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BY GERARDO MANZO & JEFFREY N. SARET

EXECUTIVE SUMMARY Recent moves in European financial markets following Mario Draghi's June speech suggest that monetary policy uncertainty remains a key source of risk, at least in the short run. While the effects of monetary policy shocks are not directly observable, an analysis of historical evidence can help quantify the potential impact of such shocks on asset prices.

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Inside:
The Market Impact of Monetary Policy Shocks in Europe

The short-lived mini-"taper tantrum" that followed a recent speech by European Central Bank President Mario Draghi was only the latest instance of markets struggling to react efficiently to monetary policy news. Quantifying the effects of monetary policy shocks on asset prices remains a difficult undertaking, principally because such effects are not directly observable. Regardless, asset allocators routinely must not only handicap a policy shock's probability of occurring, but also of its likely impacts on asset prices.

Academic research such as Rigobon (2003), highlighted in the December 2016 issue of Street View, provides a straightforward approach to modeling the effects of political risk on financial markets. This approach also proves useful in measuring the impact of monetary policy shocks on asset prices. With a meeting of the ECB's Governing Council scheduled for July 20 and policy uncertainty likely to persist well beyond then, the Rigobon method may help provide guidance on likely market reactions should a surprise be in store.

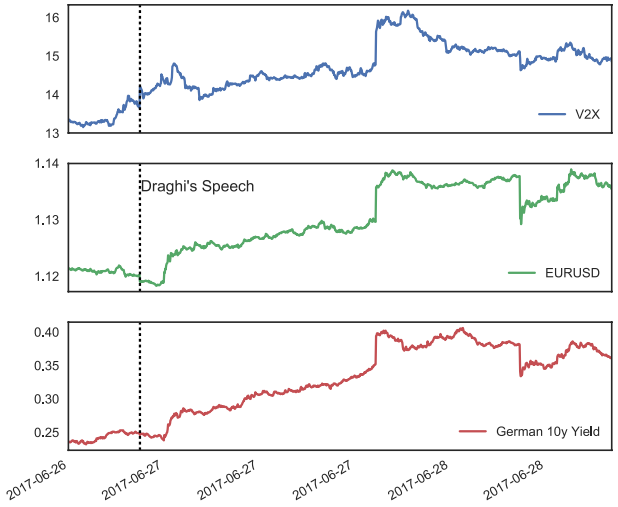
MARKETS REACTED SHARPLY TO DRAGHI'S JUNE 2017 SPEECH

In what was likely meant to be a relatively un-newsworthy speech in Portugal on June 27, 2017, ECB president Mario Draghi briefly sent European markets reeling after noting that "deflationary forces have been replaced by reflationary ones." Investors seemed to interpret the statement as a signal that the central bank aimed to tighten monetary policy soon, by starting to phase out its EUR60 billion monthly asset purchase program.

The market reaction was immediate, with 10-year German bund yields rising 15.5bps, the euro strengthening to its highest level against the dollar this year, and the EURO STOXX 50 Volatility Index (the European VIX, also known as the V2X) jumping 8.2 percent (Chart 1).

By the following day, ECB officials tried to clarify Draghi's speech and suggested that the markets had misunderstood his level of optimism.[1] Asset prices soon stopped their euphoria. However, European equity and fixed income markets remain unsettled.

CHART 1 - INTRADAY LEVELS OF V2X (PERCENT), EURUSD, AND GERMAN 10Y YIELD (PERCENT) FROM JUNE 26, 2017 TO JUNE 28, 2017



Notes: The vertical line is 3.15am EDT (9.15am GMT+1) of June 27, 2017.
Source: Bloomberg.

IMPROVING MACRO DATA INCREASES POLICY UNCERTAINTY

The quick and dramatic reaction to the ECB president's generally reserved speech suggests that investors are skittish. Indeed, it is becoming clearer to many that monetary stimulus will end sooner rather than later. While Eurozone debt levels remain high, growth rates mixed, and inflation still below target levels, other macroeconomic data has been improving, raising the specter of a more hawkish ECB. June's

1 See, for example, https://www.reuters.com/article/ecb-policy-idUSL8N1JP-2WS

IHS Markit Eurozone Manufacturing PMI, for example, showed the fastest rate of expansion for the sector since 2011, and unemployment in the currency bloc has been falling relatively steadily since 2013. These improvements present welcome economic news, but policy uncertainty has increased as a result.

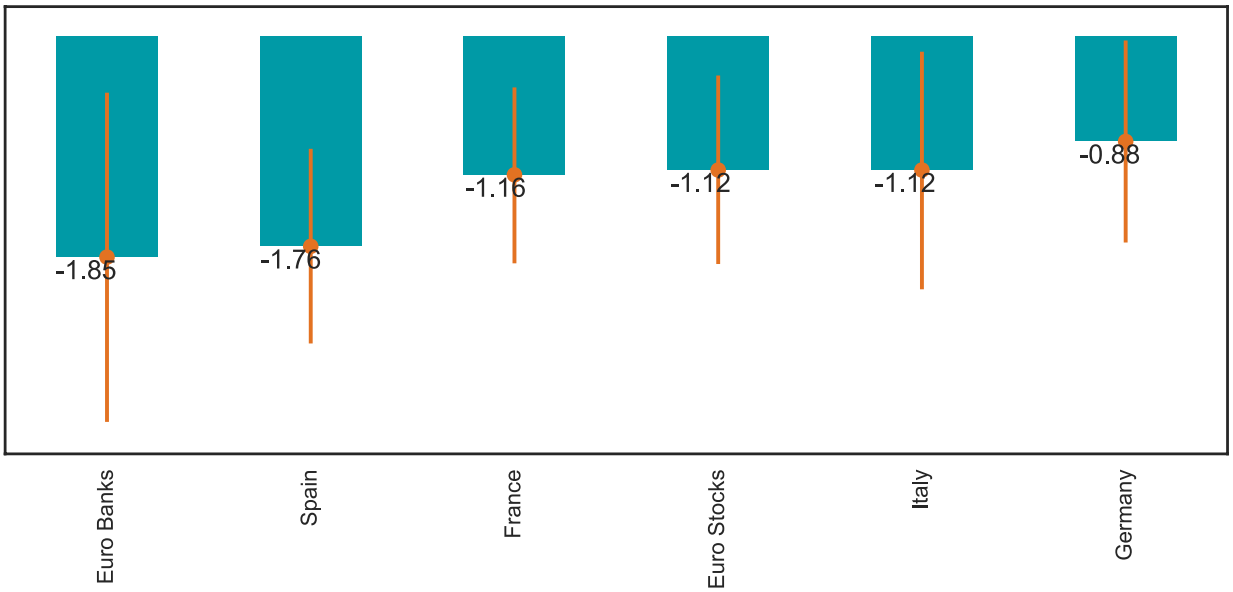
QUANTIFYING POLICY UNCERTAINTY'S POTENTIAL IMPACT ON ASSET PRICES

Monetary policy uncertainty is unobservable; as it mirrors the risk the market perceives about the central bank's actions and consequences. However, Rigobon (2003) provides a methodology to potentially gauge the impact of unobservable risk factors on asset prices without directly quantifying it.[2]

This approach quantifies the market impact by comparing the covariance between at least two variables on ECB meeting days to the covariance several days earlier. While it is impossible to identify the effect of uncertainty on both variables, Rigobon (2003) shows how to quantify the effect on one variable relative to the other. In this case, Chart 2 estimates the effect of uncertainty on equity markets relative to the volatility of the Euro Stoxx 50 (VSTOXX). The chart standardizes the results across instruments by normalizing VSTOXX changes to 10 percent on ECB meeting days.

As Chart 2 shows, a 10 percent increase in volatility would potentially have a large, negative effect on a range of equity indexes and subsectors, especially European bank stocks. Not surprisingly, the effect on German equities appears more muted than other countries. More interestingly, the magnitude of the difference (e.g., -0.88 for Germany and -1.12 for Italy) appears relatively small, suggesting that the dispersion in Eurozone economies has fallen since the peak crisis years.

CHART 2 - IMPACT OF A 10 PERCENT INCREASE IN THE V2X FOLLOWING ECB MEETING DAYS



Estimation over 119 ECB meetings.
Source: Bloomberg and authors' computation.

2 The methodology follows the approach introduced in the December 2016 issue of Street View.

POTENTIAL IMPLICATIONS

The recent moves in the European stock and bond markets following Mario Draghi's June speech suggest that monetary policy uncertainty remains one of the main sources of risk for investors with European equity exposure, at least in the short run. While the effects of policy shocks are not directly observable, an analysis of the historical evidence indicates that shocks have had a meaningful impact on European equity prices.

Asset allocators may want to consider applying the Rigobon (2003) methodology when seeking to quantify their portfolio risks of monetary policy shocks going forward—especially if Eurozone economic data continue to improve and policy uncertainty persists.

REFERENCES

Rigobon, Roberto. "Identification Through Heteroskedasticity" Review of Economics and Statistics 85.4 (2003): 777-792.

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.

"Scientists Used CRISPR to Put a GIF Inside a Living Organism's DNA " by Emily Mullin

https://www.technologyreview.com/s/608268/scientists-used-crispr-to-put-a-gif-inside-living-dna/

A team of Harvard scientists made headlines recently by using the gene-editing system CRISPR to embed the data for an animated GIF into the genomes of living *E. coli* bacteria—and successfully "downloading" it by sequencing the DNA. Lost, perhaps, in some of the coverage was the explanation for *why* anyone would want to store data in DNA in the first place. One reason is that the technique is a scalable and extremely compact way of storing information, which may become an increasingly relevant point as the world continues to generate massive quantities of data. Another reason, the article notes, is that the technique may someday enable "living sensors" that can record and store data on what's happening inside and around individual cells.

"The Vast Majority of Raw Data From Old Scientific Studies May Now Be Missing " by Joseph Stromberg

http://www.smithsonianmag.com/science-nature/the-vast-majority-of-raw-data-from-old-scientific-studies-may-now-be-missing-180948067/

A new study published in *Current Biology* estimates that an alarming amount of the raw data used in older studies is no longer available, raising concerns not about the reproducibility of older studies, but also about the potentially negative effects on future research directions. The authors tried to find the raw data for 516 biology research studies released between 1991 and 2011. They found that more than 90 percent of the data from papers written more than 20 years ago was no longer accessible—and the numbers weren't much better even for more recent papers. The reasons for the seeming disappearance of the data are varied; in some cases, the original researchers had no current contact information. Changing technology have also played a role, however. Frequently, older raw data was saved on outdated storage media, such as Zip or floppy disks, which the original researchers no longer had the hardware to read.

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