

Economics Group

Special Commentary

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Quantifying Monetary Policy Uncertainty: A New Index

“Not everything that counts can be counted, and not everything that can be counted counts.” – Albert Einstein

Executive Summary

Financial, political and economic uncertainties impact the path of monetary policy and may cause the Federal Open Market Committee (FOMC) to keep rates on hold longer than expected. At its December 2018 meeting, the FOMC’s Summary of Economic Projections (SEP)’s dot plot indicated two rate hikes for 2019. The FOMC hiked the fed funds rate four times in 2018. But, despite a pick-up in growth, muted inflationary pressures have kept the FOMC “patient” thus far in 2019.

In this report, we develop a new index to quantify monetary policy uncertainty, the *MPU-index*. To construct the MPU-index we utilize the Dynamic Factory Modeling (DFM) approach. Our index gauges economic, financial and political uncertainties to help decision makers accurately foresee the future path of monetary policy.

We identify seven (quantifiable) measures of monetary policy uncertainty: (1) probabilities of the FOMC’s rate decision, (2) inflation outlook probabilities, (3) business cycles/growth outlook probabilities, (4) the S&P500 index, (5) the yield spread, (6) the CBOE volatility index (VIX) and (7) the economic policy uncertainty (EPU) index.

Our model, which is fitted with data going back to 1970, gives us an opportunity to evaluate its historical performance during various business cycles and political environments. To analyze our model’s performance, we compare variations in the index to shifts in the monetary policy. For example, during the most recent business cycle, the MPU-index bottomed out in Q2-2017 then rebounded in the next quarter. The trend suggests increased policy uncertainty. Therefore, the FOMC’s shift to pause in 2019 is consistent with our MPU-index’s movements.

In this report, we estimate the statistical association of the MPU-index with changes in monetary policy, and we will highlight key drivers in a follow-up report.

A Theoretical Framework of Monetary Policy Uncertainty

To set monetary policy, the FOMC monitors financial markets, political developments, the labor market and price stability. Any uncertainty in these sectors could alter the monetary policy stance. In theory, if inflation falls below the FOMC’s target, the Committee would keep rates steady to combat softer-than-expected inflationary pressures.

At the December 2018 FOMC meeting, the SEP’s dot plot indicated two rate hikes in 2019. Though, due to changes in the economy, the Fed refrained from hiking rates. Currently, the target range of the fed funds rate remains unchanged from December and we expect the Fed to refrain from raising rates this year. Although growth has picked up over the past month, inflation has not followed. The Committee downgraded its read on inflation, noting that it is running below its 2% target. With stubbornly low inflation, the FOMC is expected to continue a “patient” stance.

Any shock (internal or external) to the economy would increase current monetary policy uncertainty. Depending on the source of the uncertainty, it may produce a heterogeneous effect on policy. Our method is to identify major sources of uncertainties and combine the sources into an index using the Dynamic Factory Modeling (DFM) approach.

We develop a new index to quantify monetary policy uncertainty.

Our method is to identify major sources of uncertainties and combine the sources into an index using the DFM approach.



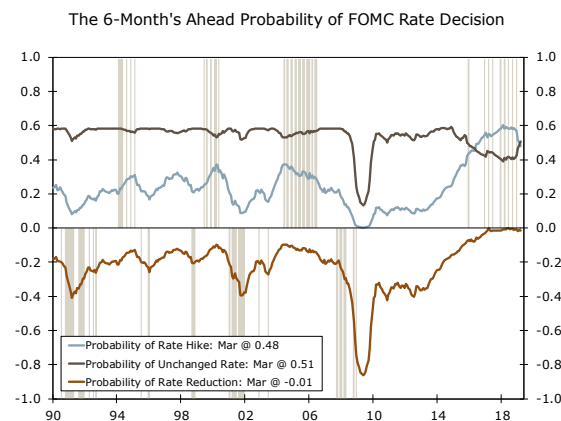
Key Drivers of the Monetary Policy Uncertainty Index

In the past we developed an ordered probit model that predicts the probability of the FOMC's rate decision. The model estimated the six month's ahead probability of three scenarios—raise the federal funds target rate (FFTR), reduce the rate or keep the rate unchanged.¹ Our model was useful for policymakers, investors and consumers who could attach the probability with scenarios of future FFTR trends.

The simulated out-of-sample probabilities are plotted in Figure 1. The shaded bars above the zero-line indicate that the FOMC increased its target for the fed funds rate, while the bars below the zero-line show a reduction in the target rate. The blank area, between January 2009 and September 2015 for instance, shows that the FOMC did not change the target rate.

The ordered probit model consistently predicted the FOMC's decision of a rate hike in the sample period. The probability of raising rates were higher than the probability of reducing rates during the September 2003 and September 2006 time period. This was consistent with the FOMC's behavior as it followed a contractionary monetary policy between June 2004 and June 2006. The FOMC raised its target for the FFTR during most of the June 2004—June 2006 period. Therefore, the model should accurately predict the current monetary policy stance and capture economic uncertainties.

Figure 1

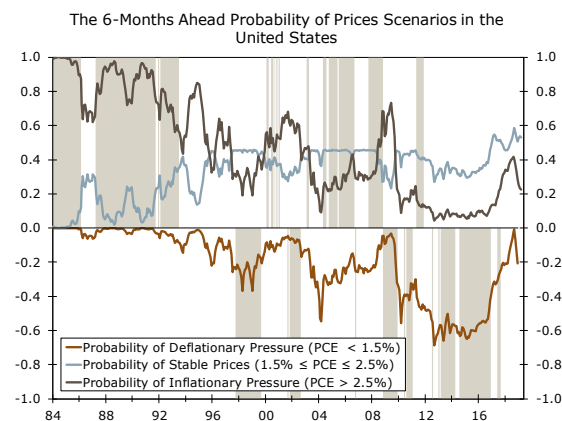


Source: IHS Markit and Wells Fargo Securities

We also developed ordered probit models to estimate the six-month and two-quarter's ahead probabilities of inflationary/deflationary pressure and price stability.² The output of these models are shown in the Figures 2 and 3. In Figure 2, the shaded bars above the zero-line indicates that the PCE deflator growth rates exceeded 2.5%, while bars below the zero-line represent periods of deflationary pressure (period in which PCE deflator growth rates were below 1.5%). The regions with no shaded bars show prices were stable (PCE inflation remained in a range of 1.5% and 2.5%). In a simulated real-time analysis, our model predicted each inflationary environment accurately and can therefore be used as a reliable estimate of the current and near-term inflation outlook.

The inflation outlook is an important element of the FOMC's rate decision. In recent FOMC statements, the Committee's inflation expectations remained low and appeared to be more constructive on recent global developments. Therefore, the probabilities of the three price scenarios capture inflation-related uncertainty which will assist in predicting the monetary policy stance.

Figure 2



The ordered probit model consistently predicted the FOMC's decision of a rate hike in the sample period.

Our model is a reliable estimate of current and near-term inflation outlook.

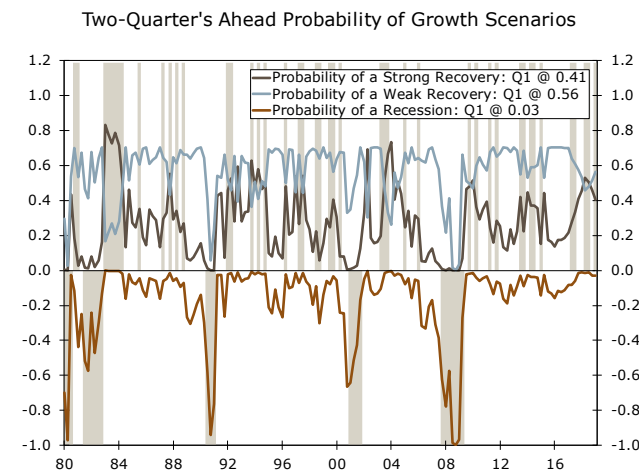
¹ Predicting the Probability of FOMC Rate Decisions: An Ordered Probit Approach. The report was published on June 04, 2014 and available upon request.

² See "Predicting the Probability of Inflation/Deflation: An Ordered Probit Approach" (February 17, 2014) available upon request and "[Predicting the Probability of Recession and Strength of Recovery: An Ordered Probit Approach](#)" (July 19, 2016).

The simulated two-quarter growth-scenario probabilities for the Q1-1980 to Q1-2019 period are plotted in Figure 3. The shaded bars above the zero-line represent strong recoveries, below the zero-line indicates recessionary periods and non-shaded gaps show GDP growth rates were in the weaker recovery zone. Our probit model successfully predicted all recoveries (stronger/weaker) and recessions in our out-of-sample period, allowing us to use it as a proxy for business cycle related uncertainties.

Our probit model predicted all recoveries and recessions successfully in our out-of-sample period.

Figure 3



Source: IHS Markit and Wells Fargo Securities

The MPU-index includes the following four predictors that drive policy decisions: the S&P 500 index, the yield spread, the Conference Board's index of leading indicators (LEI) and the CBOE volatility index (VIX) index. The S&P 500 index serves as a proxy for the financial sector while the yield spread is included to represent uncertainties within the credit market. VIX serves as a reliable measure of investor sentiment and financial market volatility within our model.

Additionally, economic and political policies drive monetary policy. For example, the recent escalation of the U.S.-China trade war has skewed risks to U.S. GDP to the downside. For that reason, we use the economic policy uncertainty index created by Baker, Bloom and Davis to measure movements in policies related to monetary policy uncertainty.³

A New Monetary Policy Uncertainty Index: A DFM Approach⁴

We identify seven (quantifiable) measures of monetary policy uncertainty: (1) probabilities of the FOMC's rate decision, (2) inflation outlook probabilities, (3) business cycles/growth outlook probabilities, (4) the S&P500 index, (5) the yield spread, (6) the CBOE volatility index (VIX) and (7) the economic policy uncertainty (EPU) index. See the Appendix for additional details.

The DFM approach is utilized to construct the MPU-index.

Our model, which is fitted with data going back to 1970, gives us an opportunity to evaluate the historical performance of the MPU-index during various business cycles and political environments. On average, a persistent MPU-index trend is associated with a policy change (Figure 4). For instance, the index spiked during each of the past seven recessions since 1970, consistent with a coming change in the policy stance. Similarly, the MPU-index trended downward during expansionary periods while the fed funds rate rose in the cycle (Figure 5).

The data indicates that FOMC behavior is consistently in-line with our model. For example, the FOMC first cut the fed funds rate in Q1-2001 and continued to cut until Q3-2003, in-line with our index, which remained positive from Q1-2000 through Q1-2003. Our index turned negative just before the Fed changed its policy stance leaving rates unchanged at the Q3-2003 meeting.

³ For more detail about methodology and application of the economic policy uncertainty index, see the [Economic Policy Uncertainty website](#)

⁴ For detail about the Dynamic Factor Modeling Approach, please see the Appendix of this report.

Similarly, in Q2-2006 the index jumped to -0.32 from -0.64 the previous quarter, and the FOMC left the fed funds rate unchanged between Q3-2006 and Q2-2007.

One noticeable observation is that the MPU-index's highest point was reached in Q4-2008 (+2.26) which shows uncertainty related to the Great Recession. In December 2008 the FOMC cut rates to an unprecedented low (range of 0 to 0.25%), which marked the first time the Fed cut rates below 1.00%. During the 2009-2011 period the index was volatile, meaning a change to the existing policy stance may be necessary. The FOMC introduced several rounds of quantitative easing (QE) during this period to jump start the recovery from the Great Recession.⁵

Another observation from the results is that the MPU-index fell into negative territory starting in Q3-2012. At the June 2013 meeting, the Fed announced the possibility of scaling back ("tapering") the QE program. The index also consistently followed a downward trend in 2014-2017, and in December 2015 the Fed raised interest rates for the first time in the post Great Recession era.

Recently, the MPU-index bottomed-out in Q2-2017 at -0.84. The index remains in negative territory, but the trend has shifted. The rebound in the trend suggests the FOMC's shift to pause in 2019 is consistent with our MPU-index.

The index consistently followed the downward trend in 2014-2017.

Figure 4

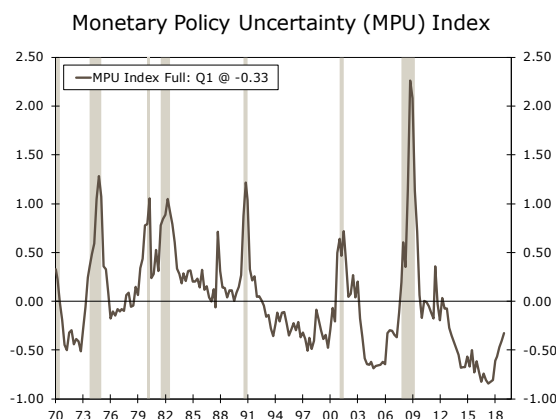
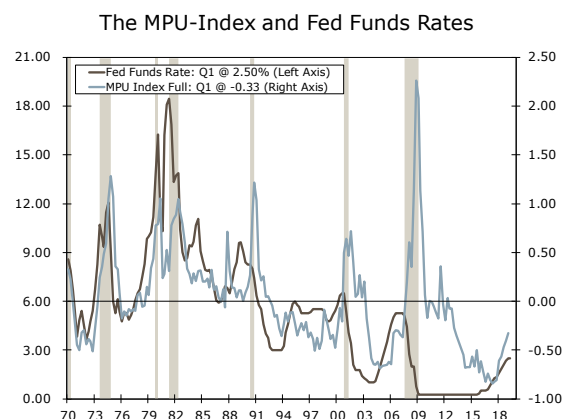


Figure 5



Source: Federal Reserve Board, IHS Markit and Wells Fargo Securities

Conclusion: Spotting the Invisible

The MPU-index is able to accurately gauge economic uncertainties that effect monetary policy and its potential sources. Our new index is consistent with monetary policy changes and could help decision makers design effective policies. In a future report, we will provide formal (statistical) evidence of a relationship between the MPU-index with monetary policy and the economy, while highlighting the key drivers of the index.

The MPU-index is able to accurately gauge economic uncertainties that effect the monetary policy.

⁵ In November 2010, the Fed announced a second round of QE (QE2) and a third round (QE3) was announced on September 13, 2012.

Appendix: Dynamic Factor Modeling Approach

The original dynamic factor modeling (DFM) approach dates back to the 1970s (Sargent and Sims 1977) and, during the 1990s, Stock and Watson (1999) improved the original DFM method by utilizing advanced estimation techniques.⁶ The fundamental assumption of the DFM approach is that each economic variable can be decomposed into a common factor component plus an idiosyncratic component. The common component is driven by dynamic factors underlying the entire economy.⁷ Stock and Watson showed that, with reasonable assumptions, principal component analysis (PCA) can be used to estimate these components consistently.

The Federal Reserve Bank of Chicago (Chicago Fed) followed the Stock-Watson approach and produced a national economic activity index for the U.S. economy, known as the Chicago Fed National Activity Index (CFNAI).⁸ The CFNAI is a weighted average of 85 economic indicators. The index extracts the principal component from the variables and uses it as a representation of national economic activity.

We followed the Stock-Watson and the Chicago Fed approaches to extract the principal component from seven variables and use as a representation of the monetary policy uncertainty.

Using the DMF approach, let X_t be the n -dimensional vector of the time series variables, observed for $t=1,2,\dots,T$. X_t is transformed to be stationary, if not stationary at level. For notational simplicity, we also assume that each series has a mean of zero. To reduce the dimension, we represent X_t with \bar{r} and common dynamic factors f_t .

$$X_t = \rho_i(L) f_t + \varepsilon_{it} \quad (1)$$

For $i=1,2,\dots,N$, where $\varepsilon_{it}=(\varepsilon_{1t}, \varepsilon_{2t},\dots,\varepsilon_{Nt})$ is a $N \times 1$ idiosyncratic disturbance. $\rho_i(L)$ is a lag polynomial in non-negative powers of L and is modeled as having finite orders, at most, s .

$$\rho_i(L) = \sum_{j=1}^s \rho_{ij} L^j .$$

The finite lag assumption permits rewriting (1) as

$$X_t = \Lambda F_t + \varepsilon_t \quad (2)$$

Where $F_t = (f'_t, \dots, f'_{t-s})'$ is an $r \times 1$ vector of common factors, where $r \leq (s+1)\bar{r}$. The i -th row of the Λ ($\rho_{10}, \rho_{11}, \dots, \rho_{is}$) is a matrix of factor loadings.

The key advantage of this static form is that the unobserved factors can be estimated consistently as $N, T \rightarrow \infty$ jointly by taking the principal components of the covariance matrix of X_t , provided mild regularity conditions are satisfied (footnote 7).

⁶ Sargent T.J, and Sims CA. (977). "Business cycle modeling without pretending to have too much *a priori* economic theory", In *New Methods in Business Cycle Research*, Sims CA (ed.). Federal Reserve Bank of Minneapolis: Minneapolis.

⁷ Stock, James H. and Mark W. Watson. (1999). Forecasting Inflation, *Journal of Monetary Economics*, Vol 44, No. 2 October, pp. 293-335.

⁸For background information about the CFNAI, see [the Chicago Fed website](#)

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