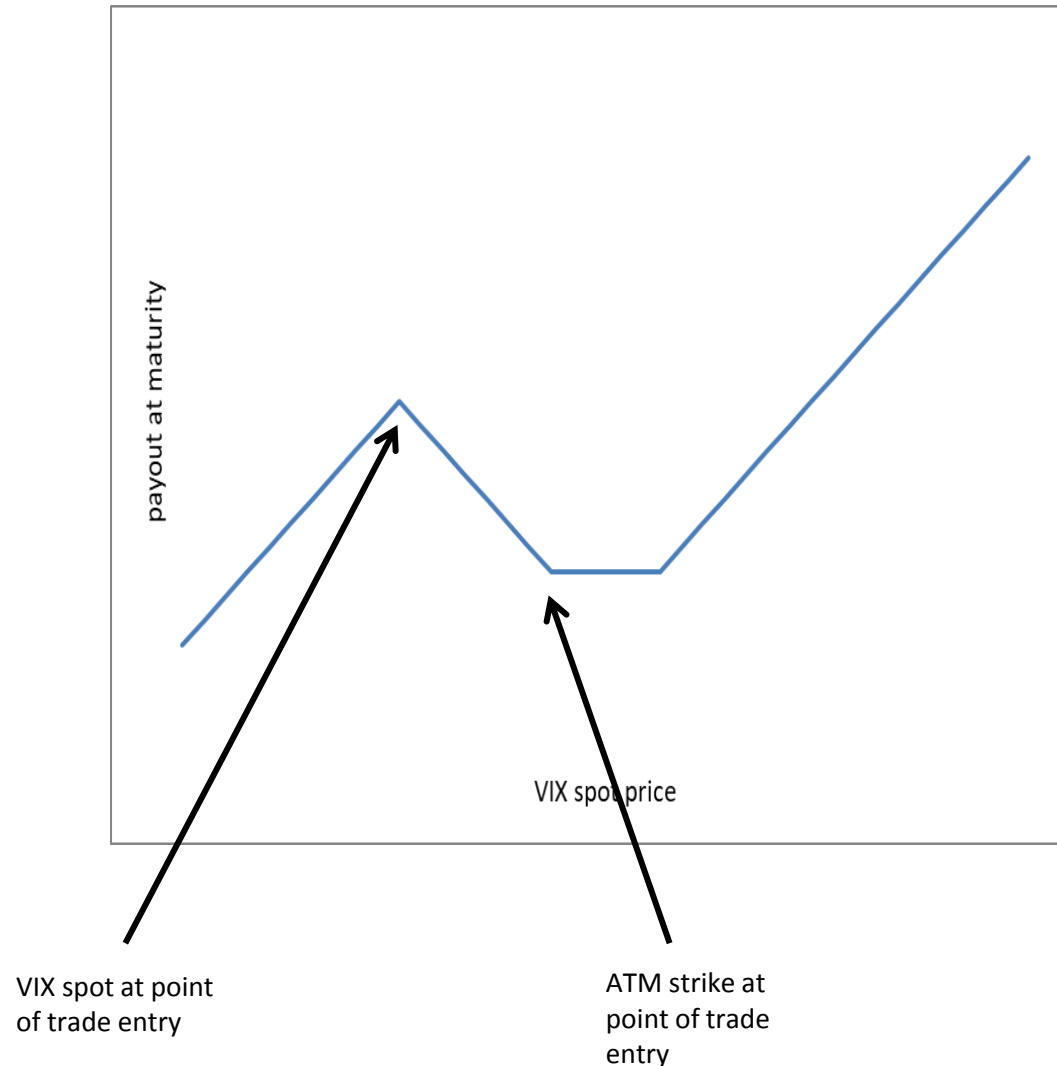
Increasingly Sharp Decay After VIX Spikes



data: Yahoo! Finance

Practical Ramifications

- Buying a VIX 1x2 put ratio to “finance” call buying would seem a natural idea
- If the VIX term structure doesn't change, forward rolls toward the point of maximum payout in the 1x2
- Put ratio is also positive theta, as OTM put burns off more quickly than ATM one
- If all of this holds, on average the 1x2 should pay for the call
- This simple replication scheme is increasingly DANGEROUS after the VIX rises, given potential for sharp collapse in the spot

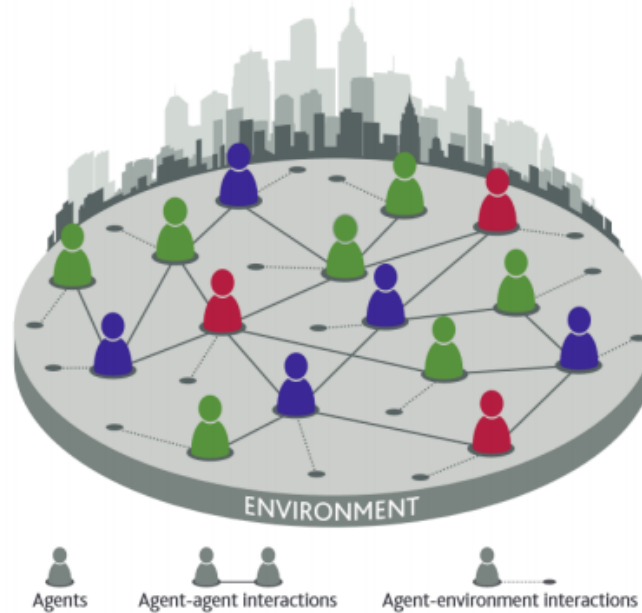


Reasons for Changing VIX Dynamics

- Chase for carry in a world with sovereign yield curves converging to 0
- Easy access to forward VIX, e.g. through ETNs
- Huge growth in ETNs up to early 2018, with an emphasis on inverse products such as XIV and SVXY
- Moderate random shocks force ETNs to rebalance aggressively, buying large quantities of VIX futures, S&P options and futures
- This pushes VIX futures much higher, especially near the close

Stylized Network

- Focus has traditionally been placed on Agent-environment interactions (exogenous vs endogenous risks)
- Endogenous risks are a new research frontier and will be the focus of this talk: can we **specify** an agent-based model?



ABM Considerations

- Who are the agents (individual or aggregate)?
- What do they hold?
- How will they behave, based on past behavior, leverage used and dynamic access to revolving credit?
- How will an agent's actions feed through the network?

ABM Methodology

- Assume fixed size jump in front month VIX futures contract on day t
- Estimate number of futures needed for ETN desk to replicate reference index on day $t+1$
- Use “heuristic” arguments to estimate price impact of rebalancing order at the close
- Recalculate jump size based on forced order

Price Impact Heuristics

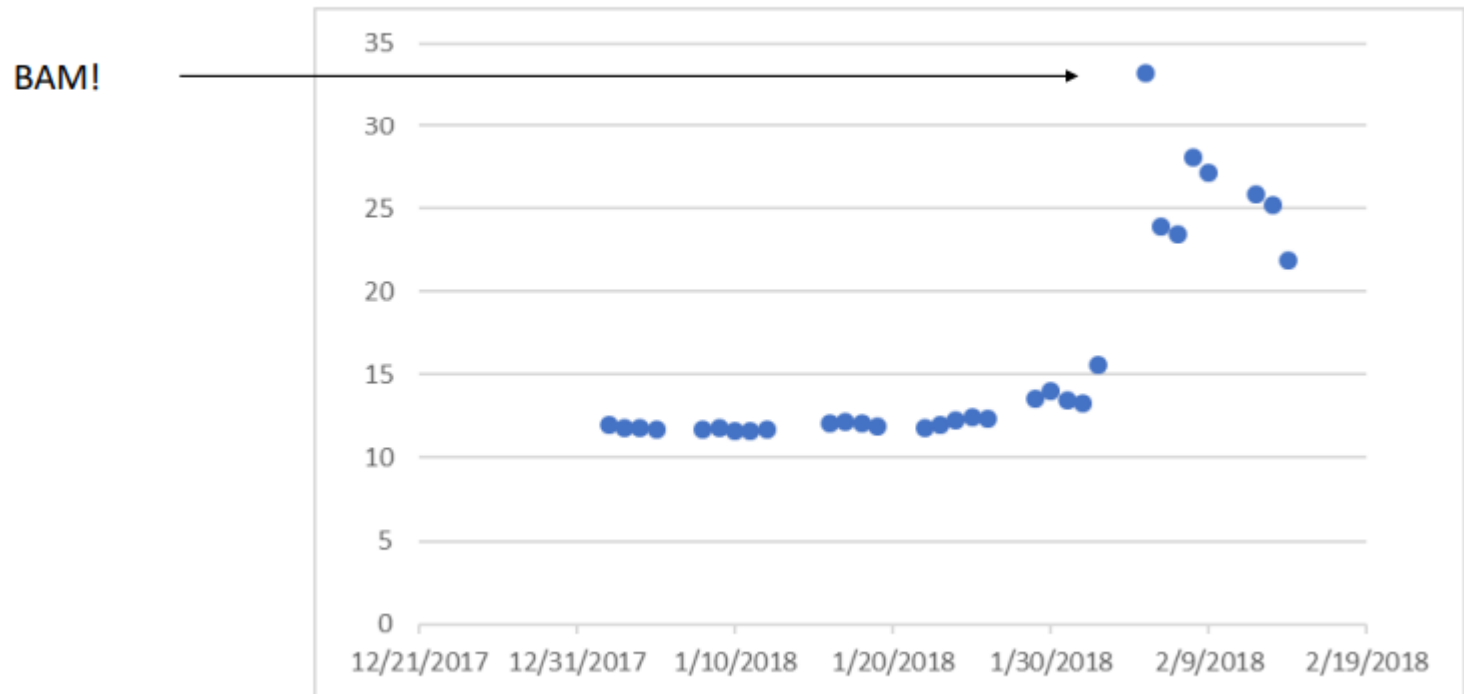
- Data confirmed square root impact for VIX futures near 4.15 EST close
- Boundary condition (hostile takeover analogy) applied to specify multiplicative parameter in square root law
- Recalculate jump size as (initial move) + (price impact of forced covering at close)

Back of the Envelope Calculations

- Focus on 5-Feb-18 "Volmageddon"
- Feb 18 VIX futures: previous close around 15
- Assuming 50% UXG8 intra-day jump, naive rebalancing requires purchase of roughly 200,000 futures
- Price impact estimates move UXG8 up another 30%, to around 28

What Actually Happened ...

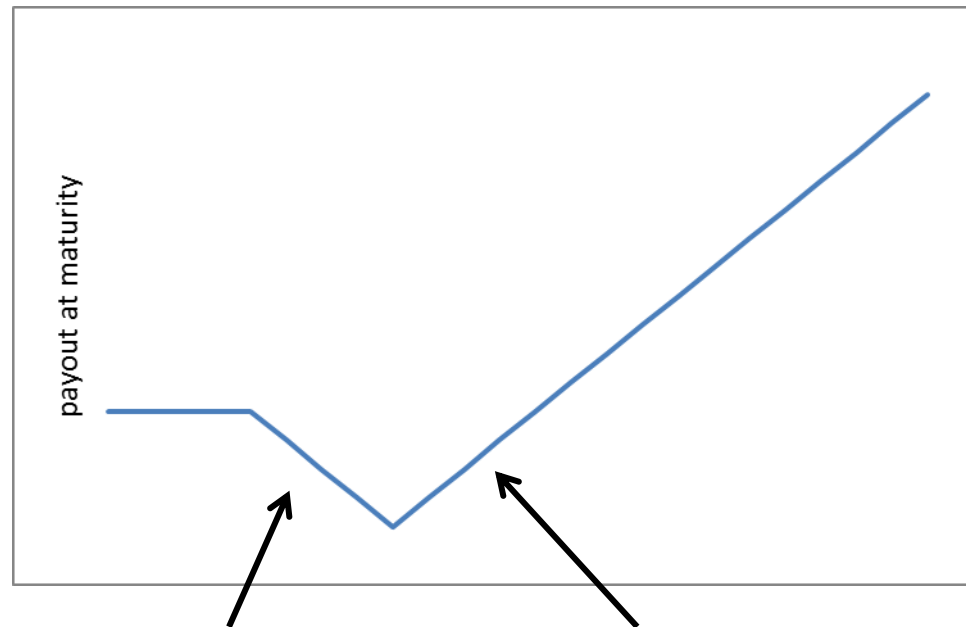
February 2018 VIX Futures Closing Prices



data: CBOE

Practical Ramifications

- Short 1x2 call ratio spreads are more suitable to the current environment (note that the ratio spread has higher strikes than in the 1x2 put ratio example)
- An assessment does have to be made as to where forced covering will occur
- However, we know that if VIX futures hit a certain range, they have a high conditional probability of blasting higher
- Follow through is likely to be less severe than in February 2018
- However, in a low volatility environment, these structures do not require a huge spike in volatility to be very profitable



VIX has tendency to stay low when below this level

once VIX futures approach here, ETNs and other volatility sellers forced to rebalance aggressively

Appendix: Price Impact Function for Shares (Including ETFs)

$$(\text{avg } \% \text{ cost per share}) = a \sqrt{\frac{(\text{trade size, in shares})}{(\text{shares outstanding})}}$$

- While *log* impact has been proposed as an alternative, we don't want our analysis to be too open-ended
- Recent work by Schachermayer *et al* validates square root impact under a small number of assumptions, using dimensional analysis

Appendix: Specifying “ a ”

- As in the XIV *post mortem*, we use an exogenous boundary condition to solve for a
- Assume that the average premium for a hostile takeover (pre-announced purchase of >50% shares outstanding) is 30%
- Then, $a = \frac{0.3}{\sqrt{0.5}}$ or 0.42