TWO SIGMA

Street View

JULY 2016

BY JEFFREY N. SARET & GERARDO MANZO

EXECUTIVE SUMMARY Along some dimensions, Europe's fiscal outlook appears worse today than in March 2012. If this trend continues, asset allocators might expect higher credit default risks and financial shocks that further stress Europe's economic health. Brexit confounds this issue, but the problems predate that decision.

www.twosigma.com

NEW YORK HOUSTON

LONDON HONG KONG

Inside:

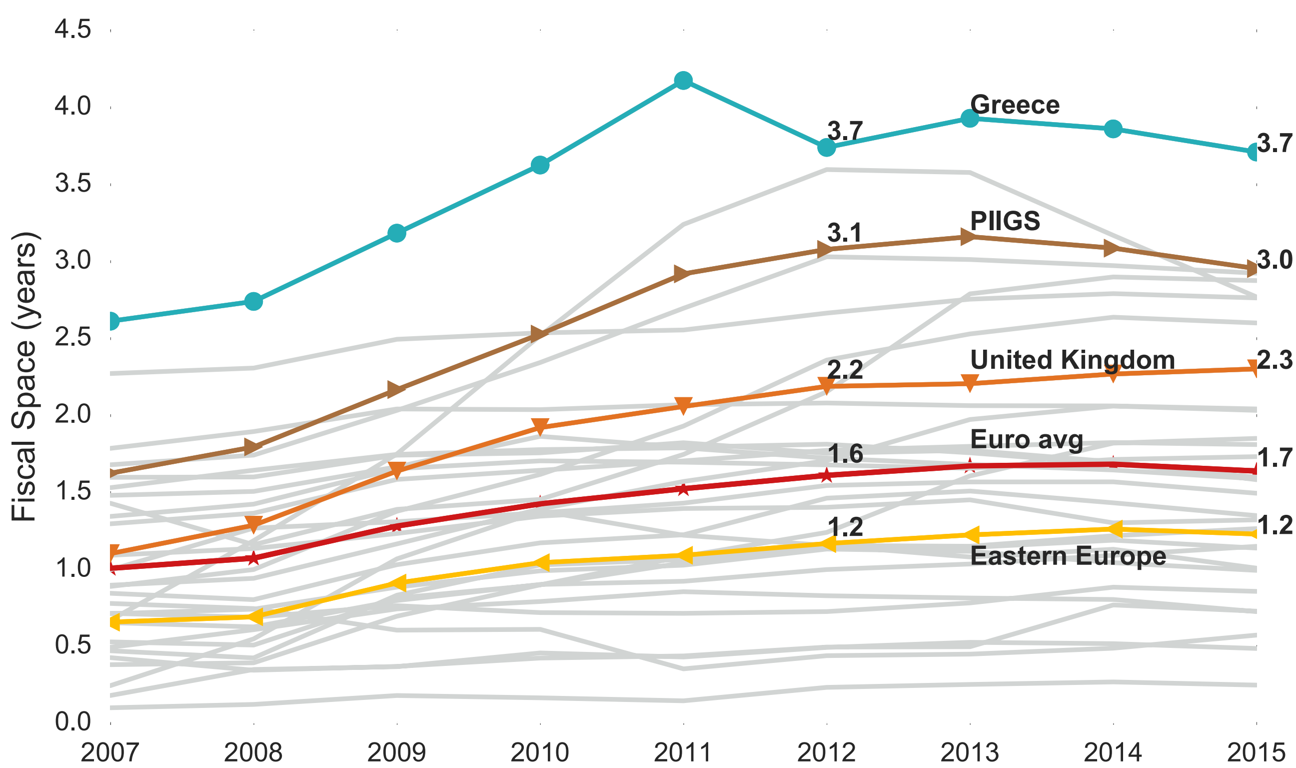
Europe's Worsening Fiscal Space

EUROPE'S WORSENING FISCAL SPACE

Some of Europe's economic vital signs appear worse today than in March 2012, when Greece defaulted on its sovereign debt. Productivity growth during full-year 2015 fell to 0.8 percent per year from a persistently low level (average of 1.8 percent from 2010-2012). Policy uncertainty in June 2016 appears to have increased relative to the 2010-2012 average by nearly a factor of two.[1] Growth and unemployment have improved slightly but remain depressed, and expectations remain low.

Asset allocators might not want to rely on policy makers to help nurse the economy back to health, at least in the near term. Average "fiscal space (FS)," a metric that tries to quantify European governments' ability to offer fiscal stimulus, has deteriorated in the EU since 2012 (see Figure 1). If this trend continues, policy makers may have limited space to stimulate the economy and to absorb financial shocks. As a result, the market might expect higher credit default risks that further stress Europe's economic health, creating a deteriorating cycle. Brexit represents an additional symptom, and its sudden appearance makes Europe's health appear more acute. However, Europe's sickliness extends well beyond Brexit.

FIGURE 1 FISCAL SPACE IN EUROPE



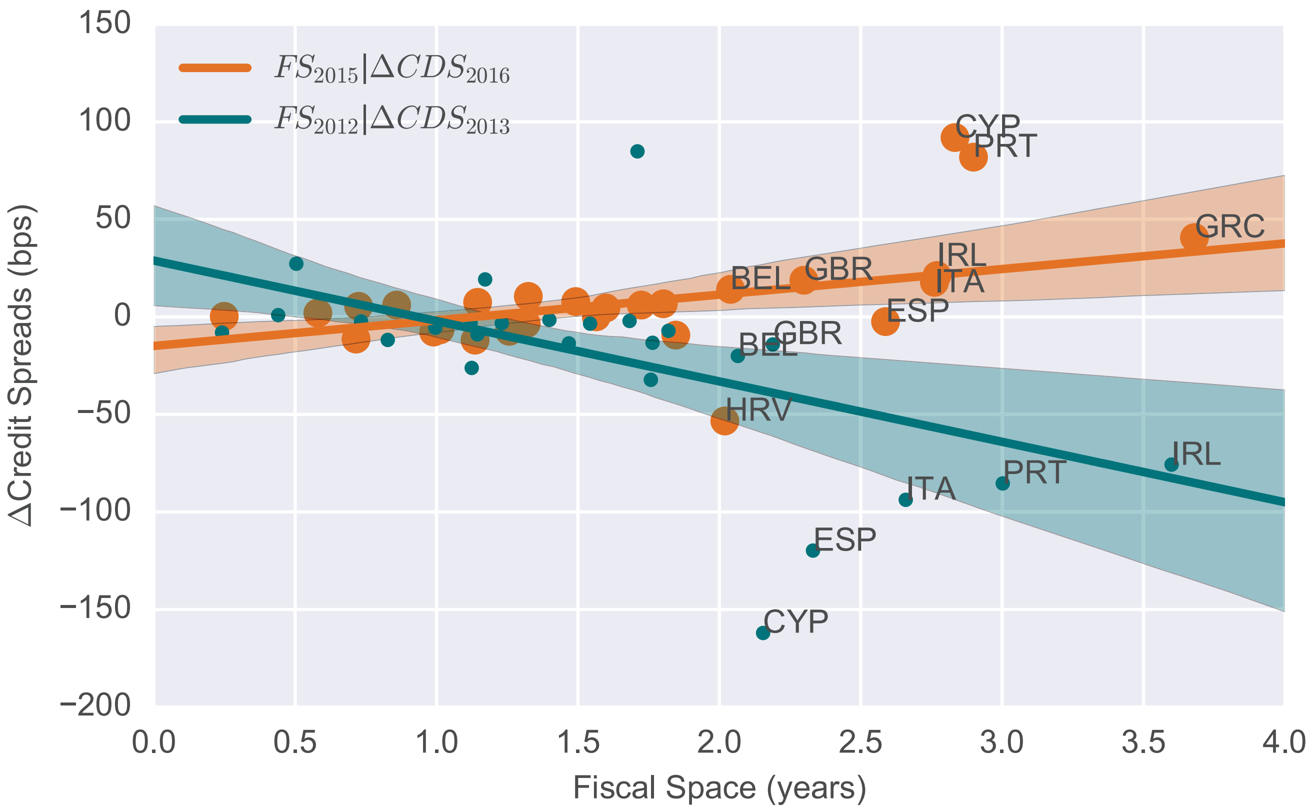
Notes: 2012 and 2015 points labeled for clarity. Sources: Eurostat and authors' computation.

EUROPE'S FISCAL SPACE HAS WORSENED ON AVERAGE SINCE 2012

IMF and academic researchers created the concept of "fiscal space" because traditional metrics of debt sustainability, such as debt/GDP, do not directly account for cross-country political and institutional constraints (e.g., policymakers' ability to raise taxes and tax collectors' ability to fulfill their responsibilities). Fiscal space, which measures the number of tax years required

1 Productivity data from Eurostat. Economic Uncertainty Index data based on Baker, Bloom, and Davis (2016) and downloaded from http://www.policyuncertainty.com/.

FIGURE 2 SOVEREIGN CREDIT RISK AND FISCAL FATIGUE



Notes: Three-letter country code convention. Shaded area represents 90 percent confidence intervals using robust standard errors. Consistent with the academic literature, fiscal space (FS) in a given year uses the average tax revenue relative to GDP for the preceding three years.
Sources: Eurostat, Markit, and authors' computation.

for a country to pay off its public debt, incorporates some of these issues by looking at historical levels of tax receipts normalized by economic output.[2]

Figure 1 plots the fiscal space of 29 European countries since 2007. Between the beginning of the financial crisis in 2007 and 2012, the unweighted average number of tax years required to repay public debt increased by nearly 61 percent across Europe, signaling an overall rise in fiscal fragility. Greece's default in March 2012 helped improve Greece's fiscal outlook, but it did little to improve Europe's. Since 2012, the European average has increased an additional three percentage points.

The economies along Europe's eastern edge exhibit less fragility (i.e., lower fiscal space) than the larger economies in Western Europe, owing to relatively higher growth and smaller debt burdens. This disparity may increase over time. Slower growth following Brexit may worsen the degree of fiscal space in the United Kingdom (2.3 years as of 2015), a country where fiscal space doubled since 2008, when it implemented a bailout program in response to the financial crisis.

FISCAL SPACE MATTERS – THE MARKET ASCRIBES HIGHER DEFAULT RISK TO COUNTRIES WITH WORSE FISCAL SPACE

A country suffering prolonged fiscal stress, potentially unable to commit to its obligations and to support further extraordinary expenses (such as during a banking bailout), raises concerns about its solvency.[3] Credit default swaps appear to price in this risk, at least to some extent. Figure 2 plots the relationship.

The orange line in Figure 2 plots the change in a country's sovereign credit default swap spreads during 2016 against the country's 2015 fiscal space (last year of

2 See, for example, Heller (2005). Aizenman and Jinjarak (2010) describe this metric in more detail. Based on their definition, fiscal space equals public debt divided by tax revenue/GDP. A four-year moving average smoothes business cycle variations in the denominator.

3 See research published by Ghosh et al. (2013) and a working paper by Manzo (a coauthor of this Street View) and Picca (2016).

data available).[4] Not surprisingly, more fiscally strained countries suffered larger increases in their credit risk during 2016.

More interestingly, the relationship between fiscal space and the market's perceived credit risk has changed. The blue line in Figure 2, which plots the same relationship for 2013, has a negative and statistically different slope than the orange (2016) line. Multiple non-exclusive explanations exist that might explain this result. Aizenman and Jinjarak (2010) noted that countries with greater fiscal space proved more willing to bail out their financial sectors, which increased growth expectations and reduced the probability of a short-term credit crisis. The change in slopes across the two time periods might also signify a change in market beliefs about the sustainability of debt. For example, policy makers that once bailed out banks may not prove able to do so in the future. That belief might increase the market risk for some countries (e.g., Greece) more than others.

4 Fiscal space is lagged by one year because of the frequency with which fundamental data is released. The figure shows only countries' names with a fiscal space greater than 2 years.

POTENTIAL IMPLICATIONS

The continued deterioration of the fiscal health of many European countries may not pose as imminent or as acute of a financial risk as Brexit, but it remains a concern. Fiscal policy makers may find that they lack the flexibility to stimulate their economies during periods of economic stress. If the market continues to respond to worsening fiscal space by widening credit spreads, it might spur a negative feedback loop that makes countries' debts even more challenging to manage. With interest rates low and in some cases negative, the option set available to monetary policy makers during a crisis also appears less robust. Europeans might instead hope for productivity improvements or other sources of long-term growth, but that trend has not offered many reasons for optimism. Brexit likely only makes the problem worse.

References

Aizenman, Joshua, and Yothin Jinjarak. "De facto fiscal space and fiscal stimulus: Definition and assessment." *NBER Working Paper* 16539 (2010).

Ghosh, Atish R., et al. "Fiscal fatigue, fiscal space and debt sustainability in advanced economies." *The Economic Journal* 123.566 (2013): F4-F30.

Heller, Peter S. "Understanding fiscal space." *IMF Policy Discussion Paper* (2005).

Manzo, Gerardo, and Antonio Picca. "The impact of sovereign shocks." *Working paper, Available at SSRN 2524991* (2016).

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.

"Would You Let An Algorithm Manage Your Relationships?" by Tim Maughan June 20, 2016 (http://www.bbc.com/future/story/20160617-would-you-let-an-algorithm-manage-your-relationships?ocid=global_future_rss)

Move over Cyrano de Bergerac – now an app can craft your emails with the appropriate amount of pathos. While some people routinely ask their friends for advice responding to a social email, researchers have designed software to crowdsource such guidance for you. Another, similar application in development, combining advances in computer vision research with linguistic analysis, will critique your video chat conversation in real-time, suggesting improvements along the way. Not surprisingly, such apps, although often offered with tongue firmly in cheek, have raised concerns about the overreach of machines in daily human interaction. Millennial testers, however, seemed particularly open to the new self-help solutions.

"Control Your Smartphone With Your Eyes" by Rachel Metz July 1, 2016 (https://www.technologyreview.com/s/601789/control-your-smartphone-with-your-eyes/?set=601831)

Researchers are crowdsourcing eye movements to help teach software to detect phone user's gaze, a task that's typically expensive and cumbersome, at best. The large set of gaze-volunteers (1,500, with plans to grow to 10,000) combined with a machine learning algorithm can circumvent the hardware and time constraints typically required to program this information. The scientists are hoping that this technology could eventually help to diagnose conditions like schizophrenia and concussions. It also means that we are closer to being able to use our eyes to play games and navigate our phones—giving humans of the near future one more reason to stay glued to our devices.

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.