



Street View

MARCH 2018

BY GERARDO MANZO

EXECUTIVE SUMMARY

Uncertainty can take on different forms. This *Street View* examines two main, separate types of uncertainty that appear to be relevant for asset allocators: macroeconomic and financial uncertainty. While the former mainly affects commodities, they both have significant implications for global markets.

www.twosigma.com

NEW YORK HOUSTON
LONDON HONG KONG

Inside:
**Beyond the VIX: Alternate Measures
of Macro and Financial Uncertainty**

Last February's sudden spike in the VIX, the implied-volatility index of the S&P500, reminded investors of the unforeseeable and potentially severe nature of market shocks. Although markets seem to have adjusted quickly following that episode, addressing uncertainty still remains one of the top priorities for investors.

It is widely accepted that the VIX is a reasonable proxy for equity market uncertainty.¹ However, the VIX is an incomplete yardstick, measuring only expectations of volatility implied by the S&P 500 (which itself only encompasses a narrow slice of the U.S. equity market). Uncertainty (defined as the conditional volatility of an unforecastable shock) can take on additional forms, however, and its effects can manifest in many other areas of the financial markets. It can relate to macroeconomic activity or financial markets, as well as to [unconventional risks](#), such as geo-political risk or monetary policy risk.

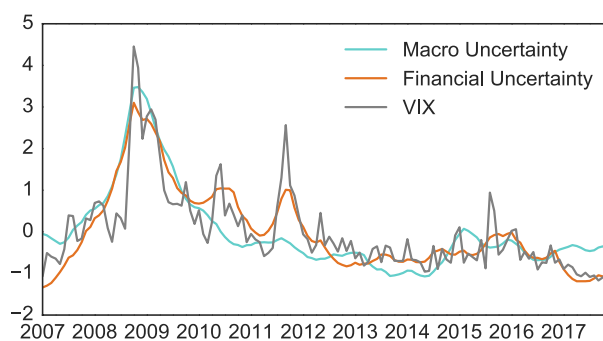
QUANTIFYING MACRO AND FINANCIAL UNCERTAINTY

This *Street View* shows that there appear to be two main, separate types of uncertainty that investors should be aware of when making investment decisions: macro and financial uncertainty. In this setting, uncertainty arises from the unpredictability of multiple economic or financial indicators as a whole, rather than their single dispersion per se.

Using a cross-section of 132 macroeconomic indicators and 147 financial time series related to the U.S. economy,² this *Street View* constructs measures of macro and financial uncertainty following the methodology in Jurado, Ludvigson, and Ng (2015).³ The macro indicators come mainly from the [FRED-MD](#) data set and include data from categories including output and income (e.g., production), labor market (e.g. employment), housing, consumption, orders, and inventories, money and credit (e.g., M1, M2), interest and exchange rates (e.g., T-bill), and finally, prices (e.g., finished goods). The financial uncertainty variables are mainly industry and style factors from [Kenneth R. French's](#) data library.

Each uncertainty indicator is constructed by equally-weighting one-month-ahead forecast errors for each indicator in the two cross-sections. Figure 1 plots the (standardized) macro uncertainty, financial uncertainty, and the VIX since 2007, the period leading to the financial crisis of 2007/09, and shows how they compare with the VIX during the same timeframe.

FIGURE 1 - Macro and Financial Uncertainty and VIX (standardized series since 2007)



Source: Jurado, Ludvigson, Ng (2015) and author's computation.

Since the large spikes at the end of 2008, both macro and financial uncertainty measures have slowly reverted to pre-crisis levels, with the former falling below 2007 levels. While macro uncertainty has remained stable (and higher than financial uncertainty) in recent months, financial uncertainty seems to be trending up, after having declined in the wake of the 2016 U.S. elections.

HOW CAN UNCERTAINTY AFFECT INVESTORS?

Macro and financial uncertainty appear to affect financial markets in different ways. To understand the potential consequences for investors of uncertainty shocks on future asset prices, Figure 2 plots the loadings of a regression of a set of market variables

1 Another widely used proxy for uncertainty is the MOVE (Merrill Lynch Option Volatility Estimate) index, which is the bond market's equivalent of the VIX.

2 A complete list of the data used is available [here](#).

3 Jurado, Kyle, Sydney C. Ludvigson, and Serena Ng. "Measuring uncertainty." *American Economic Review* 105.3 (2015): 1177-1216. They show that these types of uncertainty shocks are more persistent than proxies of stock market uncertainty such as the VIX.

on one-month-lagged values of the two measures of uncertainty.⁴ For ease of comparison, each series is scaled by the standard deviation. Each loading, therefore, represents the correlation coefficients. These market impacts are divided into three categories: market volatility, commodities, and global markets.

The top-left chart shows that financial uncertainty seems to be significantly related to stock and bond markets' implied volatilities (VIX and MOVE, respectively). But financial uncertainty has only shown a roughly 40% correlation with the VIX over this measuring period. Clearly, the VIX doesn't tell the entire story, given the large cross-section of financial indicators used to construct financial uncertainty

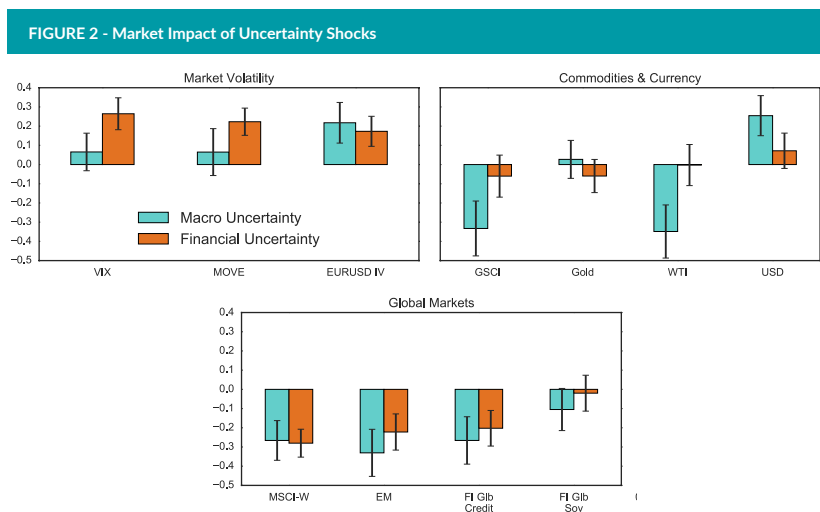
Currency volatility, Figure 2 shows, is positively associated with past (one-month) realizations of both types of uncertainty, reflecting its comparatively strong dependence on macroeconomic fundamentals. Indeed, as shown in the top-right graph, a rise in macroeconomic uncertainty appears to lead to an increase in the return of the USD against a basket of foreign currency, probably driven by a flight-to-quality effect. Moreover, the negative correlation between macro uncertainty and commodities in general, as represented by the S&P GSCI index and WTI oil prices, suggests that returns on commodities are influenced by cyclical economic forces, rather than financial risk.⁵

Finally, the bottom chart reports the impact of both types of uncertainty on global stock and fixed-income markets. Both are nearly equally important for global equity and fixed-income markets, as highlighted by the negative loadings. In the case of global government bonds, the effect of macro uncertainty is pronounced.

IMPLICATIONS FOR INVESTORS

The widespread belief that the VIX alone captures aggregate market uncertainty is inaccurate. It may be a reasonable proxy for financial uncertainty, but it does not adequately capture macroeconomic uncertainty. Macroeconomic uncertainty, instead, appears to be a separate entity with its own impacts on asset prices. For that reason, it deserves attention.

Recent research shows that large, positive macro uncertainty shocks can lead to a sizable and protracted decline in real activity (production, hours, and employment—Jurado, Ludvigson, and Ng (2015)). This *Street View* further illustrates that these shocks also seem to have significant, short-term implications for certain asset prices. Indeed, the latter's apparent link with commodity prices, the USD currency basket, and global government bonds may provide relevant insights for investors who base their asset allocation on macroeconomic scenarios.



Notes: Vertical black lines are 95%-confidence intervals. See Appendix for variable description.
Source: Bloomberg and author's computation.

4 The frequency is monthly and covers the period Jan-2007 to Feb-2018. Errors are corrected using the Newey-West estimator.

5 The similar correlation levels across the commodity index (S&P GSCI) and the oil price (WTI) is potentially due to the index composition that has a large weight on the energy sector (close to 60% as of 2018).

APPENDIX: VARIABLE DESCRIPTION

Series Name	Description	Bloomberg Ticker
<i>VIX</i>	Implied Volatility of the S&P500	VIX Index
<i>MOVE</i>	Implied Volatility of U.S. Treasury market	MOVE Index
<i>EURUSD IV</i>	Implied Volatility of EURUSD	EURUSDV1M Curncy
<i>FI Glb Sov</i>	Barclays Global Government TR Index	LTRTRUU Index
<i>MSCI-W</i>	MSCI World Index	MXWO Index
<i>FI Glb Credit</i>	Barclays Global-Agg Credit TR Index	LGDRTRUU Index
<i>EM</i>	MSCI Emergin Markets	MXEF Index
<i>GSCI</i>	S&P Goldman Sachs Commodity Index	SPGSCI Index
<i>Gold</i>	Gold USD Spot	XAU Curncy
<i>WTI</i>	Generic 1 st Crude Oil WTI	CL1 Comdty
<i>USD</i>	USD against foreign currency basket	DXY Index

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.

“The Fight Against Illegal Deforestation with TensorFlow ” by Topher White

<https://www.blog.google/topics/machine-learning/fight-against-illegal-deforestation-tensorflow/>

Preserving the world's forests has been a priority for conservationists for decades, but illegal logging—particularly in rainforests—has proven difficult to counter. A group of engineers and developers working with the Rainforest Connection has, however, recently introduced a new, AI-based tool to help in the fight. Billed as “the world's first scalable, real-time detection and alert system for logging and environmental conservation in the rainforest,” the small, solar-powered device (made from recycled cell phones) is hidden in trees in threatened areas, and constantly records ambient noise. Using Google's TensorFlow machine-learning framework, the system analyzes the recorded data and can discern and pinpoint sounds of chainsaws or logging trucks, providing a way for authorities to detect illegal logging activity as it happens.

“New Theory Cracks Open the Black Box of Deep Neural Networks” by Natalie Wolchover

<https://www.wired.com/story/new-theory-deep-learning/>

In tasks ranging from language translation to playing Go, computer scientists have produced impressive results using deep neural networks, a type of machine learning approach loosely based on the design on the human brain. In spite of deep learning's successes, however, the exact mechanism by which such algorithms “learn” has remained unclear. But new research from Naftali Tishby, a computer scientist and neuroscientist from the Hebrew University of Jerusalem, may help advance our understanding of what really goes on inside a neural net. He proposes that these systems learn via an “information bottleneck” that “rids noisy input data of extraneous details as if by squeezing the information through a bottleneck, retaining only the features most relevant to general concepts.” While additional research is needed to confirm the findings, Tishby's theory may mark a significant step forward in our understanding of deep neural networks—and lay the groundwork for additional innovation in the field.

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"), and may be 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) may 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.

© 2018 Two Sigma Investments, LP | ALL RIGHTS RESERVED | "Two Sigma" and "2σ" are trademarks of Two Sigma Investments, LP.