Journal of Monetary Economics 82 (2016) 1–19

Contents lists available at ScienceDirect

Journal of Monetary Economics

journal homepage: www.elsevier.com/locate/jme

Surprise and uncertainty indexes: Real-time aggregation of real-activity macro-surprises ☆

Chiara Scotti *

Federal Reserve Board, 1801 K Street, NW, Washington, DC 20006, United States

ARTICLE INFO

Article history:
Received 9 January 2015
Received in revised form
8 June 2016
Accepted 8 June 2016
Available online 18 June 2016

Keywords:
Business cycle
Dynamic factor model
State space model
Forecasting weights

ABSTRACT

Two daily, real-time, real-activity indexes are constructed for the United States, euro area, United Kingdom, Canada, and Japan: (i) a surprise index summarizing recent economic data surprises and measuring optimism/pessimism about the state of the economy, and (ii) an uncertainty index measuring uncertainty related to the state of the economy. The surprise index parsimoniously preserves the properties of the underlying series when affecting asset prices. For the United States, the real-activity uncertainty index is compared to other uncertainty proxies to show that, when uncertainty is strictly related to real activity only, it has a potentially milder effect on economic activity.

Published by Elsevier B.V.

1. Introduction

Parsimonious measures of macroeconomic surprises and proxies of economic uncertainty have been of great interest over the past several years. A new methodology is proposed in this paper to construct two real-time, real activity indexes: (i) a surprise index that summarizes recent economic data surprises and measures deviation from consensus expectations and (ii) an uncertainty index that measures uncertainty related to the state of the economy. The indexes, on a given day, are weighted averages of the surprises or squared surprises from a set of releases, where the weights depend on the contribution of the associated real activity indicator to a business condition index *à la* Aruoba et al. (2009). The surprise index measures whether agents are *ex-post* more optimistic or pessimistic about the real economy than indicated by actual data releases.[1] A positive (negative) reading of the surprise index suggests that economic releases have on balance been higher (lower) than consensus, meaning that agents were more pessimistic (optimistic) about the economy. The uncertainty index measures how uncertain agents are *ex-post* about current real activity conditions. A greater (smaller) reading of the uncertainty index suggests that agents have on balance been more (less) uncertain about the state of the economy. This methodology is applied to construct indexes for the United States, euro area, the United Kingdom, Canada, Japan, and an aggregate of the five countries over the 2003–2016 period.[2]

☆ The views expressed in this paper are solely the responsibility of the author and should not be interpreted as reflecting the view of the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System.

* Tel.: +1 202 452 3827.
E-mail address: chiara.scotti@frb.gov

[1] *Ex-post* optimism or pessimism differs from *ex-ante* optimism or pessimism. Considering the weather, for example, the optimal, model-consistent forecast for the temperature tomorrow could be 15 degrees Fahrenheit. A person could be ex-ante optimistic and expect it to be 20 degrees Fahrenheit. If the forecast turns out to be wildly wrong, and the temperature turns up to a toasty 25 degrees, that person was still ex-ante optimistic, even though, ex-post, her forecast looks pessimistic. Ex-post optimism or pessimism is neither necessary nor sufficient to say anything about ex-ante beliefs. Another definition that captures these measures well is *realized* optimism or pessimism.

[2] The indexes continue to be updated and are available from the author upon request or at chiarascotti.com.

http://dx.doi.org/10.1016/j.jmoneco.2016.06.002
0304-3932/Published by Elsevier B.V.

The Aruoba, Diebold, and Scotti (ADS) index maintained by the Federal Reserve Bank of Philadelphia has proven to be a successful economic indicator and as such it has been classified by the Wall Street Journal as being among the 50 economic indicators that really matter (Constable and Wright, 2011) and has been added to Bloomberg's real-time data that can be followed on its platform (ADS BCI Index).[3] The ADS index measures the state of the economy and serves as a summary statistic of the information that market participants have received thus far about real activity. However, in efficient markets, asset prices react to *new* information. Thus it is important to measure the surprise component of the information that has just arrived and the uncertainty surrounding that information. To this end, the surprise index presented here aggregates the information contained in the surprises to construct a summary measure of the deviation of the real economy from consensus expectations, and the uncertainty index quantifies economic uncertainty, which is otherwise challenging to measure. The indexes are not competitors but complements to existing business condition indicators such as the ADS index and to existing uncertainty indexes.

This paper relates to several branches of the literature. First and foremost is the uncertainty literature, which has thrived in recent years. Because uncertainty is not observable, a number of proxies have been used to measure it, ranging from stock market realized and implied volatilities (Bloom, 2009), to the cross-sectional dispersion of survey-based forecasts (Bachmann et al., 2013), the frequency of newspaper references to economic policy uncertainty (Baker et al., forthcoming), and the common variability in the purely unforecastable component of the future value of a big number of variables (Jurado et al., 2015). However, these measures tend to combine economic uncertainty with other notions. For example, stock return volatility combines information about stock market volatility with economic uncertainty, and forecast disagreement could measure a divergence of opinions among forecasters rather than just the underlying uncertainty about the economy. My paper contributes to this literature by providing a *daily* macroeconomic information uncertainty measure which quantifies the part of uncertainty that specifically relates to the state of the real economy. It also contributes by helping to disentangle the effect of purely macro-uncertainty from more general uncertainty. The index is daily in that it gets updated every time new information about the state of the economy gets released. Second, this paper relates to those papers that study the effect of news surprises on asset prices, such as Andersen et al. (2003, 2007), and Gilbert et al. (2015), and contributes to this literature by providing a parsimonious summary measure of real-activity macroeconomic surprises. Also relevant are papers that use similar factors models to extract a business condition index (Aruoba et al., 2009, and Banbura et al., 2010, among others). The idea of forecasting weights developed in Koopman and Harvey (2003) and applied in Banbura and Runstler (2010) and Camacho and Perez-Quiroz (2009), among others, will be used here to study the impact of news releases on GDP forecast revisions.

In order to construct the surprise and uncertainty indexes, a dynamic factor model is employed to estimate monthly business condition indexes for the aforementioned countries and to compute the weights representing the contribution of the economic indicators to these business condition indexes. Those weights are then used to average the surprises or squared surprises in order to construct the surprise and uncertainty indexes, respectively. The weights depend on the time elapsed since the release of the associated information and the unbalancedness pattern of the underlying releases. The former is a time decay feature that reduces the contribution of each surprise over time. The latter is a missing data characteristic that sets to zero the contributions of an indicator in months in which no data is available.

I find that surprise indexes tend to be negative during the recession associated with the 2008 financial crisis, the so-called Great Recession, suggesting that agents were more optimistic about the real economy than warranted.[4] There appear to be other episodes when the indexes are negative. Of note are several declines in the euro-area surprise index after 2011, the sharp drop in the Japanese surprise index after the March 2011 earthquake, and the prolonged low levels of the U.K. index in 2010 and 2011. There are also several instances where the surprise indexes are positive, especially coming out of the recession in the United States, the United Kingdom and Canada. The surprise index preserves the properties of the underlying series when affecting asset prices, with the advantage of being a parsimonious summary measure of real-activity surprises. In light of this, Demiralp et al. (2016) make use of it as a control variable when investigating the effects of political commentaries on policy rate decisions and policy expectations in the United States and the euro area, and find it to be a significant determinant of policy expectations. Similarly, Brunetti et al. (forthcoming) employ it as a control variable in studying the impact of speculation activity in the crude oil market.

The uncertainty indexes tend to be higher during recession periods. Interestingly, the euro-area uncertainty index reaches its highest values just before and after the 2008–2009 recession, suggesting that agents were more uncertain about the economy as the euro area was entering and exiting the recession. The *daily* U.S. uncertainty index looks somewhat similar to the U.S. stock market implied volatility as measured by the VIX. Implied volatility, a forward-looking measure, is computed from option prices. The uncertainty index, a historical measure, is calculated from current and past macroeconomic news surprises. The former is a wider measure that combines information about risk aversion and future stock market volatility/uncertainty, and to the extent that these two move with news surprises, the VIX also contains information about current and future economic uncertainty. The VIX is also decomposed following Bakaert et al. (2013) into stock market uncertainty and variance risk premium, and it is found that the VIX patterns are mainly driven by the Bakaert et al. (2013)

[3] The updated ADS index can be found at http://www.philadelphiafed.org/research-and-data/real-time-center/business-conditions-index/.

[4] Unfortunately, it is not clear whether this is a characteristic of all recessions because the surprise indexes only start in 2003 and hence only cover one recession episode. Expectation data are available from Bloomberg for all countries since 2003.