VIX Index limitations – how low can it go?

DUNN CAPITAL MANAGEMENT, LLC

CBOE Risk Management Conference

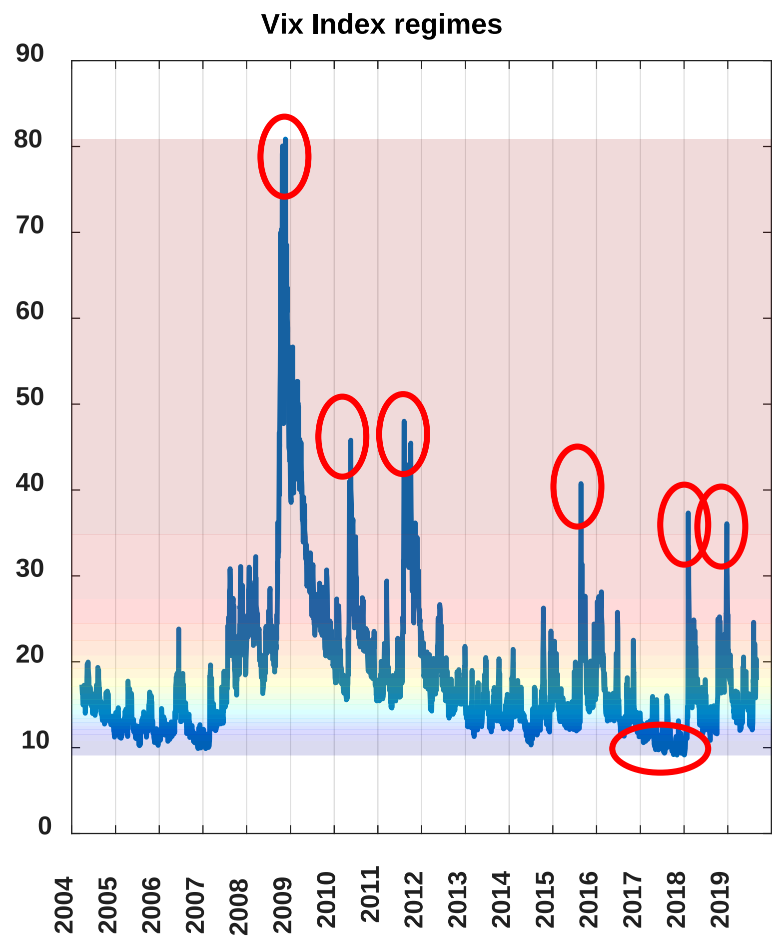
Munich, September 2019

EVERYONE SEEMS TO BE CONCERNED ABOUT THE VIX INDEX …

DUNN
CAPITAL MANAGEMENT, LLC

…ONLY WHEN THE VIX INDEX PEAKS YET AT PEAKS IT BEHAVES MOSTLY AS EXPECTED

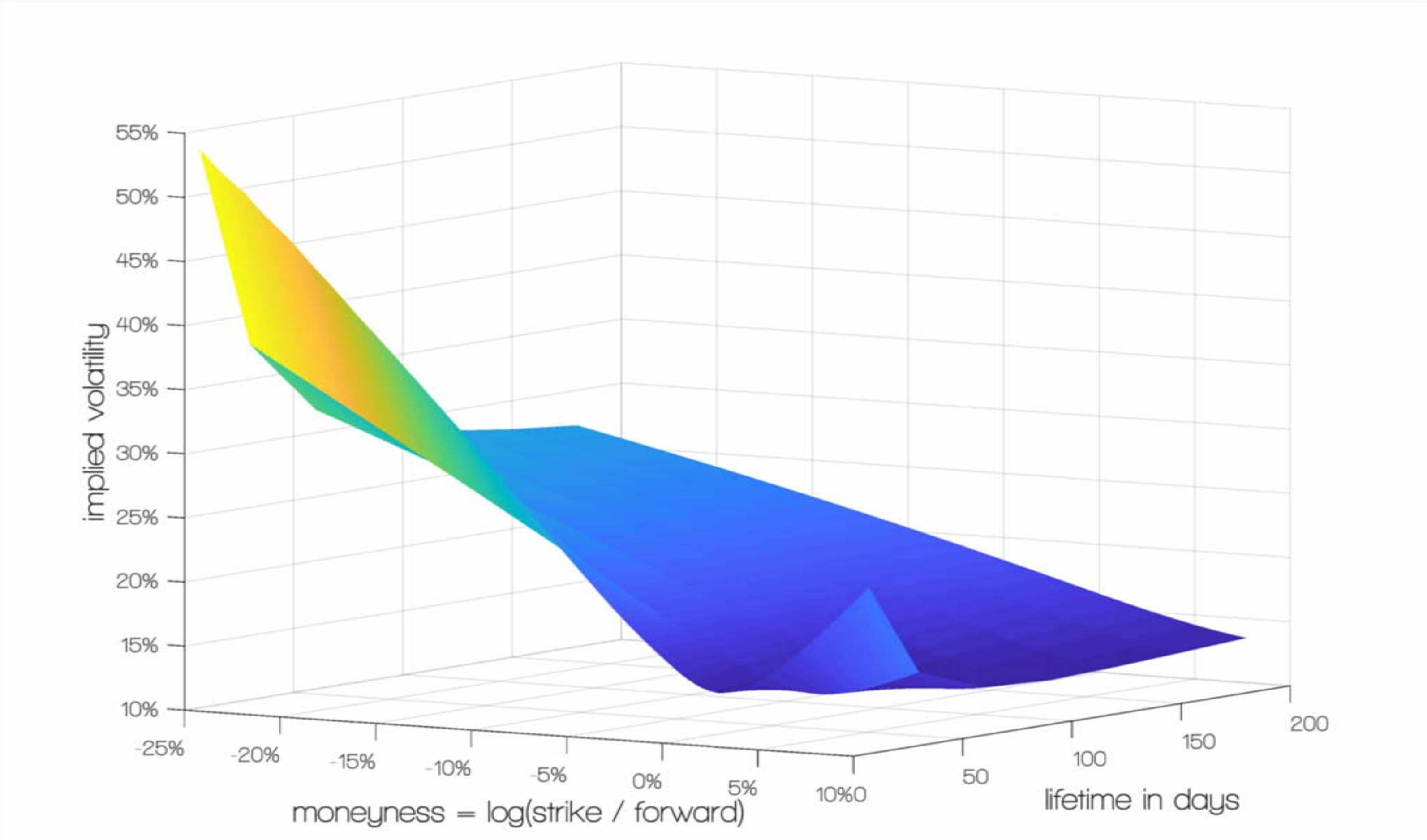
DUNN CAPITAL MANAGEMENT, LLC



DUNN CAPITAL MANAGEMENT, LLC

- **The volatility surface for different volatility regimes**
  - At-the-money- (atm), minimum-volatility and skew slope
  - How they are connected
- **Is there a lower “limit” to the VIX Index?**
  - The impact of the volatility risk premium
  - The impact of “volatility-of-volatility”
- **What are the conclusions for volatility (VIX) trading?**
  - Is shorting vol in low vol environments a good idea?
  - Return sources for vol trading in low vol environments?

DUNN
CAPITAL MANAGEMENT, LLC



Skew = implied volatility over moneyness
Term structure = implied volatility over lifetime

VIX INDEX CALCULATION RECAP (I)

VIX uses out-of-the-money options (otm) only

VIX is based on option prices

(but for simplification purposes, implied volatility is used in the following slides)

VIX is interpolated from two option series to have a constant 30-day lifetime

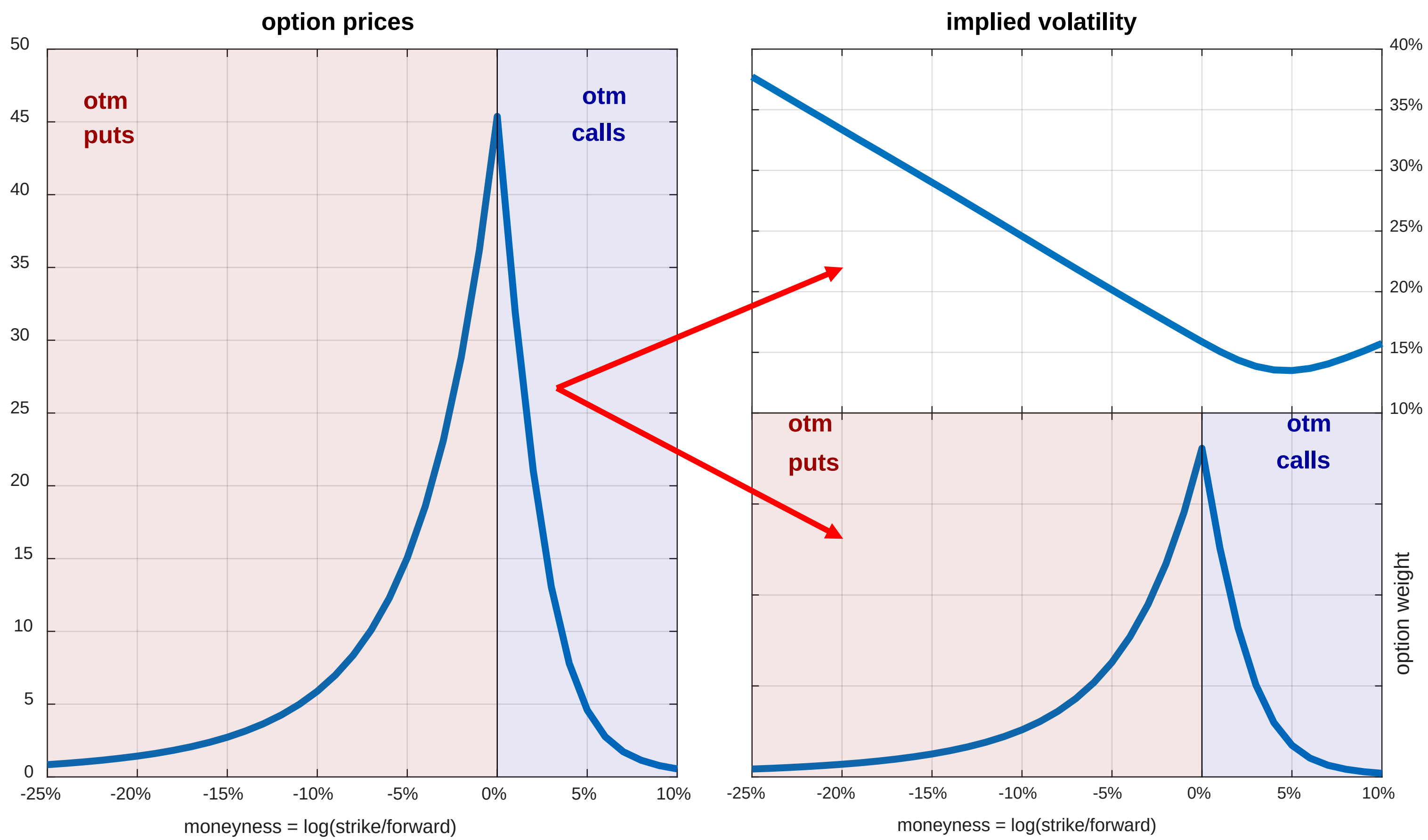
(for simplification, a single hypothetical series with exactly 30-day lifetime is used)

VIX is calculated as a "sum" of all options with bid prices, not an average

(the actual options used are dependent on a set of rules as specified by the Cboe; for simplification, the following slides show a fixed strike range only)

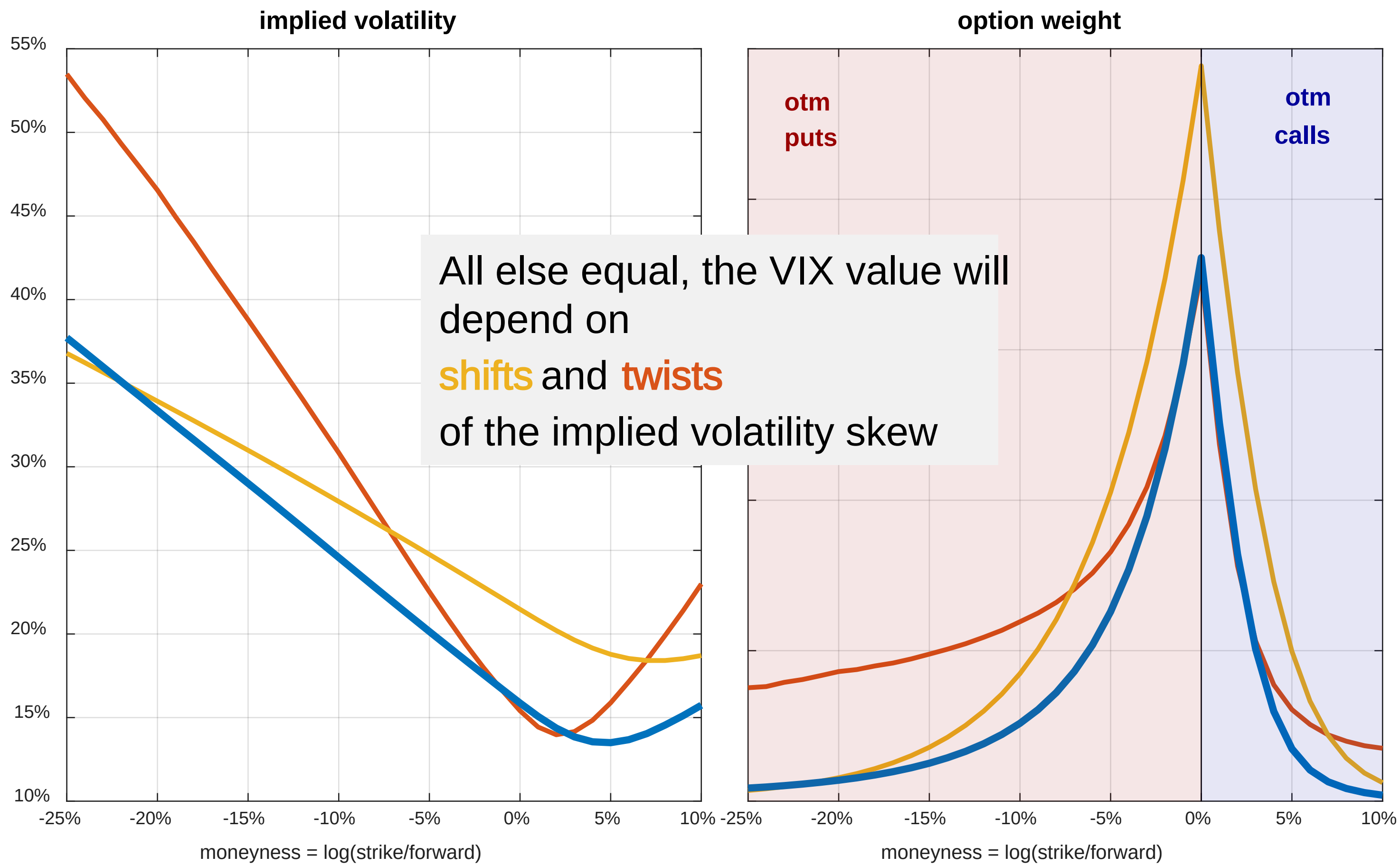
The full process is documented in https://www.cboe.com/micro/vix/vixwhite.pdf

VIX INDEX CALCULATION RECAP (II)



DUNN CAPITAL MANAGEMENT, LLC

Which volatility skew will result in a higher VIX – yellow or orange?

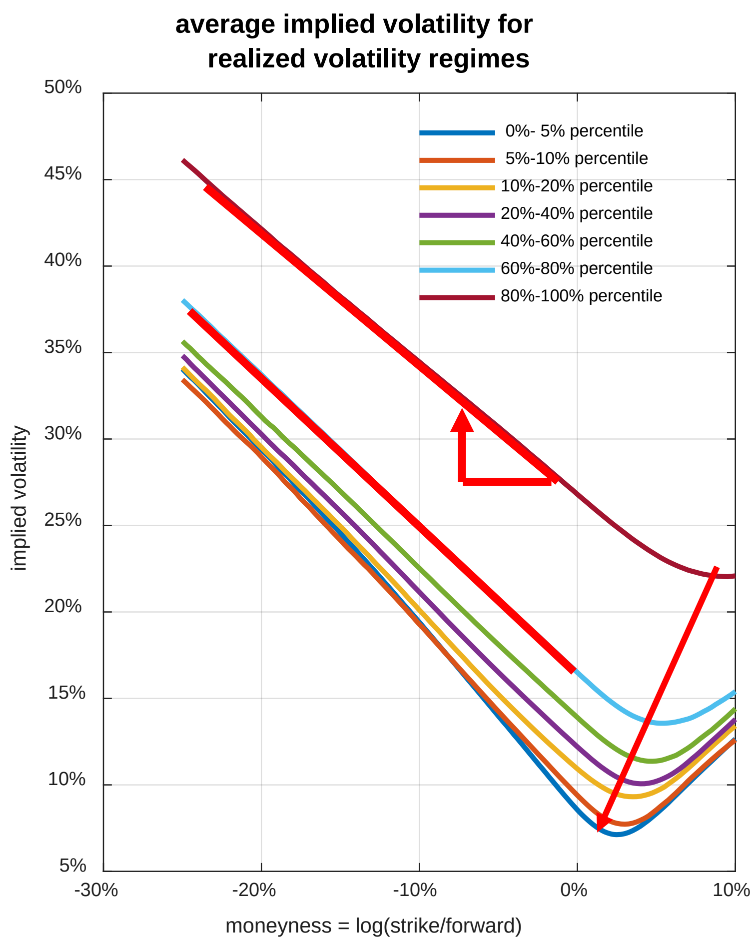


All else equal, the VIX value will depend on

shifts and twists

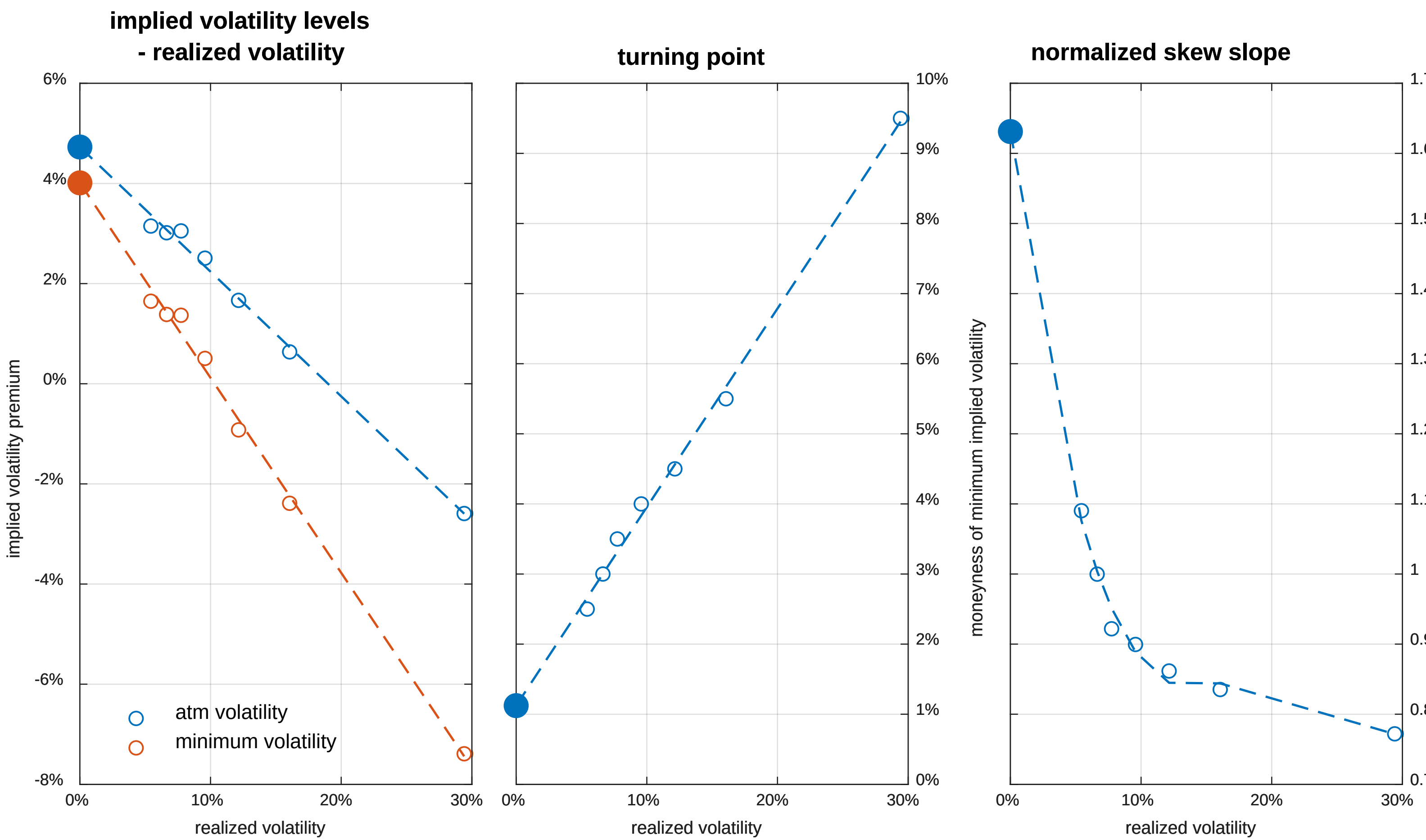
of the implied volatility skew

LUCKILY, THIS IS GOOD NEWS…

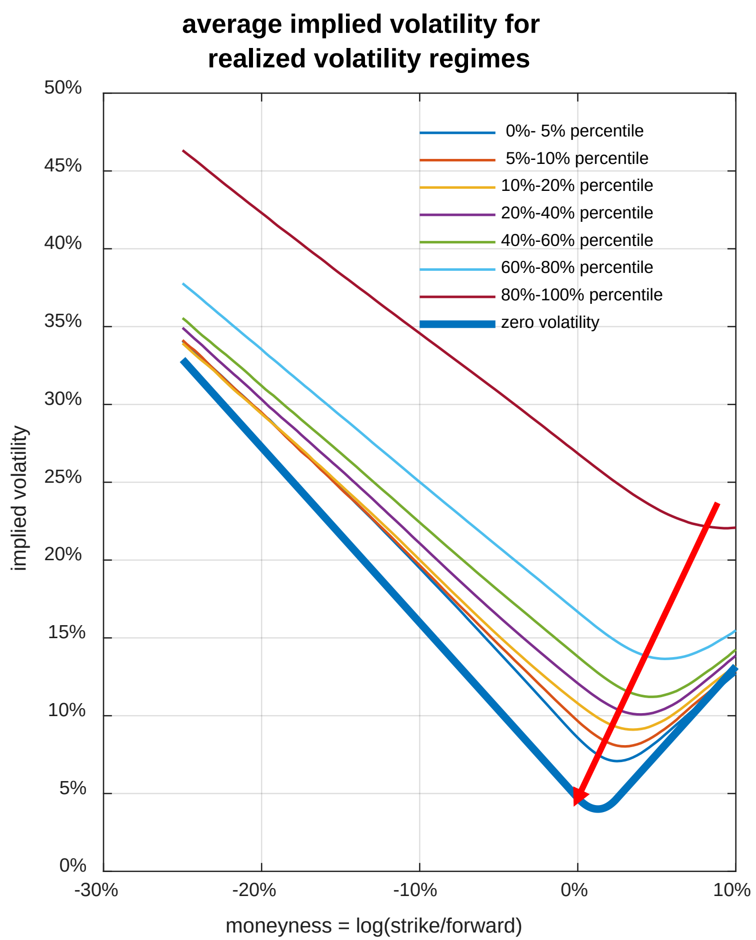


- **Keep in mind that the volatility skew is "man-made"**
- **The implied volatility skew is based on the level of realized volatility**
  - At-the-money volatility
  - Slope
  - Turning point
- **Lower volatility means**
  - Steeper slope of volatility skew
  - Turning point closer to at-the-money strike

…AS ANY "MAN MADE" MODEL FOLLOWS RULES



THE MINIMUM VIX LEVEL THEREFORE IS …



- **Not zero**

  More likely ~6

- **Involve a volatility skew with a very steep slope on both the upside and downside**

  Basically any move in the underlying price beyond a constant drift is volatility

- **Therefore atm-implied volatility will be dependent on expected/possible volatility of volatility**

What is the Volatility Risk Premium (VRP)? (I)

What is implied volatility?

- A risk measure? 40
- ~~A risk estimate?~~ 50
- ~~A fixed number?~~ 13
- A return source? 27
- A return estimate? 10
- ~~A random number?~~ 21
- ~~A problem?~~ 83

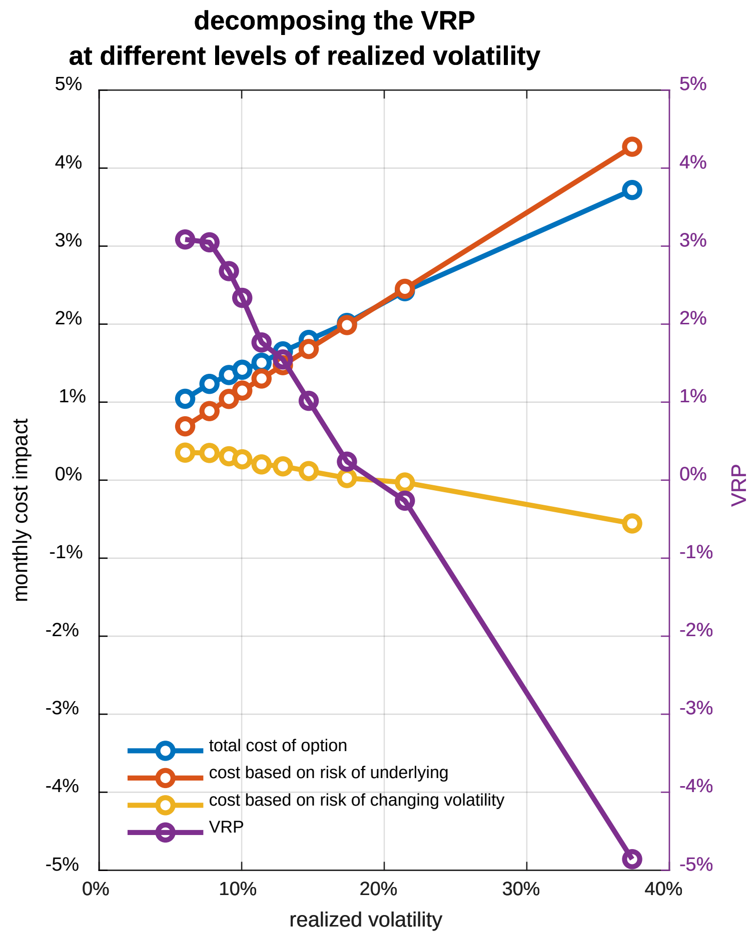
What is it based on

Two main factors to keep in mind:

1. (Equity) Volatility risk premium contains/is linked to the equity risk premium
2. Volatility risk premium contains a "volatility-of-volatility" component

Historically, these two factors have been highly correlated

VRP contains “compensation” for risk and for “expected change of risk”



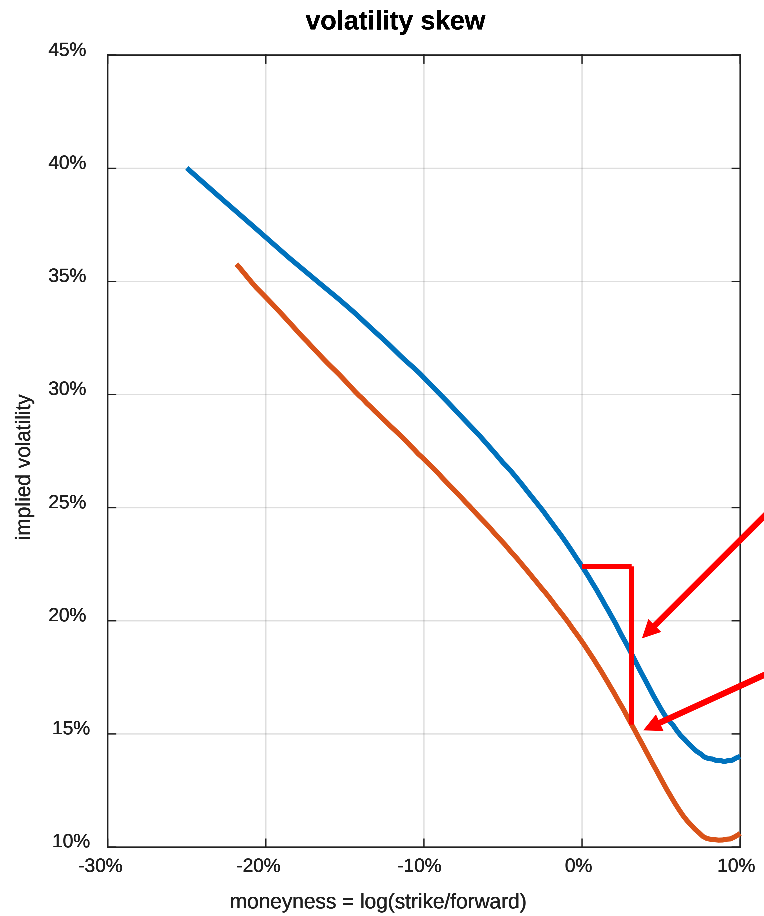
- **Defining the volatility risk premium (VRP) as the difference between implied and (prior) realized volatility**
  - VRP is “highly positive” at low realized volatility levels
  - VRP is “negative” at high realized volatility levels
- **How can a risk premium be negative?**

The VRP covers

- The risk of the underlying
- The risk of changing volatilities

Those risks can offset each other

The VIX reacts to changes in the underlying and changes in volatility



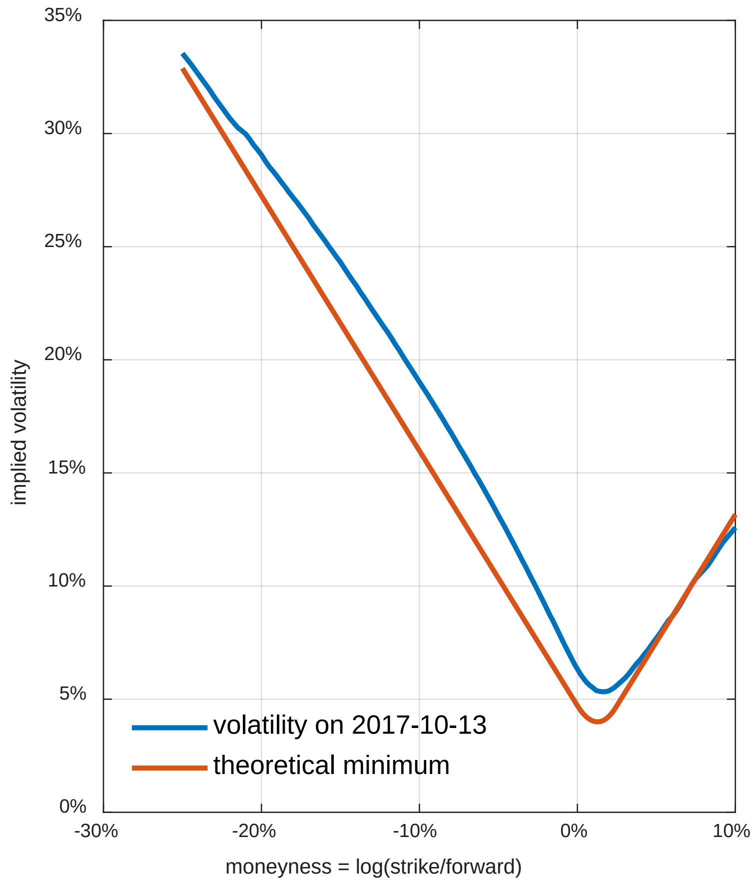
For changes of at-the-money (and therefore VIX) implied volatility, these two factors can be isolated:

- The change in volatility based on the movement along the volatility skew, correspond to the equity risk = skew effect
- The change in volatility due to shifts in the skew correspond to differing expectations of volatility-of-volatility =volatility effect

If volatility is already too low the shift of the volatility skew will offset the move along the skew

DUNN CAPITAL MANAGEMENT, LLC

In low volatility environments the two components decouple



In 2017, realized volatility approached new historic lows:

- Annualized 1-month realized volatility < 4% in November
- Max drawdown from previous peak in the 4th quarter was ~1%

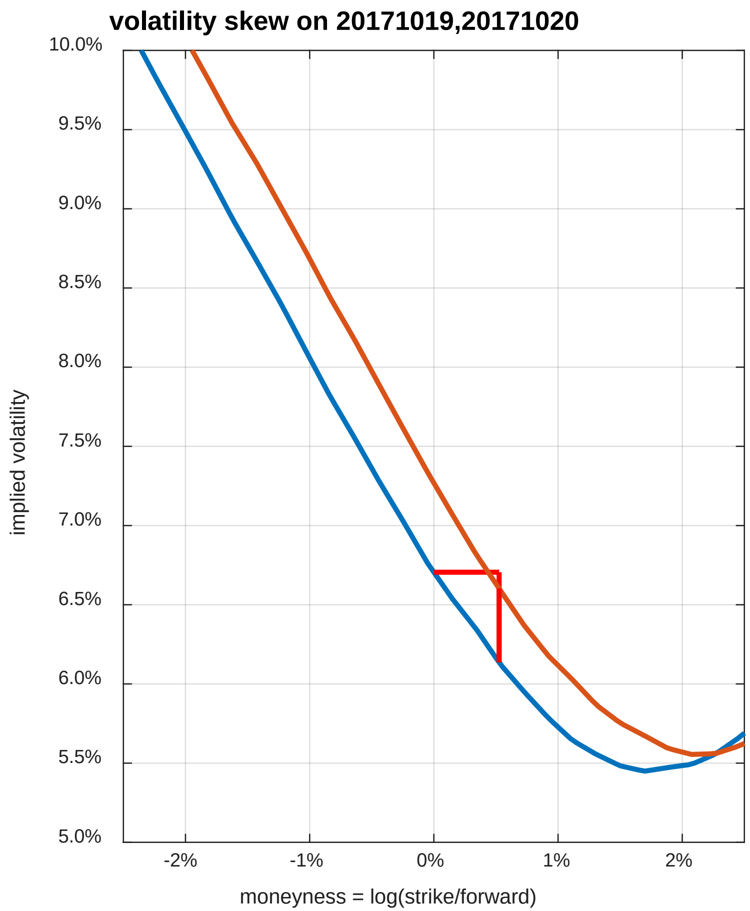
And therefore implied volatility approached its "theoretical" lows:

- October 13th 2017 had an at-the-money volatility of ~6.2%

What should we expect if the underlying market continues to rise?

DUNN CAPITAL MANAGEMENT, LLC

At-the-money volatility remained almost unchanged, despite gains in the underlying

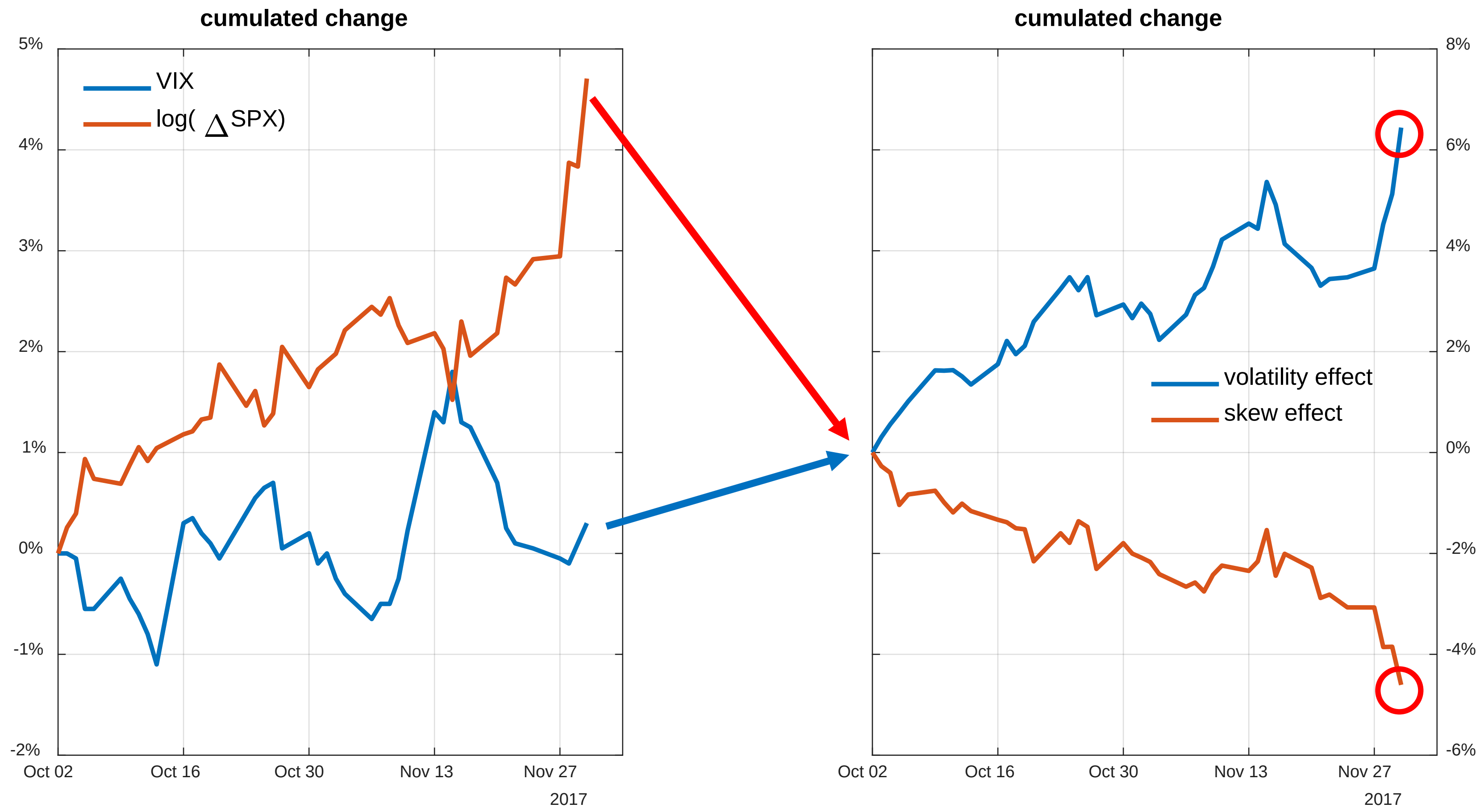


On October 19th 2017:

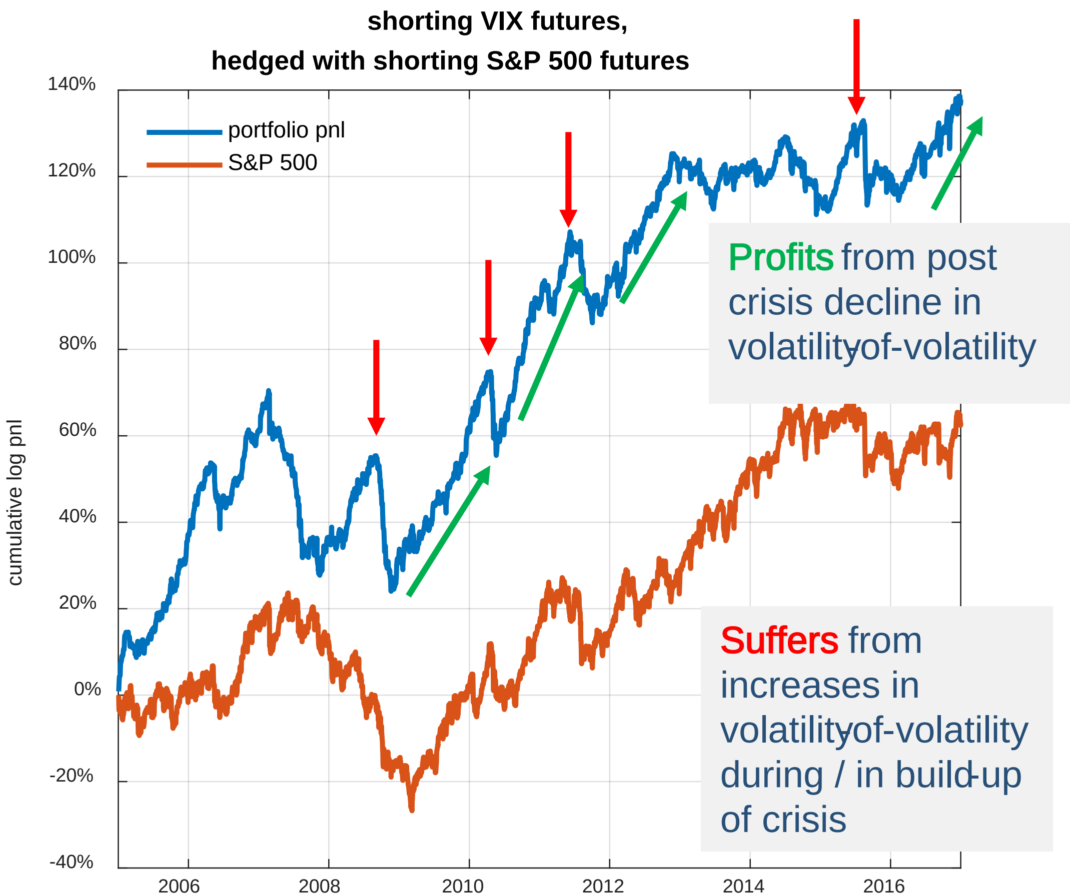
- Realized volatility was close to its low (~3.7% annualized)
- The S&P 500 increased by 0.51% (a 2 standard deviation move!!) on October 20th
- Implied volatility remained almost unchanged between the two days

DUNN CAPITAL MANAGEMENT, LLC

At some point, implied volatility will not go any lower



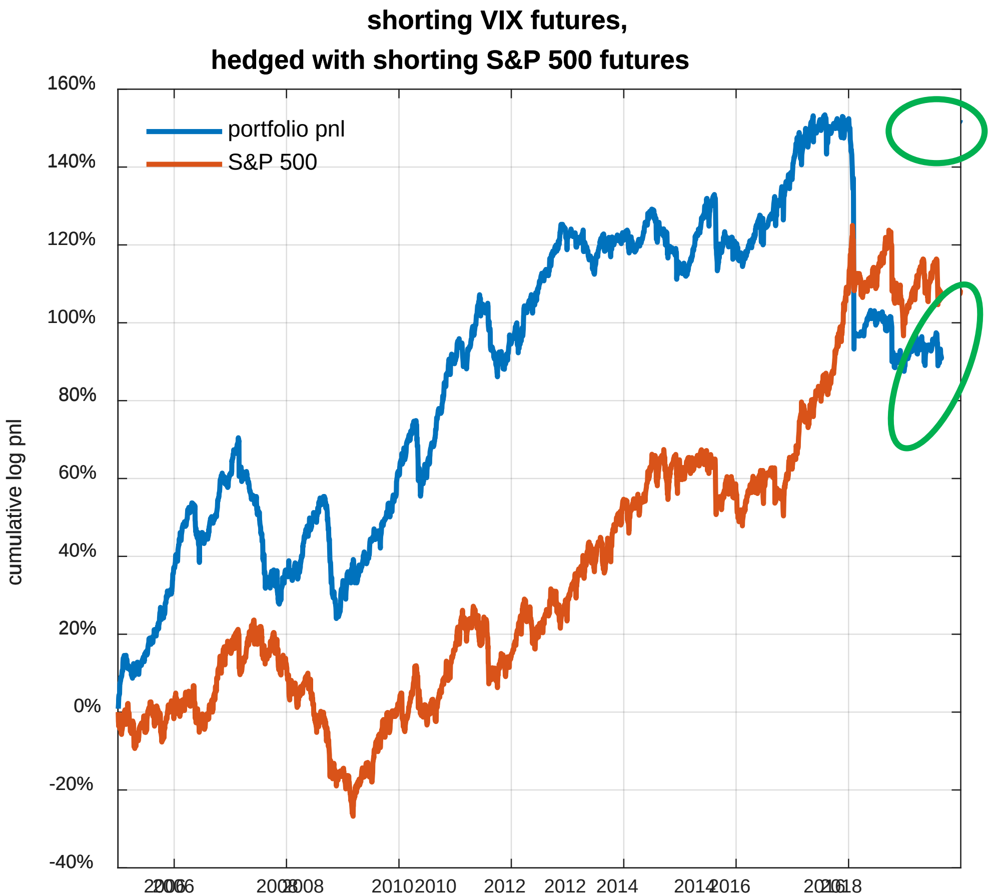
VIX TRADING RETURN SOURCES (I)



2004 – 2016: The two portfolios are positively correlated at around 50%

Assume a portfolio of:

- Always short S&P 500 futures scaled to 15% annualized volatility
- Short VIX futures such that the average time-to-maturity is 30 days and the VIX future position neutralizes the "skew effect"
- Compared with a long S&P 500 portfolio scaled to 15% annualized volatility



2017:

- Ultralow volatility environment
- Massive rally in S&P 500
- Volatility "couldn't" decline more
- None of the gains…
- But A LOT of ensuing pain

2017: correlation declined to 0.25

Only negative days of S&P 500 were correlated

- The VIX Index has a lower boundary that is not zero
- The (equity) volatility risk premium shares many properties with the equity risk premium
- The volatility risk premium contains compensation/costs for expected changes in volatility
- Ultra-low volatility environments create a one-sided relationship between underlying and volatility
- Be cautious when shorting volatility in low volatility environments, it is an uphill battle

DUNN CAPITAL MANAGEMENT, LLC

The information set forth herein has been obtained or derived from sources believed by DUNN Capital Management, LLC (DUNN) to be reliable. However, DUNN does not make any representation or warranty, express or implied, as to the information's accuracy or completeness, nor does DUNN recommend that the attached information serve as the basis of any investment decision. This document has been provided to you solely for information purposes and does not constitute an offer or solicitation of an offer, or any advice or recommendation, to purchase any securities or other financial instruments, and may not be construed as such. This document is intended exclusively for the use of the person to whom it has been delivered by DUNN and it is not to be reproduced or redistributed to any other person. Please refer to the Appendix for more information on risks and fees. Past performance is not a guarantee of future performance.

This presentation is not research and should not be treated as research. This presentation does not represent valuation judgments with respect to any financial instrument, issuer, security or sector that may be described or referenced herein and does not represent a formal or official view of DUNN.

The views expressed reflect the current views as of the date hereof and neither the speaker nor DUNN undertakes to advise you of any changes in the views expressed herein. It should not be assumed that the speaker will make investment recommendations in the future that are consistent with the views expressed herein, or use any or all of the techniques or methods of analysis described herein in managing client accounts. DUNN and its affiliates may have positions (long or short) or engage in securities transactions that are not consistent with the information and views expressed in this presentation.

The information contained herein is only as current as of the date indicated, and may be superseded by subsequent market events or for other reasons. Charts and graphs provided herein are for illustrative purposes only. The information in this presentation has been developed internally and/or obtained from sources believed to be reliable; however, neither DUNN nor the speaker guarantees the accuracy, adequacy or completeness of such information. Nothing contained herein constitutes investment, legal, tax or other advice nor is it to be relied on in making an investment or other decision.

There can be no assurance that an investment strategy will be successful. Historic market trends are not reliable indicators of actual future market behavior or future performance of any particular investment which may differ materially, and should not be relied upon as such. Target allocations contained herein are subject to change. There is no assurance that the target allocations will be achieved, and actual allocations may be significantly different than that shown here. This presentation should not be viewed as a current or past recommendation or a solicitation of an offer to buy or sell any securities or to adopt any investment strategy.

The information in this presentation may contain projections or other forward-looking statements regarding future events, targets, forecasts or expectations regarding the strategies described herein, and is only current as of the date indicated. There is no assurance that such events or targets will be achieved, and may be significantly different from that shown here. The information in this presentation, including statements concerning financial market trends, is based on current market conditions, which will fluctuate and may be superseded by subsequent market events or for other reasons. Performance of all cited indices is calculated on a total return basis with dividends reinvested.

The investment strategy and themes discussed herein may be unsuitable for investors depending on their specific investment objectives and financial situation. Please note that changes in the rate of exchange of a currency may affect the value, price or income of an investment adversely.

Neither DUNN nor the speaker assumes any duty to, nor undertakes to update forward looking statements. No representation or warranty, express or implied, is made or given by or on behalf of DUNN, the speaker or any other person as to the accuracy and completeness or fairness of the information contained in this presentation, and no responsibility or liability is accepted for any such information. By accepting this presentation in its entirety, the recipient acknowledges its understanding and acceptance of the foregoing statement.