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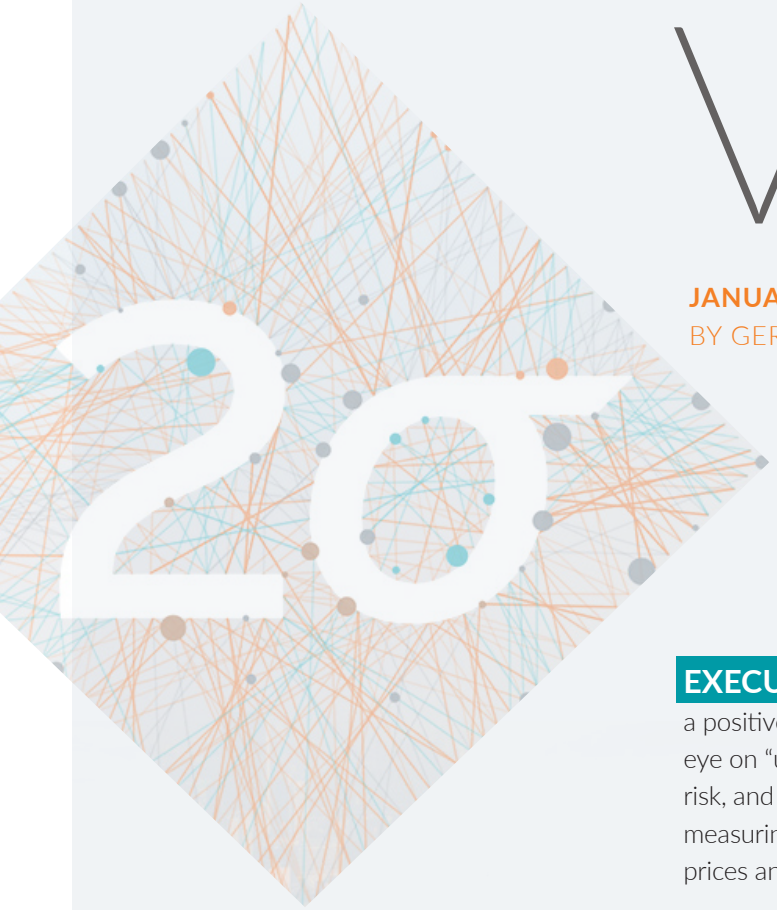

EXECUTIVE SUMMARY Equities have begun the New Year on a positive note globally, but market participants may want to keep an eye on "unconventional" risks, including monetary policy risk, political risk, and geopolitical risk. This issue of *Street View* examines one way of measuring such risks and shows how they may interact with both equity prices and volatility.

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Inside:
Quantifying "Unconventional" Risks in 2018

The year appears to be off to a reasonably positive start for equities globally, following a roughly 21% gain for the MSCI ACWI Index in 2017. Amid a generally favorable U.S. and European macroeconomic background, decent earnings growth, and realized volatility that's approaching 50-year lows, market participants may find it tempting to be sanguine. But they should also be cognizant of important sources of potential "unconventional" risk—that is, risks that aren't directly observable, particularly those of the monetary policy, political, and geopolitical varieties.[1]

On the monetary policy front, the FOMC recently revised its growth projections higher and unemployment forecasts lower, and markets anticipate a series of three (or perhaps even four) rate hikes to come in 2018. Meanwhile, Fed officials appear to be keeping a close eye on inflation, and a new Federal Reserve chair is set to take office next month.

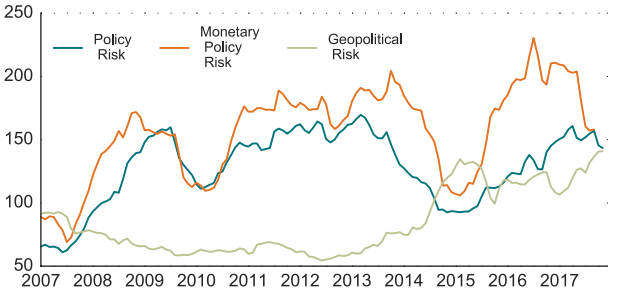
Political risks come in many forms, but most germane to publicly traded companies are those pertaining to fiscal policy (uncertainty around which has been rising, as we recently noted), regulatory changes, healthcare policy changes, infrastructure, and the like. And geopolitical risk remains a perennial concern, whether in the form of armed conflicts, trade disputes, or social unrest.

MEASURING "UNCONVENTIONAL" RISK LEVELS

The December 2017 issue of *Street View* described a method[2] for estimating economic policy uncertainty following Baker, Bloom, and Davis (2016). Similar methods exist for measuring monetary policy uncertainty,[3] firm-level political risk,[4] and geopolitical risk.[5] In summary, these methods parse broad corpora of texts (such as quarterly earnings conference-call transcripts and public news sources) to quantify into an index (displayed in Figures 1) language associated with the respective risks being measured.

As Figure 1 shows, monetary policy and firm-level political risk have been elevated since the aftermath of the global financial crisis, according to these proxies.[6] While both have fluctuated over time and appear to be in a downtrend, they are nevertheless well above their post-crisis lows.

FIGURE 1 - Policy-related uncertainty, monetary policy uncertainty, and geopolitical risk



Note: Each series is smoothed using a rolling average of 12 months. Source: www.policyuncertainty.com

Geopolitical risk, on the other hand, appears to have remained subdued for years following the financial crisis before slowly beginning to climb in the wake of events such as the Arab Spring, the conflict between Russia and Ukraine, turmoil in Venezuela, Brazil, and Argentina, saber-rattling between the U.S. and North Korea, and others. Notably, unlike monetary policy uncertainty and political risk, geopolitical risk is near a 10-year high, with what may be little sign of abating.

1 Policy uncertainty is a measure of uncertainty regarding policy-related macroeconomic variables and federal tax code provisions. Monetary policy uncertainty quantifies uncertainty regarding policy actions and their consequences. Geopolitical risk measures the coverage of actual adverse geopolitical events and risks, such as terrorist acts or the beginning of a war.
2 As outlined on the website policyuncertainty.com
3 Husted, Lucas, John H. Rogers, and Bo Sun, "Monetary Policy Uncertainty," working paper, Board of Governors of the Federal Reserve Board, 2017.
4 Hassan, Tarek A. and Hollander, Stephan and van Lent, Laurence and Tahoun, Ahmed, Firm-Level Political Risk: Measurement and Effects (December 2017).
5 Caldara, Dario and Matteo Iacoviello, "Measuring Geopolitical Risk," working paper, Board of Governors of the Federal Reserve Board, 2017.
6 The risk indices cited generally pertain to the impact of U.S.-related risks on the global economy.

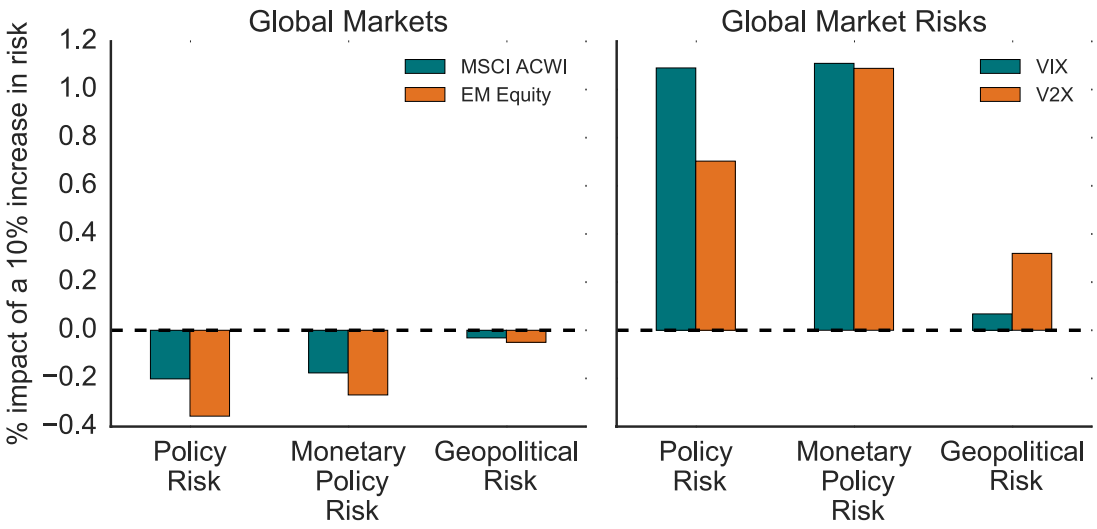
DO "UNCONVENTIONAL" RISKS AFFECT EQUITY PRICES?

Although the political and monetary policy risk measures are U.S.-focused, their impact has the potential to affect global markets and volatility. Regressing the historical performance of global stock indices (MSCI ACWI Index and MSCI EM Index) and U.S. and European volatility indices against the risk factors may provide an idea of their market impact. As Figure 2 illustrates, each is negatively correlated with equity performance, with a larger impact on emerging-market stocks. Their correlation with broad market volatility is positive, with increasing geopolitical risk having a greater impact on European volatility.

IMPLICATIONS FOR INVESTORS

If there is a silver lining to the notion that geopolitical risk is apparently rising, it may be that U.S. equities and the VIX have a history of mostly disregarding it (up to a point, at least). The same cannot quite be said for European volatility, however. And while the other "unconventional" risks appear elevated if not worsening, their impact—particularly on EM equities—has been more pronounced. It therefore would be wise for allocators to keep an eye on these risk levels as we move into 2018 and beyond.

Figure 2 - Impact of a 10% increase in policy-related uncertainty, monetary policy uncertainty, and geopolitical risk on global market performance and volatility.



Note: Monthly data from Feb 1990 to Dec 2017.

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.

"Techmate: How AI rewrote the rules of chess" by Richard Waters

https://www.nytimes.com/2017/11/30/technology/ai-will-transform-the-economy-but-how-much-and-how-soon.html

Chess has long been a favored playground in AI research, with IBM Deep Blue's victory over Gary Kasparov 20 years ago making global headlines and seeming to herald the imminent arrival of truly intelligent machines. AlphaGo's subsequent mastery of the even more complex game of Go seemed to suggest researchers were getting even closer to "general" artificial intelligence. Perhaps most tantalizing of all was the outcome of a game last year between two powerful AI chess engines, Stockfish 8 and Google's AlphaZero. Using a machine-learning technique called reinforcement learning, the latter won an upset after making a highly unusual, aggressive move. What's more, the program was not even a specialized chess algorithm; in fact, it had taught itself the game in just four hours prior to the match, and still it managed to win despite analyzing "only" 80,000 positions per second, versus its competitor's 70 million positions per second. While what we think of as "true" AI may be years off, AlphaZero's victory over a more traditional, brute-force type of learning algorithm would seem to be yet another milestone on the way to a more refined and powerful type of machine intelligence.

"Kernel panic! What are Meltdown and Spectre, the bugs affecting nearly every computer and device?" by Devin Coldewey

https://www.citylab.com/transportation/2017/12/google-street-view-data-demographics-cars-research/547436/

Researchers recently identified two major bugs, Meltdown and Spectre, which together affect virtually every modern CPU. Unlike more common software bugs, these bugs interact with the actual architecture of microprocessors, compromising security in "inviolable spaces where data passes through in raw, unencrypted form, such as inside the kernel, the most central software unit in the architecture, or in system memory carefully set aside from other applications." Although many technology companies—notably large cloud providers—have issued security updates, some architecture-level bugs would require significant CPU redesign to eradicate totally. And with CPUs now embedded in everything from cars and smartphones to toaster ovens, a full fix may be years away.

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