EQUITY MARKET VOLATILITY IN THE COVID-19 ERA: A FEW FACTS

Luke Stein, Ph.D.
Assistant Professor of Finance
Babson College
Today’s presenter/host:  
Luke Stein, Ph.D.  
Assistant Professor of Finance  
lcdstein@babson.edu  
@lukestein

Backup stream via YouTube at  
http://livestream.lukestein.com  
and Twitch (twitch.tv/lcdstein) and Twitter/Periscope (periscope.tv/lukestein)

• Session is being recorded for  
Cutler Center webpage and  
Babson Finance Association  
(BFA) Canvas page  
Did we remember to start recording?

• Please mute your microphone  
• Moderator will collect questions  
(through Zoom chat) throughout  
• Q&A will follow presentation
1. Fast-moving environment
2. Preliminary analysis
3. Various sources, measures, visualizations
4. More facts than explanations

SMALL CAVEATS
1. The US isn’t the world
2. The US economy isn’t the US
3. The stock market isn’t the economy
4. Large-cap stocks (e.g., S&P 500) aren’t the stock market

BIG CAVEATS
62% of days
38% of days

Through 4/9/20. Vertical axis shows S&P 500 TR Index (i.e., incl. dividend reinvestment) on log scale.

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As of 4/7/2020
S&P 500 total return index since first hitting today's level

Through 4/9/20. Vertical axis shows S&P 500 TR Index (i.e., incl. dividend reinvestment) on log scale.

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VOLATILITY TRENDS
Daily S&P 500 returns (%)

Red bars show all changes greater than ±3%.

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As of 4/6/2020
1. **Extent** of the virus
2. **Effects** of the virus
   - Direct
   - Indirect
3. **Response** to the virus
   - Short-term
   - Long-term

**WHAT ARE WE SEEING? UNCERTAINTY**
Daily S&P 500 returns (%)  
June 2008–May 2009

Red bars show all changes greater than ±3% (n=59).  
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Daily S&P 500 returns (%)

Through 4/9/20. Red bars show all changes greater than ±3% (n=22).

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S&P 500 total return (daily)
April 2008–June 2009

Label is calendar day. Horizontal lines at ±3%.
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S&P 500 total return (daily)

Through 4/9/20. Label is calendar day. Horizontal lines at ±3%.

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Figure 1. Realized U.S. Stock Market Volatility, January 1900 to March 2020

Volatility Last Two Weeks

- Great Crash 10-11/1929
- Great Depression 3/1933
- Black Monday 10/1987
- Global Financial Crisis 12/2008
- Coronavirus Pandemic 3/2020

Notes: Sample period, 1/1/1900-3/23/2020. From 12/1925-Present, returns are computed using Yahoo Finance’s ‘adjusted close’ series for the S&P 500 (^GSPC). Before that, returns are from the Global Financial Data extension of the Dow Jones Index. Volatility last two weeks is the sum of squared returns over the past 10 trading days.

Source: Baker, Bloom, Davis, Kost, Sammon, and Viratyosin
Daily SPY price changes (%)


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The Stock Market Works by Day, but It Loves the Night

By Jeff Sommer
Feb. 2, 2018

The daytime is for losers. Overnight is when the big money is made in the stock market — not by trading but by getting a good night’s sleep.

That’s because of a gap between daytime and overnight returns in the American stock market. The real profits for investors have

Cf. Cooper, Cliff, Gulen (2008)
Looking Forward: Implied Volatility and the VIX
• To understand “the market”’s forecast of X, find an asset whose price now is related to how X turns out
  – Prices are determined by supply and demand
  – Caution: Supply and demand may be determined by things other than X!
• The price of options increases with volatility, all else equal
  – Prices can’t be [too?] predictable…
  – But only for “durable” assets
• VIX uses options on the S&P 500 (23–37 day)
VIX vs. S&P 500 return (daily)

S&P 500 (daily return, %)

VIX (previous day’s close)

One year through 4/6/20.
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Daily S&P 500 Return Standard Deviation
1-mo implied (orange) and subsequent realized (blue)

Note: 12-month moving average. Calculated at calendar month level.
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As of 3/20
Markets

The Booming Short-Volatility Bet That Lost 46% in a Single Month

By Yakob Peterseil
April 3, 2020, 7:37 AM MST

Barclays says shorting S&P 500 variance fell apart in March
Trade thrived as banks unloaded risk to hedge funds, managers

A booming but opaque volatility trade beloved by hedge funds just erased two decades of performance in a single month.

Betting against price swings in the S&P 500 Index via an over-the-counter instrument known as a variance swap returned minus 46% in the month through March 20, according to Barclays Plc. While perennially popular, the trade has ballooned in recent years as banks unloaded their volatility exposure to hedge funds and other asset managers hungry for yield.

Exactly how much was riding on such wagers is not known, but the short-volatility complex overall is estimated at as much as $1.5 trillion.

Note: Variance not volatility

Payoffs proportional to excess ($\sum_i R_i^2$), not its squareroot

The systematic strategy of selling the volatility spike eventually runs into the turn of the cycle.

Covered call and put-write strategies were actually down more than the $SPX YTD as of yesterday's close. Half of the upside with all of the downside! Brilliant - here's $100bn!

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The problem is not the desire to generate income against an equity portfolio, or the desire to capture risk premium — it's doing the same thing as every other big institutional investor. Derivatives markets aren't large enough for a 20% risk allocation from global pension funds.
VOLATILITY AS A HEDGE
Feb 19, 2020: S&P 500 all-time high close

Mar 16, 2020: VIX all-time high close

VIX vs. S&P 500 level (daily, month through 3/16/2020)

Label is calendar day. Horizontal axis is log scale.
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Uncertainty
(Raises questions)

Bad
(Relative to expectations)

Resolution
(Answers questions)

Good
(Relative to expectations)
Max ever (since VIX introduced in 1990): March 16, 2020!
VIX vs. S&P 500 level (daily, previous decade)

Through 4/6/20. Orange labels are calendar day (last month). Horizontal axis is log scale.
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VIX vs. S&P 500 level (daily, previous 15 years)

Through 4/7/20. Orange labels are calendar day (last month). Horizontal axis is log scale.

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Uncertainty
(Raises questions)

Resolution
(Answers questions)

Bad
(Relative to expectations)

Good
(Relative to expectations)
Through 3/6/2020, Red dots are the fifteen "weirdest" daily VIX declines based on residual from linear regression on contemporaneous daily S&P 500 return.

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Through 4/9/20. Label is calendar day. Horizontal axis is log scale.

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WHERE DO WE GO FROM HERE?
Figure 4: Household Spending Response Across Categories

Notes: This graph displays the response of household spending across a number of categories of spending. Spending is measured in daily dollars. Estimates are taken as the change in household spending from the first week of February to the first week of March. Source: Non-Profit Fintech.

Retail Spending

Restaurant Spending

Air Travel Spending

Food Delivery Spending

Public Transit Spending

Credit Card Spending

Source: How Does Household Spending Respond to an Epidemic? Consumption During the 2020 COVID-19 Pandemic (Baker, Farrokhnia, Meyer, Pagel, Yannelis)
Appendix Figure 1: Percentage Earnings Calls Discussing Epidemic Diseases

(a) China  (b) United States  (c) Europe

Source: Firm-Level Exposure to Epidemic Diseases: COVID-19, SARS, and H1N1 (Hassan, Hollander, van Lent, Tahoun)
Change in 1-year dividend-growth expectations
_Percentage point difference from Jan. 1_

- US
- EU

Lower bound of the change in expected dividends
_Percentage point change from Jan. 15, 2020_

- S&P 500
- Euro Stoxx 50

Source: Coronavirus: Impact on Stock Prices and Growth Expectations (Gormsen, Koijen)
We show that unanticipated changes in predicted infections during the SARS and COVID-19 pandemics forecast aggregate equity market returns. We model cumulative infections as either exponential or logistic, and re-estimate the parameters of these models each day of the outbreak using information reported up to that day. For each trading day $t$ we compute the change in predicted infections using day $t-1$ versus day $t-2$ information. Regression results imply that a doubling of such predictions is associated with a 4 to 11 percent decline in aggregate market value. This result implies a decline in returns’ volatility as the trajectory of the pandemic becomes clearer.

Source: Aggregate and Firm-Level Stock Returns During Pandemics, in Real Time (Alfaro, Chari, Greenland, Schott)
US COVID-19 Deaths (daily, blue; cumulative, orange)

Through 4/9/20. Source: Johns Hopkins CSSE.

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Source: Frank Donnarumma @frankman1000
Italy and Spain have turned the corner, with numbers of new cases now in decline, following in China's footsteps.

Daily confirmed cases, by number of days since 30 daily cases first recorded.
Stars represent national lockdowns.

Source: Frank Donnarumma
@frankman1000