TWO SIGMA

Street View

JUNE 2017

BY GERARDO MANZO & JEFFREY N. SARET

EXECUTIVE SUMMARY Low pairwise correlations in a low-volatility market environment may suggest that investors currently expect benign conditions to continue in the short term, and/or that any near-term market shocks will have a low probability of becoming systemic. Whether these expectations signal justified confidence or naïve complacency is open to interpretation, but investors should remain aware of the historical tendency for rapid, positive shifts in volatility measures to occur.

www.twosigma.com

NEW YORK HOUSTON
LONDON HONG KONG

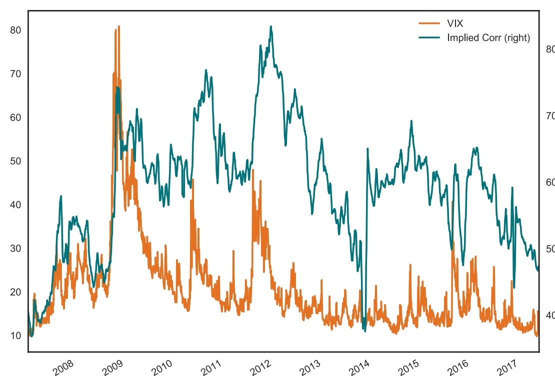
WHAT TO MAKE OF A LOW-VOLATILITY, LOW-CORRELATION MARKET?

Is historically low volatility in U.S. stocks a sign of investor confidence or complacency? With the CBOE Volatility Index (VIX) recently hitting an all-time low, and pairwise correlations among U.S. shares similarly subdued, the answer remains elusive. Regardless, markets may not be pricing in the risk of a broad, systemic shock to the U.S. equity market. It is worth remembering, however, that both volatility and correlations have a history of suddenly spiking higher.

THE CURRENT LOW-VOLATILITY ENVIRONMENT

The VIX fell to a 23-year low on June 9, 2017 (Chart 1), accelerating a year-long downtrend that has accompanied the S&P 500 Index's steady climb. The recent performance of the VIX may suggest that investors seem to have mostly cast aside their fears, remaining undaunted even in the face of an aging bull market and increasing valuations (e.g., PE ratios).

CHART 1 VIX AND IMPLIED CORRELATION IN THE S&P 500 (IN %)



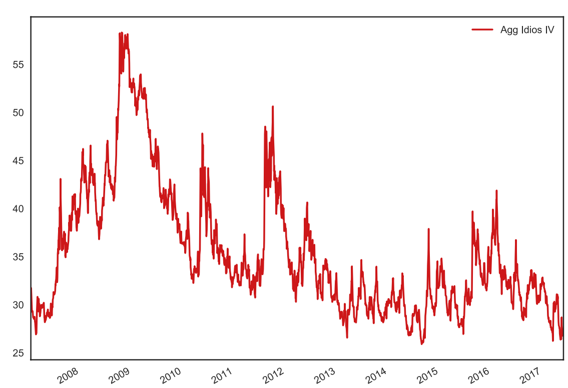
Notes: The implied correlation is the cross-sectional average of implied correlations in SPX option contracts with maturities ranging from 2008 to 2019. Source: Bloomberg, CBOE, and author's computation.

It is possible to try to make general inferences as to why the VIX has been falling so precipitously, but pinpointing exact causes is difficult. One measure offers important context, however. The average 30-day implied pairwise correlation of stocks in the S&P 500 (Chart 1- right y-axis) has also been falling since 2012, a downtrend that has only grown more pronounced over the past year.

Low pairwise correlations in a low-volatility market environment may suggest that investors expect low volatility in the short term and/or that any market shocks will have a low probability of becoming systemic. In other words, investors may believe that the biggest near-term risk they face is a shock that affects only a discrete slice of the S&P 500, a risk that can theoretically be mitigated through diversification.

Additionally, individual stocks have become, on average, less volatile since the 2008 financial crisis, and especially so over the past year. Chart 2 plots the aggregate cross-sectional volatility for more than 1000 of the most liquid (based on trading volume) U.S.-listed equities. Once again, the data may imply that investors have adopted an increasingly sanguine outlook. A negative reaction to any approaching shock, investors seem to believe, will likely manifest meaningfully in only a narrow subset of the overall market.

CHART 2 CROSS-SECTIONAL AVERAGE OF SINGLE NAME IMPLIED VOLATILITIES (IN %) OF THE MOST LIQUID NAMES



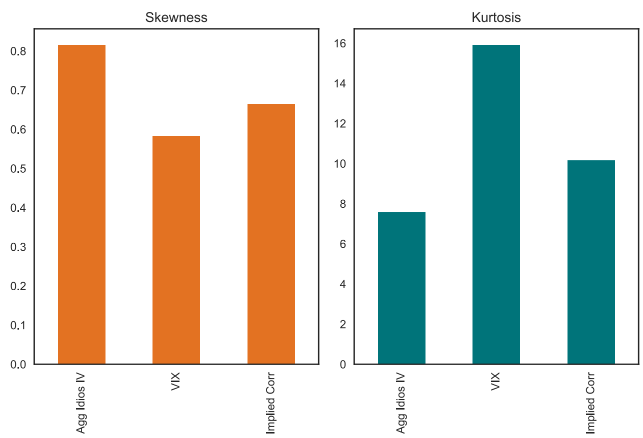
Source: Bloomberg and authors' computation

LOW-VOLATILITY AND THE POTENTIAL FOR SUDDEN CHANGES

Whether historically low VIX levels, pairwise correlations, and idiosyncratic volatilities should reassure investors or militate greater caution depends on one's perspective. Optimistically, markets could accurately be signaling a continuing period of relatively low—or at least contained—risk, generally an environment conducive to the beneficial effects of diversification that offer potentially greater rewards for skilled stock-pickers.

The alternative view is potentially more troubling. The data may indicate that markets underestimate the probability of a systemic shock. All two of the charts above show a tendency, since the 2008 financial crisis, for periods of falling volatility (or correlation, as the case may be) to precede sudden, sharp spikes higher. All three series exhibit relatively high skew and kurtosis (Chart 3).

CHART 3   SKEWNESS AND KURTOSIS OF DAILY CHANGES IN VIX, IMPLIED CORRELATION, AND CROSS-SECTIONAL AVERAGE VOLATILITY



Source: Bloomberg and authors' computation

POTENTIAL IMPLICATIONS

While none of these measures speak directly to the timing of sudden moves in either direction, investors should remain cognizant of the historical tendency for rapid, positive shifts to occur. When they do, diversification may not prove as effective as expected, with 2008 being an extreme example of this phenomenon.

Are investors right to be so sanguine about near-term market risks, or are they being complacent? Only time will tell which interpretation is correct, but it is unclear whether investors' portfolios are ready for the latter scenario, should it come to pass.

INTERESTING TECHNOLOGY-RELATED ARTICLES

Two Sigma views itself as a technology company that applies a rigorous, scientific method-based approach to investment management. Our technology is inspired by a diverse set of fields including artificial intelligence and distributed computing. Occasionally, we read articles in the popular press that describe applications of technology that we find interesting, thought-provoking, and relevant for people thinking about improving the investment management process. Below is a subset of the articles we read this month. Please do not view the inclusion of these articles as an endorsement by Two Sigma of their viewpoints or the companies discussed therein. Two Sigma welcomes discussions (and contributions) about these and other such technology-related articles.

"Cricket's Batsmen Get the High-tech Treatment "

http://www.economist.com/news/science-and-technology/21722823-smart-bats-and-pitch-analysing-drones-are-latest-additions-great?frsc=dg%7Cc

Professional sports generate a seemingly endless profusion of data and statistics, making them fertile ground for geeks. Baseball fans are particularly renowned for their embrace of game and player data, gleaned initially from the backs of baseball cards, then later through "sabermetrics" (of Moneyball fame), and most recently from advanced sensors that measure hits' exit velocities, pitches' spin rates, and more. Now it is cricket's turn. As a recent article in The Economist explains, the International Cricket Council (ICC) has started using gyroscope- and accelerometer-equipped "smart bats" to generate data on bat angle, stroke speed, and more. Meanwhile, it has also begun experimenting with drones originally designed for farmland analysis to analyze the state of the pitch during lulls in play.

"Why Car Companies Are Hiring Computer Security Experts" by Nicole Perlroth

https://mobile.nytimes.com/2017/06/07/technology/why-car-companies-are-hiring-computer-security-experts.html

Until recently the stuff of science fiction, autonomous cars and trucks appear to be nearing brink of widespread production and adoption. Advanced computer systems are also becoming integral to an increasing number of human-driven vehicles with each passing year. As a result, car manufacturers find themselves gradually transforming into quasi-software companies, explains a recent New York Times article. Security is perhaps the most pressing concern for automakers. Whereas 20 years ago, cars had roughly one million lines of code, on average, they now typically have more than 100 million and growing—raising the potential for malicious attacks. Researchers have already demonstrated the ability for a skilled hacker to assume at least partial control of various types of cars from miles away. As vehicles become ever more technologically advanced, the need for robust security rapidly becoming a matter of life and death.

IMPORTANT DISCLAIMER AND DISCLOSURE INFORMATION

This report is prepared and circulated for informational and educational purposes only and is not an offer to sell or the solicitation of an offer to buy any securities or other instruments. The information contained herein is not intended to provide, and should not be relied upon for investment, accounting, legal or tax advice. This document does not purport to advise you personally concerning the nature, potential, value or suitability of any particular sector, geographic region, security, portfolio of securities, transaction, investment strategy or other matter. No consideration has been given to the specific investment needs or risk-tolerances of any recipient. The recipient is reminded that an investment in any security is subject to a number of risks including the risk of a total loss of capital, and that discussion herein does not contain a list or description of relevant risk factors. As always, past performance is no guarantee of future results. The recipient hereof should make an independent investigation of the information described herein, including consulting its own tax, legal, accounting and other advisors about the matters discussed herein. This report does not constitute any form of invitation or inducement by Two Sigma to engage in investment activity.

The views expressed herein are not necessarily the views of Two Sigma Investments, LP or any of its affiliates (collectively, "Two Sigma") but are derived from the Two Sigma Alpha Capture system (the "Alpha Capture System"), which gathers inputs from sell-side contributors (not analysts) to the Alpha Capture System who receive compensation for their participation, as further described in the section titled "Brief Explanation of the Data" (page 1 hereof) and the document titled "Overview of the Two Sigma Alpha Capture System". Such views (i) may be historic or forward-looking in nature, (ii) reflect significant assumptions and subjective judgments of the contributors to the Alpha Capture System as well as, in some instances, the authors of this report, and (iii) are subject to change without notice. Two Sigma may have market views or opinions that materially differ from those discussed, and may have a significant financial interest in (or against) one or more of such positions or theses. In some circumstances, this report may employ data derived from third-party sources. No representation is made as to the accuracy of such information and the use of such information in no way implies an endorsement of the source of such information or its validity.

This report may include certain statements and projections regarding the anticipated future performance of various securities, sectors, geographic regions or of the Alpha Capture System generally. These forward-looking statements are inherently subject to significant business, economic and competitive uncertainties and contingencies, many of which are beyond our control. In addition, these forward-looking statements are subject to assumptions with respect to future business strategies and decisions that are subject to change. Factors which could cause actual results to differ materially from those anticipated include, but are not limited to: competitive and general business, economic, market and political conditions in the United States and abroad from those expected; changes in the legal, regulatory and legislative environments in the markets in which Two Sigma operates; and the ability of management to effectively implement certain strategies. Words like "believe," "expect," "anticipate," "promise," "plan," and other expressions or words of similar meanings, as well as future or conditional verbs such as "will," "would," "should," "could," or "may" are generally intended to identify forward-looking statements.

Two Sigma makes no representations, express or implied, regarding the accuracy or completeness of this information, and the recipient accepts all risks in relying on this report for any purpose whatsoever. This report is being furnished to the recipient on a confidential basis and is not intended for public use or distribution. By accepting this report, the recipient agrees to keep confidential the existence of this report and the information contained herein. The recipient should not disclose, reproduce, distribute or otherwise make available the existence of and/or all or any portion of the information contained herein to any other person (other than its employees, officers and advisors on a need-to-know basis, whom the recipient will cause to keep the information confidential) without Two Sigma's prior written consent. This report shall remain the property of Two Sigma and Two Sigma reserves the right to require the return of this report at any time.

Some of the images, logos or other material used herein may be protected by copyright and/or trademark. If so, such copyrights and/or trademarks are most likely owned by the entity that created the material and are used purely for identification and comment as fair use under international copyright and/or trademark laws. Use of such image, copyright or trademark does not imply any association with such organization (or endorsement of such organization) by Two Sigma, nor vice versa.