TWO SIGMA

Street View

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EXECUTIVE SUMMARY Two Sigma surveyed its macro Alpha Capture contributors about nine tail risks in today's financial markets. Respondents rank a China hard landing (i.e., GDP growth of less than 3 percent per year) as 1.4 times more concerning than sustained global deflation, but a market liquidity event presents the most imminent threat during the next six months. Each of the nine tail risks could destabilize global asset prices, but emerging-market equities and the euro appear the most vulnerable.

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Inside:

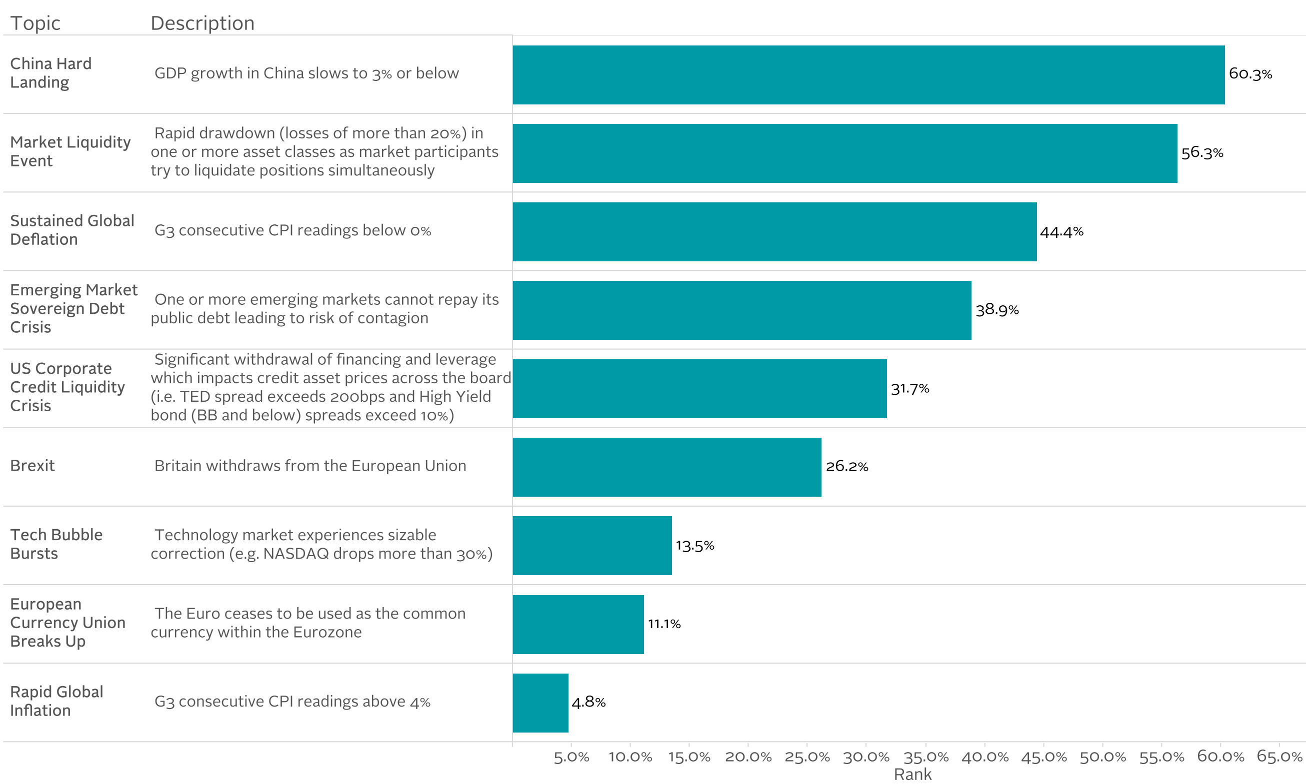
TWO SIGMA MACRO TAIL RISK SURVEY:
CHINA HARD LANDING TOPS LIST OF SELL-SIDE WORRIES

BY THEIR NATURE, TAIL RISKS PROVE CHALLENGING TO QUANTIFY. That does not present an excuse to avoid trying. As scary as many tail risks appear, it seems even more vexing to navigate through the proverbial dark without a flashlight, knowing that painful stumbling blocks abound but ignorant of their potential size and location. One approach to shine a little more light into the darkness is to gather perspectives from other navigators. In other words, tap the “wisdom of crowds.”

The sell-side professionals who contribute to Two Sigma’s Macro Alpha Capture platform constitute one such crowd. These individuals enjoy a unique perspective by sitting at the intersection of their organizations’ research findings and the feedback from their institutional clients. Two Sigma polled many of these macro specialists, and more than 120 responded with their estimates on the probability of nine different tail risks presented to them by the survey, as well as the expected timing of such events, and the probable effect on select asset classes.

Respondents in the survey rank a China hard landing (i.e., GDP growth of less than 3 percent per year) as 1.4 times more concerning than sustained global deflation, but these same respondents consider a market liquidity event as the most imminent threat during the next six months. Each of these nine tail risks could destabilize global asset prices, but the euro and emerging-market equities appear the most vulnerable based on the survey.

CHART 1: MOST FREQUENTLY SELECTED TAIL RISKS



Notes: Number of respondents (n) = 127

RANKING THE RISKS: WHICH TAIL EVENTS MIGHT PRESENT THE GREATEST CONCERN?

The Two Sigma Tail Risk Survey presented a list of nine tail events to sell-side professionals and asked them to select their top concerns. Chart 1 plots the results.

Not surprisingly, respondents (60 percent) cited a hard landing in China, defined as a GDP growth of less than 3 percent per year, as a tail risk that warrants concern. A nearly equal percentage (56 percent) expressed concern about a market liquidity event, or a scenario in which a rapid drawdown of at least 20 percent in one or more asset classes induces market participants to try to liquidate positions simultaneously.

The least intense concerns for respondents include a breakup of the European currency union and rapid global inflation, two risks that first reared their heads during the financial crisis due to the threat of sovereign defaults and central bankers' decisions to adopt unorthodox monetary policy.

Perhaps more interesting than the absolute percentages of respondents who selected a tail risk might be the relative rankings of these tail risks. For example, sustained global deflation (defined as consecutive CPI readings below zero percent in the US, Germany, and Japan) concerns nearly 16 percentage points fewer contributors than a China hard landing does. Similarly, only 26 percent of our respondents classified a UK exit from the EU as a tail risk, even though support among British citizens for a Brexit rose to more than 40 percent in late January,[1] and despite online prediction markets (e.g., Betfair

1 As of 2/4/2016. Source: https://yougov.co.uk/news/2016/01/28/4-point-lead-leave-eu-referendum-and-support-danis/

CHART 2: LIKELY TIMING OF LISTED TAIL RISKS (RANKED BY CONTRIBUTOR)

Average Time Frame for Possibility of Event

Topic	0 to 6 Months	6 to 12 Months	12 + Months	Never
China Hard Landing	18.9%	23.8%	23.5%	33.8%
Market Liquidity Event	24.5%	24.9%	19.5%	31.5%
Sustained Global Deflation	20.4%	22.9%	27.3%	31.3%
Emerging Market Sovereign Debt Crisis	15.1%	27.3%	30.3%	27.8%
US Corporate Credit Liquidity Crisis	21.3%	23.2%	20.3%	35.8%
Brexit	8.6%	24.1%	19.7%	47.9%
Tech Bubble Bursts	18.8%	20.0%	23.2%	37.9%
European Currency Union Breaks Up	4.0%	16.5%	42.0%	37.5%
Rapid Global Inflation	17.5%	37.5%	30.8%	14.2%

0% — 40%

0% — 40%

Notes: Number of respondents (n) = 127

and PredictIt) ascribing an approximately 33 percent probability to this risk materializing.[2] Understanding this relative ranking may help investors better evaluate the risk hedging they want to apply to their portfolios.

Several respondents also contributed their own suggestions for additional tail risks. These concerns included rapid negative or positive changes in global oil prices, unrest in the Middle East, and the election of Donald Trump to the US Presidency. Future Two Sigma Macro Tail Risk Surveys may poll on these suggested topics.

TIMING MATTERS: WHICH TAIL EVENTS APPEAR MOST IMMINENT?

While the consensus among survey respondents is that a China hard landing poses the most serious risk to financial markets, the survey indicated that most believe the prospect to be six months or more into the future (if it occurs at all). Even so, respondents foresee a 19 percent chance of year-over-year Chinese real growth dropping to three percent or lower within the next six months—a drastic drop from the official 6.9 percent rate the Chinese government reported for 2015.

Survey participants believe a market liquidity event poses the most imminent threat, with respondents assigning an almost 50 percent likelihood to such an occurrence within the next year. Respondents estimate the risk of sustained global deflation as being modestly less acute in the near term than over longer time horizons.

2 As of 2/4/2016. Sources: https://www.betfair.com/exchange/plus/#/politics/market/1.118739911; https://www.predictit.org/contract/784/will-the-uk-vote-to-leave-the-eu-by-year-end-2016#data

SIZING THE EFFECTS: WHICH TAIL EVENTS MIGHT AFFECT WHICH MARKETS?

Survey contributors expect large declines in emerging-market equities, energy commodities, and (to a lesser extent), US and non-US developed-market equities in the event that any of the top three tail risk concerns come to fruition. As Chart 3 shows, respondents would expect directionally similar, if less acute, market effects from the majority of tail risks, with the exception of rapid global inflation.

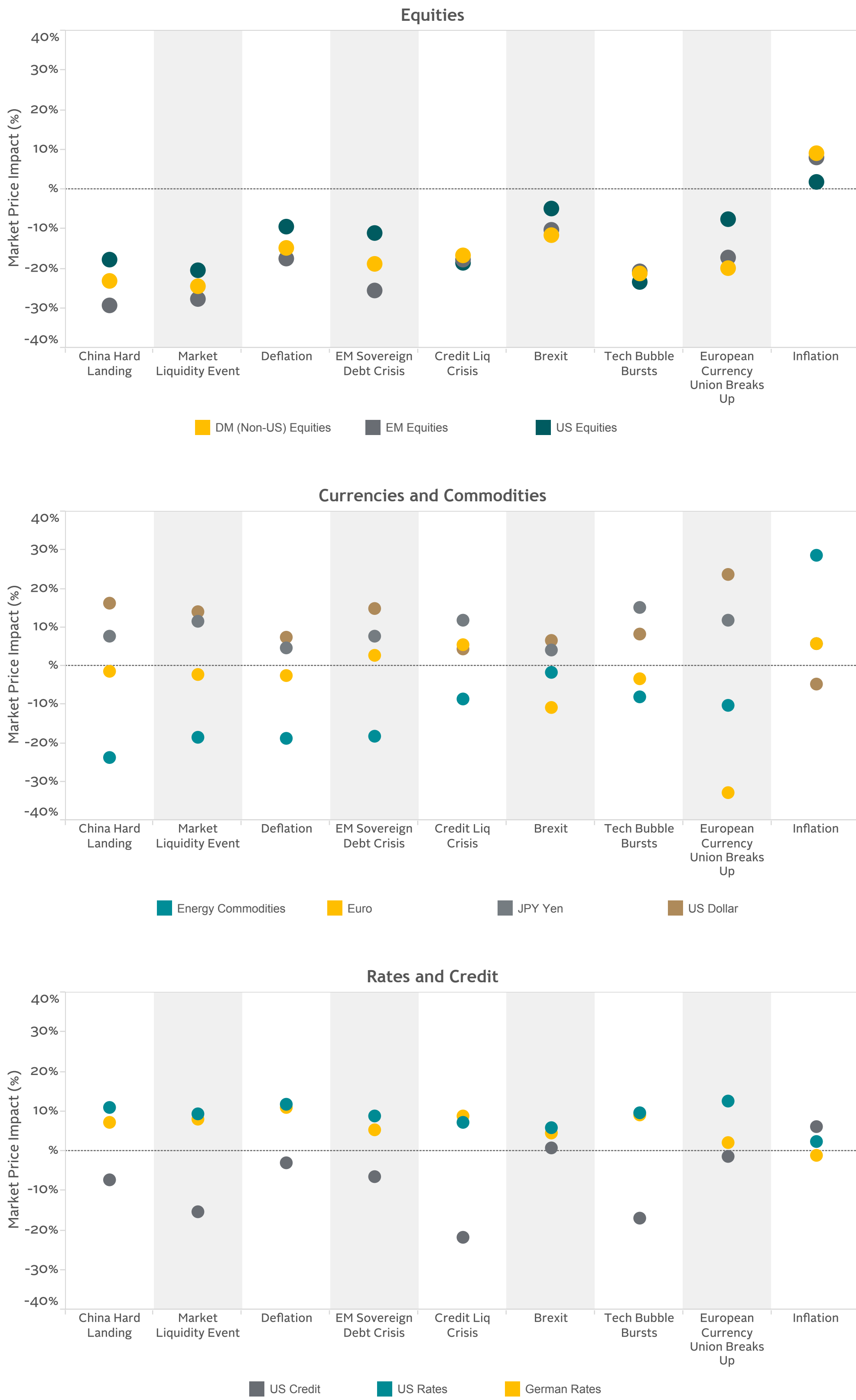
Looking at other markets, contributors expect the US dollar to rise substantially against a basket of global currencies, and US rates and the Japanese Yen to rise more modestly, should virtually any of these tail risk events materialize.

Judging by these results, contributors seem to perceive vulnerability in emerging market equities, an asset class that fell more than 20 percent during 2015 and has continued to slide in early 2016. If Chinese GDP continues to slow and demand for energy and materials decline further—as many respondents expect—export-reliant emerging economies may feel the pain.

ASSESSING THE FED RISK

The January 2016 Two Sigma Macro Tail Risk survey asked respondents for their Federal Funds rate projections for 2016. Last December's "dot plot" shows that Federal Reserve Board members and Bank presidents expect four rate hikes this year, while the market expects less than one (as of February 15, 2016). On average, survey respondents similarly forecast that Federal Funds will be approximately 78 basis points – or two rate hikes – by the end of 2016. At the same time, approximately 70 percent of respondents do not expect the Fed to raise rates at the next meeting in March.

CHART 3: EXPECTED EFFECTS OF TAIL RISK EVENT ON MACRO MARKETS



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POTENTIAL IMPLICATIONS AND A REQUEST

Due to their number, diversity, and varying degrees of interconnectedness, macro tail risks are inherently difficult to quantify. Differing reference frames – e.g., endowments in the US, European pension plans, emerging market focused bond investors, and Asian sovereign wealth funds – make doing so harder still. Nevertheless, Two Sigma's Macro Tail Risk Survey aims to shed light on the characteristics of the most worrisome market stumbling blocks on investors' minds today. The survey seeks to provide insight into the gravity, imminence, and potential effects of these tail risks relative to one another. This information may prove useful for calibrating one's own perceptions against those of the broader population of market participants.

Of course, the informational value of this data increases with larger and more diverse crowds. As such, future iterations of this survey would seek to expand the population of potential respondents. Two Sigma welcomes qualified volunteers to contribute to this survey in the future. In addition to the social benefits of participating, respondents have the opportunity to help shape future surveys including influencing the list of potential tail risks covered by the poll.

APPENDIX

TWO SIGMA MACRO TAIL RISK SURVEY METHODOLOGY

Two Sigma introduced its Macro Tail Risk Survey in September 2015 in an effort to quantify low probability "tail events" that could afflict financial markets. The second survey took place between Jan 19 and Jan 29, 2016, and more than 120 sell-side professionals from the Americas, Europe, and Asia responded. The results described above stem from the most recent survey. Drawn from Two Sigma's Macro Alpha Capture Platform, these contributors work in sales, trading, and research roles at broker-dealer and research firms.

The web-based survey seeks to quantify exogenous market risk events by presenting users with a list of risks for selection and evaluation. Respondents also had the opportunity to write in other tail risks not already listed. Conditional upon the risks selected, contributors then assess the likelihood of each event (excluding the write-in selections) occurring within three time frames, or not at all. Finally, the survey asks contributors to quantify the event's effect on the return of ten macro instruments on a scale from -50 percent to +50 percent. As an addendum to the January survey, respondents may also forecast the Federal Funds rate by the end of 2016 and whether the Fed would act in March.

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.

"Preservationists Race to Capture Cultural Monuments with 3D Images" by Herbert Maschner, *The Conversation,* January 26, 2016 (https://theconversation.com/preservationists-race-to-capture-cultural-monuments-with-3d-images-53536)

Preservation projects have been launching worldwide to capture for posterity the beauty and magnificence of cultural sites and museum pieces in the form of 3D images. Hundreds of global heritage sites have been damaged or destroyed in the past 15 years, underscoring the need for a speedy recording method—even when access to the sites is impossible. Many of the projects have turned to photogrammetry, or the use of photos taken from multiple angles to construct high-resolution 3D models. In some cases, preservationists have crowdsourced photos of destroyed artifacts and historic sites from tourists and US military personnel before stitching them together. And as a preventive measure, a project from the University of South Florida is using 3D imaging to scan entire museum collections and archaeological sites to stay ahead of potential destruction.

"New Ways to Teach Young Children to Code" by Sue Shellenbarger, *Wall Street Journal,* February 9, 2016 (http://www.wsj.com/articles/new-ways-to-teach-young-children-to-code-1455049777)

Near and dear to every modern, competitive parent's heart: how to help children learn to code, even when parents themselves have no idea how to work a computer. This article highlights many of the programs and techniques a parent can employ to make coding fun and help kids develop tech skills. Suggestions include experimenting with Scratch for children aged eight and above. The article warns the ambitious parent not to worry too much about a lack of interest early on; the right tools and a little encouragement can help kids come to see computers not a passive technology but as a platform for creativity and sharing ideas.

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