Deciphering the Fed Communication via Text-Analysis of Alternative FOMC Statements *

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March 18, 2020

Abstract

We construct a novel measure of monetary policy stance by relying on a natural language processing algorithm that enables identification of subtle differences in the tone across alternative FOMC statements, available from March 2004. High-frequency bond prices are used as instruments to tease out the surprise component of monetary policy stance. We find that our text-based monetary policy surprises are highly correlated with forward guidance shocks in the existing literature. According to our measures, an unexpected one-standard-deviation monetary policy tightening reduces stock market return by 20 bps on average, implying that the FOMC's communication was largely effective in moving stock prices in the intended direction. Leveraging the ability of text-analysis to quantify the impact of changing a particular sentence in policy statements, we evaluate the (counterfactual) implication of alternative policy prescriptions on the financial markets.

JEL Classification: G12, E30, E40, E50.

Keywords: Alternative FOMC statements, counterfactual policy evaluation, monetary policy stance, text analysis, natural language processing.

*We thank John Rogers for sharing his dataset on monetary policy shock estimates with us. The opinions expressed herein are those of the authors and do not reflect the views of the Federal Reserve Bank of Kansas City or Federal Reserve System.

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1 Introduction

Central banks have increasingly relied on public communications to provide guidance regarding future policy actions, e.g., Woodford (2005) and Blinder et al. (2008). The practice became more prevalent when monetary policy is constrained by the effective lower bound, see Bernanke (2010). In this regard, both quantitative decisions (e.g., interest rates or asset purchases) by central banks and their qualitative descriptions of the economic factors that lead to the decisions serve as important information variables for understanding monetary policy. While the profession has moved to treating the policy statements and speeches of the central bank officials as data to be analyzed, important limitations exist in the parsing of textual content. First, identifying the tone (between a dovish stance and a hawkish one) directly from the text is often difficult. Second, even when using asset prices as instruments, it is difficult to identify which part of communications is perceived to be most crucial by the markets because statements and speeches are multi-dimensional objects. Third, it is hard to evaluate the (counterfactual) impact of alternative policy scenarios on the markets within the commonly used text-analysis methods largely based on word counting.

The purpose of this paper is to contribute in all three dimensions to enhance our understanding of the transmission of monetary policy to the financial markets, which is important for both the policymakers and market participants. We work with the Federal Open Market Committee's (FOMC) postmeeting statements in this paper. We differ from the existing literature on two fronts in achieving our objectives. First, we refine the information in the FOMC statements using a novel natural language processing algorithm known as the Universal Sentence Encoding (USE). In contrast to the word-counting methods that treat individual words as atoms and ignore the context (e.g., Term Frequency-Inverse Document Frequency (TF-IDF) and Latent Semantic Analysis (LSA)), USE preserves multiple dependencies between different words in the document.[1] Second, and more importantly, we consider benchmark as well as alternative policy statements created by the Federal Reserve Board staff in the parsing of policy statements. Alternative statements are available for each

[1]The encoding algorithm was pre-trained based on the Stanford Natural Language Inference (SNLI) dataset. Under the USE, the entire statement is encoded as a large-dimensional vector capturing various features of the whole text including the context between words or sentences. The algorithm allocates attention weights between each word and all the other words in the text to capture the contextual link in the sentence embedding. See Cer et al. (2018) and Vaswani et al. (2017) for the details.

FOMC meeting and contain a more dovish (Alt A) or a more hawkish (Alt C or Alt D) statement than the benchmark one (Alt B). The different views of economic outlook and policy prescription contained in the alternative statements provide important anchoring points for interpreting the tone of benchmark policy statement.[2]

We provide a novel measure of the surprise component of monetary policy announcements based on our text analysis. We do this in two steps. First, we characterize the "monetary policy stance" communicated by each FOMC statement. For this, we identify the "tone" of monetary policy announcements by computing the similarities between the released statement and the alternative statements.[3] We define the "novelty" of monetary policy announcements by computing the difference between the current statement and the previous statement. By taking the product of the tone and novelty of monetary policy announcements, we obtain the monetary policy stance.[4] The first step only relies on the text analysis of the FOMC statements. In the second step, we introduce (high-frequency) bond prices to compute the surprise component of the monetary policy stance. The expected component of the monetary policy stance is defined as a weighted average of the hawkish and dovish policy stances of the alternative statements. We build on the idea of the maximum rank correlation estimator, see Han (1987) and Sherman (1993), to back out the weight that maximizes the correlation of the (high-frequency) bond prices and the surprise component of monetary policy announcements (aka, monetary policy shocks), i.e., the difference between the monetary policy stance and its expected component.[5]

We then use (high-frequency) stock prices to show that a tightening policy surprise according to our measure generates a negative stock price reaction. Specifically, a positive one-standard-deviation surprise leads to a 20 bps drop in stock prices on average. Also, we verify that our measure of monetary policy shocks is highly correlated (about 50%) with

[2]Like FOMC transcripts, alternative statements are made public five years after they were created. Although published with a significant lag, dovish and hawkish alternative statements generally incorporate information on market expectations regarding the upcoming policy statement because they are written to surprise the market in respective directions. See Board (2004) for the detailed description of statement language.

[3]The released statement is typically very similar to the benchmark statement created before each FOMC meeting but may not be exactly same because some phrases can change during the FOMC deliberation.

[4]Ke et al. (2019) extract a return forecasting factor from text-mining news paper articles in a similar way.

[5]Unlike Han (1987) and Sherman (1993), the weight is time-varying rather than constant in our case. Therefore, the asymptotic distribution theory of the maximum rank correlation estimator developed in these papers is not applicable and we calibrate time-varying weights to maximize the rank correlation.

forward guidance shocks identified in the existing literature (that relies on high-frequency bond prices). Both serve as external validation of our measure.

The key advantage of our approach is that we are able to conduct a counterfactual policy evaluation by replacing the released statement with either one of the alternative statements. We can also isolate the effect of changing a particular sentence or paragraph in the released statement to that in the alternative statements, which allows us to perform a more detailed investigation at the sentence or paragraph level of the statement. Specifically, we work with the FOMC statement released in September 2007 for ease of illustration.[6] The policy decision in Alt B was to lower its target for the federal funds rate 50 bps whereas that in Alt C was to lower it by 25 bps. Thus, the market could view Alt C more hawkish than Alt B. On the other hand, in the assessment of risk, Alt C stated that the downside risks to economic growth outweigh the upside risks to inflation (we refer to it as "balance of risk statement"), which was omitted in Alt B. Our similarity measures suggest that the statement about the balance of risk can be perceived to be more accommodative than the 50 bps cut in the target rate. In fact, when we included the balance of risk statement in the released statement, the counterfactual monetary policy stance turns out to be much more dovish leading to an 8.2% increase of stock prices relative to the 0.1% increase without that statement.[7] While suggestive, this counterfactual exercise highlights the importance of narrative information in the Fed communication.

Related Literature. Our paper is related to multiple lines of research. First, our work draws on papers that identify monetary policy shocks using high-frequency bond data, e.g., Gürkaynak et al. (2005), Swanson (2017), Nakamura and Steinsson (2018), Bu et al. (2020), Bauer and Swanson (2020), Hoesch et al. (2020). However, none of these papers use information from alternative statements and cannot evaluate the counterfactual implications of alternative policy prescriptions as we do. Our empirical finding on the negative stock market response to an unexpected monetary policy tightening is consistent with Bu et al. (2020),

[6] See the appendix for the detailed description of alternative statements.

[7] We regress stock returns on our measure of monetary policy surprises and obtain the respective OLS coefficient estimates. We replace the monetary policy stance with the counterfactual one and subtract the bond price-implied expected monetary policy stance to compute the counterfactual monetary policy surprise component. We multiply the counterfactual monetary policy surprise component to the OLS slope coefficient to assess the counterfactual impact of alternative policy prescription. It is important to note that we are only replacing one data point (that corresponds to the September 2007 FOMC statement release date) while keeping all else equal in this exercise.

Bauer and Swanson (2020), Hoesch et al. (2020) which imply that the FOMC's communication was largely effective in inducing the intended asset market responses during our sample period (from March 2004 to December 2014). Hoesch et al. (2020) and Lunsford (2018) find that the stock market response coefficient was unstable over time but became largely negative to policy tightening since 2004. Since this timing coincides with the creation of alternative statements (March 2004), we suspect that the Board staff's increasing attention to effective communication might account for the timing of the break.

Second, our work is also related to the increasingly popular application of text-analysis in economics and finance, e.g., Gentzkow et al. (2019), Ke et al. (2019), Hansen et al. (2017), Schonhardt-Bailey (2013), Shapiro and Wilson (2019), Jegadeesh and Wu (2017), Meade and Acosta (2015), Giavazzi et al. (2020). Our departure from these papers is that we combine a natural language processing technique with alternative statements to better identify the tone of the statement focusing on the contextual meaning of sentences. Most papers use methods based on word-counting and do not fully utilize the contextual meaning of words in the text.[8] In this paper, we highlight the importance of capturing the contextual meaning using the alternative FOMC statements prepared for the October 2013 meeting as an example.

Outline of the structure of the paper is as follows. Section 2 describes our natural language processing technique and identification scheme of monetary policy surprises using alternative statements. Section 3 discusses empirical results and policy implications. Section 4 concludes.

2 Text-based Identification of Monetary Policy Stance

The recent development in the natural language processing provides tools to better capture the contextual meaning of a word in a text. We rely on the universal sentence encoding (USE) to quantify information in texts. We explain and highlight its features in this section. We then provide the details about the FOMC statements and explain how we identify the monetary policy stance from the alternative statements using the USE. Finally, we explain

[8]The exception is Giavazzi et al. (2020). who use the Doc2vec algorithm. While Doc2vec is also a sentence embedding algorithm that can capture the context of a given text, the USE algorithm is known to perform better in many natural language processing tasks.

how we leverage high-frequency asset prices to measure the surprise component of monetary policy stance.

2.1 Universal sentence encoding versus word-counting methods

We apply the USE of Cer et al. (2018) to calculate the similarity between texts. USE is able to capture the dependencies between even distant words by training deep neutral networks that can recognize complex dependencies of different words. Hence, it can score the similarity between texts in a more sensible way. For example, imagine that there are two sentences consisting of n_1 and n_2 words respectively:

$$\begin{aligned} &\left\{S_1 = (w_{1,1}, \cdots, w_{1,n_1}) \quad , \quad S_2 = (w_{2,1}, \cdots, w_{2,n_2})\right\} \\ &\qquad\qquad\qquad\qquad \downarrow \\ &\left\{U_1 = (U_{1,1}, \cdots, U_{1,512}) \quad , \quad U_2 = (U_{2,1}, \cdots, U_{2,512})\right\}. \end{aligned} \tag{1}$$

USE will find out numerical representations of S_1 and S_2 by two 512 dimensional vectors (U_1 and U_2) using a deep neural network architecture. The embedding representation is optimized to recover the original sentence by decoding the numerically encoded sentence.[9] USE is available through Google TensorFlow and is easy to implement and better at capturing the context as a whole relative to existing methods that do not consider the link between words. We calculate the similarity between the two texts based on the cosine similarity between two embedding vectors:

$$\text{Sim}_{\text{USE}}(\text{Text}_1, \text{Text}_2) = \text{cosine}(U_1, U_2) \quad = \quad \frac{U_1' U_2}{\sqrt{U_1' U_1}\sqrt{U_2' U_2}}. \tag{2}$$

Term Frequency-Inverse Document Frequency. We provide a comparison with the Term Frequency-Inverse Document Frequency (TF-IDF) method. Here, similarities between multiple (N) documents are determined by the frequency of words that show up in all of

[9] USE first creates word representations and transforms them in the numerical representation of a sentence using a neural network architecture.

these documents. Specifically,

$$\begin{aligned} W_{i,j} &= \frac{n_{i,j}}{\sum_k n_{k,j}} \ln(\frac{N}{df_t}), \\ \text{Sim}_{\text{TF-IDF}}(\text{Text}_1, \text{Text}_2) &= \text{cosine}(W_{\cdot,1}, W_{\cdot,2}). \end{aligned} \tag{3}$$

where $n_{i,j}$ is the count of the i-th word in the j-th document and df_t is the number of documents that contain the i-th word. The main problem of this method is that word counting does not consider the semantic similarity between different words and the algorithm cannot be trained to incorporate the contextual meaning.

Latent Semantic Analysis. A more sophisticated embedding method than word counting is available, i.e., the Latent Semantic Analysis. LSA considers the high co-frequency of similar words in calculating the similarity score. Instead of $W_{\cdot,1}$ and $W_{\cdot,2}$, LSA uses low-dimensional objects obtained by the singular value decomposition of $W = [W_{\cdot,1}, W_{\cdot,2}]$ to calculate the similarity between texts. Specifically,

$$\begin{aligned} W &= U\Sigma V', \\ \text{Sim}_{\text{LSA}}(\text{Text}_1, \text{Text}_2) &= \text{cosine}(V_{\cdot,1}, V_{\cdot,2}). \end{aligned} \tag{4}$$

By rotating term frequency vectors to maximize the co-frequency of words across multiple document, the LSA extracts representations that highlight the co-frequency of words used in different documents. However, this method also does not take into account dependencies between different words at the sentence level, which is important for understanding semantic similarity.

A simple illustration. We illustrate the advantage of the USE in capturing the contextual meaning by comparing the similarity between the following sentences. We repeat the same exercise with TF-IDF and LSA for comparison.

(S_1) How old are you?

(S_2) What is your age?

(S_3) How are you?

Table 1: Sentence similarity

	TF-IDF	LSA	USE
$\text{Sim}(S_1, S_2)$	0	0	0.91
$\text{Sim}(S_1, S_3)$	0.78	0.87	0.28

Notes: We compare the similarity between the following sentences based on three different methods: (S_1) How old are you?; (S_2) What is your age?; (S_3) How are you?

It is obvious that S_1 and S_2 are asking the same question, whereas S_3 is not. Hence, the ideal classifier should recognize that S_1 is more similar to S_2 than S_3. However, the similarity score under the TF-IDF or LSA provides an opposite ranking whereas the USE provides a more sensible similarity score. We highlight the results in Table 1.

Table 2: Alternative FOMC statement similarity

	TF-IDF	USE
$\text{Sim}(FOMC_{A,t}, FOMC_t)$	0.975	0.895
$\text{Sim}(FOMC_{C,t}, FOMC_t)$	0.972	0.990

Notes: The released statement, indicated by $FOMC_t$, is typically very similar to the benchmark statement, i.e., $FOMC_{B,t}$, created before each FOMC meeting but may not be exactly same because some phrases can change during the FOMC deliberation.

The superiority of USE over word-counting methods can be further illustrated by considering alternative FOMC statements prepared for the October 2013 FOMC meeting. As shown in the appendix, the first paragraph of Alt A starts by acknowledging the challenge in interpreting economic data released during the intermeeting period due to the temporary shutdown of the federal government whereas Alt C does not mention this challenge. By pointing the near-term uncertainty, the reference to the government shutdown reveals that policymakers are not so sure about the recent improvement in the data. Otherwise, the description of the current outlook is fairly similar between Alt A and Alt C. The actual released statement dropped the reference to the temporary shutdown of the federal government like Alt C although it was rather close to Alt A otherwise. The textual similarity results in Table 2 suggest that the USE captures the large impact of dropping the reference to the

government shutdown while TF-IDF does not.[10]

2.2 Implementation of text-analysis

We characterize the "monetary policy stance" communicated by each FOMC statement. For this, we identify the "tone" of monetary policy announcements by computing the similarities between the released statement and the alternative statements. We define the "novelty" of monetary policy announcements by computing the difference between the current released statement and the previous released statement. By taking the product of the tone and novelty of monetary policy announcements, following Ke et al. (2019), we obtain the monetary policy stance.

Specifically, we define the (benchmark) monetary policy stance as

$$\text{MP stance } (t) = \underbrace{(1 - \text{Sim}(FOMC_t, FOMC_{t-1}))}_{\text{Novelty}} \underbrace{\left(\frac{\text{Sim}(FOMC_t, FOMC_{C,t}) - \text{Sim}(FOMC_t, FOMC_{A,t})}{1 - \text{Sim}(FOMC_{A,t}, FOMC_{C,t})} \right)}_{\text{Tone}} \quad (5)$$

and the (alternative) dovish and hawkish monetary policy stance as

$$\begin{aligned} \text{Dovish MP stance } (t) &= \text{Sim}(FOMC_{A,t}, FOMC_{t-1}) - 1, \\ \text{Hawkish MP stance } (t) &= 1 - \text{Sim}(FOMC_{C,t}, FOMC_{t-1}), \end{aligned} \quad (6)$$

respectively. Novelty in the current benchmark FOMC statement relative to the previous one quantifies the change in the FOMC's intended policy stance. Note the monotonicity

$$\text{tone(Dovish MP stance)} \leq \text{tone(MP stance)} \leq \text{tone(Hawkish MP stance)}. \quad (7)$$

As conventional, we sign a positive tone as a hawkish stance and a negative tone as a dovish stance. We further normalize the tone measure between -1 and 1.

To identify monetary policy surprises around FOMC announcements, we have to proxy the market expectations for the MP stance right before the FOMC meeting. We do this using a weighted average of the dovish MP stance and the hawkish MP stance based on

[10] When we calculate the paragraph-by-paragraph similarity, only the first paragraph makes a large difference between USE and TF-IDF. Other paragraphs do not create significant differences between the two methods.

the assumption that alternative statements mimic expectations of market participants with more extreme views.

$$E_{t-\Delta}\text{MP stance}(t) = (1 - p_t) \times \text{Hawkish MP stance } (t) + p_t \times \text{Dovish MP stance } (t). \quad (8)$$

Note that the weight, p_t, can vary over time.

2.3 Measuring the market expectations from bond prices

At the time of the FOMC announcement, the reaction of the high-frequency asset i's prices can be captured by

$$r^i_{t-\Delta_l,t+\Delta_h} \equiv \ln\left(\frac{P_{i,t+\Delta_h}}{P_{i,t-\Delta_l}}\right) = \alpha_i + \beta_i \text{MPS}(p_t; t-\Delta) + \varepsilon_{i,t}, \quad \varepsilon_{i,t} \sim (N, \sigma_i^2). \quad (9)$$

The surprise component of the FOMC announcement measured at $t - \Delta$ is

$$\text{MPS}(p_t; t-\Delta) = \text{MP stance } (t) - E_{t-\Delta}\text{MP stance } (t). \quad (10)$$

It is important to understand that $\text{MPS}(p_t; t-\Delta) > 0$ corresponds to tightening monetary policy.[11]

2.4 Constructing the surprise component of monetary policy stance.

We calibrate the weight $\{p_t\}_{t=1}^T$ that maximizes the rank correlation of the high-frequency bond returns (left-side of (9)) and the surprise component of monetary policy announcements $MPS(p_t; t-\Delta)$, aka, monetary policy shocks. When p_t is not time-varying, ($p_t = \overline{p}$) our

[11] The underlying assumption of (8) is that the market is perfectly aware of the two future alternative statements Alt A and Alt C and they provide bounds when evaluating the benchmark statements. But there is still uncertainty in the market expectations that is captured by p_t. One practical justification is that if we look at the bluebook in 2004, they rationalize alternative statements by intentionally beating market expectations in the hawkish or the dovish direction. So roughly speaking, the hawkish statement represents the most hawkish person in the financial market while the dovish statement represents the most dovish person. We are capturing the marginal investor's expectation as a weighted average of these two extreme expectations. As long as the marginal investor's expectation is within the bound set by the survey of market participants and we do not know exactly who would be the marginal investor, this assumption seems to be plausible.

estimate is identical to the maximum rank correlation estimator, see Han (1987) and Sherman (1993). Here, we assume that a dovish surprise should lead to a positive bond return because bond prices move inversely with bond yields.[12] Specifically, we maximize the following the rank correlation functicon with respect to p_t:

$$(p_{\tau_i})_{i=1}^T = \text{argmax} \sum_{t \neq t'} \mathbf{1}(r^b_{\tau_t - \Delta_l, \tau_t - \Delta_h} > r^b_{\tau_{t'} - \Delta_l, \tau_{t'} - \Delta_h}) \mathbf{1}(MPS(p_{\tau_t}) < MPS(p_{\tau_{t'}})). \tag{11}$$

This (negative) rank correlation is maximized by calibrating p_t based on the sorted bond return. Specifically, the time series of bond returns $\{r^b_{t-\Delta_l, t+\Delta_h}\}_{t=1}^T$ are sorted from most negative to most positive. Let the ordering of the sorted-returns be indicated with new time subscripts $\{\tau_1, ..., \tau_T\}$:

$$\begin{aligned} r^b_{\tau_1 - \Delta_l, \tau_1 + \Delta_h} &= \min\{r^b_{t-\Delta_l, t+\Delta_h}\}_{t=1}^T \\ r^b_{\tau_T - \Delta_l, \tau_T + \Delta_h} &= \max\{r^b_{t-\Delta_l, t+\Delta_h}\}_{t=1}^T. \end{aligned} \tag{12}$$

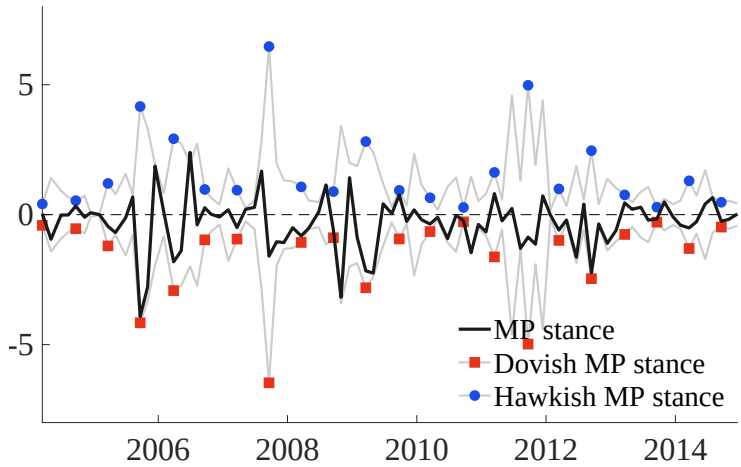
For a strictly negative value of β_b in (9), we have that

$$\begin{aligned} MPS(p_{\tau_T}) \leq ... \leq \quad & MPS(p_{\tau_t}) \quad \leq ... \leq MPS(p_{\tau_1}) \\ r^b_{\tau_1 - \Delta_l, \tau_1 + \Delta_h} \leq ... \leq \quad & r^b_{\tau_t - \Delta_l, \tau_t + \Delta_h} \quad \leq ... \leq r^b_{\tau_T - \Delta_l, \tau_T + \Delta_h} \end{aligned} \tag{13}$$

where $\tau_t \in \{\tau_1, ...\tau_T\}$. Because it is possible that there are (potentially) multiple realizations of $\{p_{\tau_1}, ..., p_{\tau_T}\}$ that satisfy (13), we pick the one that achieves the largest negative correlation between $\{MPS(p_{\tau_1}), ..., MPS(p_{\tau_T})\}$ and $\{r^b_{\tau_1 - \Delta_l, \tau_1 + \Delta_h}, ..., r^b_{\tau_T - \Delta_l, \tau_T + \Delta_h}\}$. This can be done via grid search (with respect to p_{τ_t}). Once we select $\{p_{\tau_1}, ..., p_{\tau_T}\}$, we can sort them back to match the original time subscript $\{p_1, ..., p_T\}$ and construct the corresponding $MPS(p_t)$ for each p_t, $t \in \{1, ..., T\}$.

[12] The sign of the correlation is negative because p_t corresponds to a dovish probability, which contributes to a negative surprise in monetary policy stance.

Figure 1: Monetary policy stance



Notes: We normalize these measures to have a unit variance.

3 Empirical Results

3.1 Data for alternative FOMC statements

The Federal Reserve Board staff started to prepare alternative FOMC statements from the March 2004 FOMC meeting. The latest available statement is the one prepared for the December 2014 FOMC meeting. We have 87 FOMC statements (March 2004 to December 2014) excluding two inter-meeting announcements (Aug 2007, Jan 2008). When multiple versions of hawkish or dovish alternative statements are available (e.g., Alt A1 or Alt D), we use the most extreme one to identify the tone of the released statement.[13]

3.2 Monetary policy stance and surprises

Figure 1 provides the time series of (5) and (6) constructed based on the USE. Our measure captures the change in the policy stance including both the current action (e.g., change in the federal funds rate target) and the expected future action (e.g., forward guidance about

[13]For four meetings (September 2008, June 2009, June 2011, August 2013), we drop the first paragraph of each statement to calculate the textual similarity because the original version including the first paragraph has not shown enough dissimilarity between the dovish alternative statement and the hawkish statement which is crucial for our identification of the tone.

the future interest rates). As in (7), we observe the monotonicity across the three measures. While the sign of the monetary policy stance is determined by the tone, its magnitude is largely governed by the dissimilarity from the previous statement.

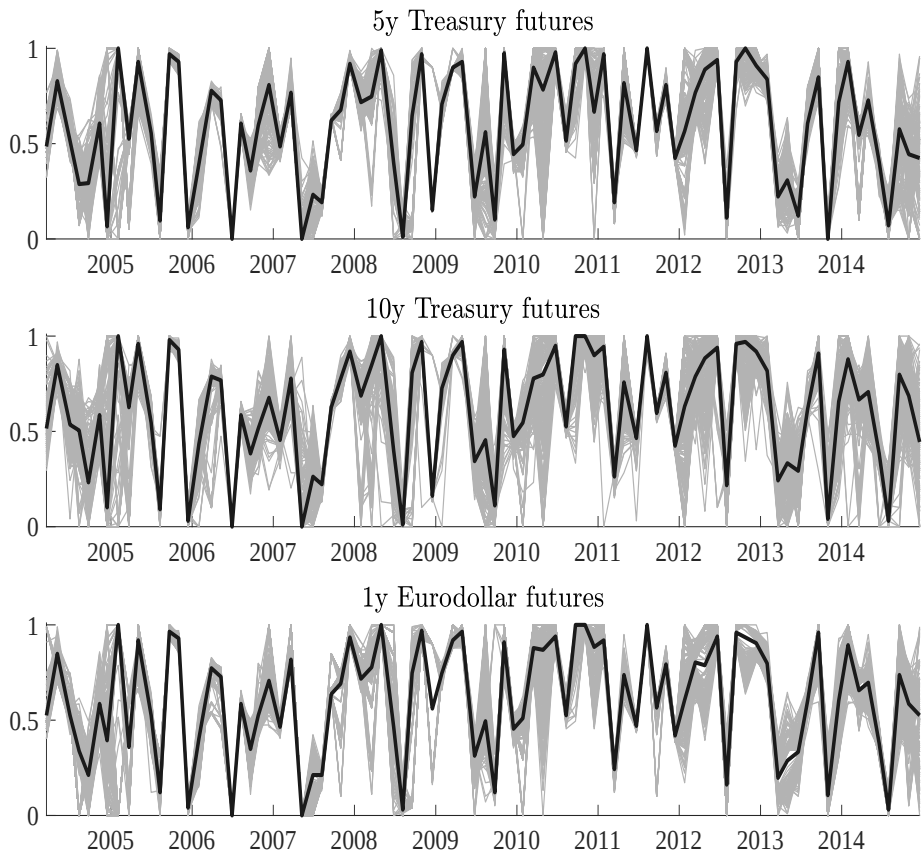
To extract monetary policy surprises, we construct the market expectation of monetary policy stance which is the weighted average of the dovish and hawkish monetary policy stance. The market-based probability that the dovish and hawkish alternative statement would be released are parameterized by p_t and $1 - p_t$, respectively. To calibrate the market-based probability p_t, we use high-frequency bond market return data around FOMC announcements. One virtue of our maximum rank correlation approach is that it sidesteps the burden of estimating $\alpha_i, \beta_i, \sigma_i^2$ when identifying $p_{1:T}$ in (9). To provide robustness to our claim, we rely on bond futures returns of various combinations of $\Delta_l, \Delta_h \in \{10, ..., 120\}$min to obtain $p_{1:T}$ and the corresponding MPS($p_{1:T}$). We provide the results in Figure 2. The median values of $\hat{p}_{1:T}$ are highly correlated with each other, e.g., 0.96 or higher. This finding implies that the dovish probability extracted from bond returns are fairly robust to different window intervals or instruments.[14]

3.3 Stock market responses to monetary policy surprises.

For the benchmark case, we select the 5-year Treasury bond futures returns with window intervals $\Delta_l = \Delta_h = 10$min to back out the probability weights and construct MPS($\hat{p}_t$). Conditional on this output, we conduct the regression analysis using stock returns as an external validation check. Specifically, we regress stock returns $r^s_{t-\Delta_l, t+\Delta_h}$ on the bond market-implied MPS($\hat{p}_t$). In essence, we are estimating (9) using OLS with stock returns. The estimation results summarized in Table 3 imply that the bond market-implied MPS($\hat{p}_t$) significantly predict stock returns measured at various window intervals. Because we normalized MPS($\hat{p}_t$) to have a unit variance, we can directly interpret the magnitude of β coefficient in assessing the economic significance of MPS($\hat{p}_t$). On average, we find that a positive one-standard-deviation surprise leads to a 20 bps drop in stock prices. The R^2 values are higher for returns defined with shorter window intervals.

[14]The robustness of our result is different from Bu et al. (2020) who find large differences in monetary policy shock estimates depending on the maturity of the bond data. However, when both use the five-year bond return, our measures are highly correlated with each other.

Figure 2: Dovish probability comparison



Notes: We rely on the 5-year and 10-year Treasury bond futures returns and the 1-year Eurodollar futures returns. Returns are defined with the following interval $\Delta_l, \Delta_h \in \{10, ..., 120\}$min. The median values are indicated with solid lines.

Nakamura and Steinsson (2018) argue that unexpected policy easing or tightening by the FOMC identified by five different high-frequency interest rate futures data (current month and next month federal funds futures, 2, 3, 4 quarter ahead Eurodollar futures) around announcements often did not move the private sector's expectation of economic growth in the intended direction. For instance, they show that the Bluechip forecast of real GDP growth declined after unexpected policy tightening in many cases because the dovish announcement might have revealed the Federal Reserve's private information on the gloomy economic outlook. However, Bauer and Swanson (2020) provide evidence that the Federal Reserve does not have an information advantage over the private sector and suggest that the finding in Nakamura and Steinsson (2018) can be explained by the relatively low-frequency

Table 3: Stock returns: Regression results

$[\Delta_l$	$\Delta_h]$	α	β	t-stat (α)	t-stat (β)	R^2
$[-10$	$10]$	0.05	-0.23	1.08	-4.75	0.19
$[-20$	$20]$	0.04	-0.20	0.75	-4.78	0.12
$[-30$	$30]$	0.10	-0.18	1.49	-4.45	0.08
$[-40$	$40]$	0.16	-0.19	2.25	-3.33	0.07
$[-50$	$50]$	0.16	-0.18	2.21	-3.20	0.07
$[-60$	$60]$	0.20	-0.22	2.56	-3.35	0.08
$[-90$	$90]$	0.19	-0.21	2.25	-2.43	0.06
$[-120$	$120]$	0.17	-0.21	1.72	-1.85	0.05

Notes: Based on the median value of $\hat{p}_{1:T}$, we regress stock returns (defined at various window intervals) on $MPS(\hat{p}_{1:T})$.

nature of the private sector forecast data. In particular, Bauer and Swanson (2020) show that the unexpected policy tightening led to a decline in the high-frequency stock market return as they use the same monetary policy shock measure as Nakamura and Steinsson (2018). Our finding is consistent with Bauer and Swanson (2020) in terms of the sign of the stock market response to a monetary policy surprise. As in Bauer and Swanson (2020), our finding is not driven by the difference between our measure and monetary policy shock estimates of Nakamura and Steinsson (2018) because both measures are highly correlated as shown in Table 4.

Our $MPS(\hat{p}_t)$ is also highly correlated with other measures of monetary policy shocks based on the high-frequency asset market data around FOMC announcements. Bu et al. (2020) construct a monetary policy shock using the idea that the variance of the daily bond return is higher on FOMC days relative to non-FOMC days due to the monetary policy announcement. In addition to near-term maturities, they use information from the entire yield curve (up to the maturity of thirty years). They find that the information channel effect highlighted by Nakamura and Steinsson (2018) is not present in their study mainly because Nakamura and Steinsson (2018) consider only the near-term interest rate data. However, we do not find any significant difference in our sample in terms of the correlation of our measure with the two measures provided by Nakamura and Steinsson (2018) and Bu et al. (2020). Also, given the robustness of our measure to the maturity of the bond return used to back out policy surprises, we do not think that the maturity of the bond return is critical

in accounting for the lack of the information channel effect in our study. More plausibly, we suspect that more efforts made by the Federal Reserve staff to fine tune statement language since 2004 might have increased the effectiveness of monetary policy communications on the asset markets. This hypothesis is consistent with the finding in Lunsford (2018) who shows that the information channel effect was present before 2004 but disappeared for the later sample.[15]

Swanson (2017) identifies multiple dimensions of monetary policy shocks using eight different asset prices consisting of three Treasury bond yields (maturities of 2, 5, 10 years) on top of the five interest rate futures used in Nakamura and Steinsson (2018). He computes the three principal components that account for common variations in these eight different asset prices around FOMC announcements. He rotates three components to get 1) federal funds rate (FFR) factor that affects the current month federal funds rate futures, 2) forward guidance (FG) factor that is orthogonal to the change in the current month federal funds rate futures, and 3) large-scale asset purchase (LSAP) factor that is also orthogonal to the change in the current month federal funds rate futures and plays a minimum role in explaining the data before the federal funds rate reached the effective lower bound in December 2008. In practice, these factors are largely distinguished by their different loadings on the maturity spectrum of the underlying interest rate data. The FFR factor has a large non-zero loading on the current month federal funds futures while the other factors have zero loadings. In addition, the loadings of FG factor are concentrated in the one-to-five year maturity spectrum while the LSAP factor has the largest loading on the ten-year Treasury yield. Our measures is particularly highly correlated with the FG factor, indicating that the communication strategy by different wording can be mostly effective in moving the medium-term interest rates.[16]

3.4 Counterfactual policy evaluation.

The key advantage of our approach is that we are able to conduct a counterfactual policy evaluation by replacing the released statement with either one of the alternative statements.

[15] A similar observation was made by Hoesch et al. (2020).

[16] The negative correlation with the LSAP factor is somewhat puzzling but this does not imply that our measure is not associated with the movement in the ten-year Treasury yield because the FG factor also has a significant non-zero loading on the ten-year Treasury yield.

Table 4: Comparison with other measures

	MP stance: surprise	MP stance: level
Bu et al. (2020)	0.50	0.16
Nakamura and Steinsson (2018)	0.50	-0.10
Swanson (2017) (FFR+FG+LSAP)	0.50	0.01
FFR	0.20	0.03
FG	0.52	-0.16
LSAP	-0.12	-0.17

Notes: Based on the median value of $\hat{p}_{1:T}$, we construct $MPS(\hat{p}_{1:T})$ and compute correlation with other existing measures of monetary policy factors. The last three factors are from Swanson (2017): 1) federal funds rate (FFR) factor; 2) forward guidance (FG) factor; and 3) large-scale asset purchase (LSAP) factor.

We can also isolate the effect of changing a particular sentence or paragraph in the released statement to that in the alternative statements, which allows us to perform a more detailed investigation at the sentence or paragraph level of the statement.

Specifically, we work with the FOMC statement released in September 2007 for ease of illustration.[17] The policy decision in Alt B was to lower its target for the federal funds rate 50 bps whereas that in Alt C was to lower it by 25 bps. Thus, the market could view Alt C more hawkish than Alt B. On the other hand, in the assessment of risk, Alt C stated that the downside risks to economic growth outweigh the upside risks to inflation (we refer to it as "balance of risk statement"), which was omitted in Alt B. Our similarity measures suggest that the statement about the balance of risk can be perceived to be more accommodative than the 50 bps cut in the target rate. In this section, we include the balance of risk statement in the released statement and quantify its counterfactual impact on stock prices.

Conditional on $\hat{\beta} = -0.23$ in (the first row of) Table 3, we multiply the counterfactual monetary policy surprise component to asset the impact on the stock returns (defined in the 10-minute interval). For this, we replace the monetary policy stance with the counterfactual one and subtract the bond price-implied expected monetary policy stance to compute the counterfactual monetary policy surprise component. It is important to note that we are only replacing one data point (that corresponds to the September 2007 FOMC statement release date) while keeping all else equal in this exercise. We find that the counterfactual monetary

[17] The detailed description of alternative statements is provided in the appendix.

policy stance turns out to be much more dovish leading to an 8.2% increase of stock prices relative to the 0.1% increase without that statement. While suggestive, this counterfactual exercise highlights the importance of narrative information in the Fed communication.[18]

4 Conclusion

The central bank's public communications about current and future policy actions have increasingly received attention as a policy tool. Since March 2004, the FOMC have deliberated on alternative policy statements prepared by the Federal Reserve staff before each FOMC meeting. Two alternative statements capture the hawkish or dovish deviation from the central tendency of the market expectation right before the meeting, providing cross-sectional variations around the released statement. We apply a novel natural language processing algorithm based on a deep learning architecture to alternative FOMC statements to identify the tone of the released statement. This USE algorithm detects the contextual meaning of words in the statement and quantifies the information provided by language in alternative statements. We construct a new measure of monetary policy surprises by combining the high-frequency bond returns around FOMC announcements with the text-analysis of alternative statements by the USE. We find that an unexpected policy tightening leads to a decline in the stock market return on average. The finding vindicates that the FOMC's communication achieved mostly its intended effect on the stock market return at least since 2004, which is consistent with the recent empirical findings. A suggestive counterfactual exercise involving alternative statements implies that changing the language describing the risk assessment may have had a much bigger impact on the stock market return than changing the federal funds rate target by 25 basis points.

[18] Caution is needed in interpreting our results. To the extent we identify exogenous monetary policy shocks, our counterfactual analysis is similar to the one using a structural VAR (SVAR). Of course, if the counterfactual shock is much bigger than the realized one, the linearity of our stock market return regression may not be a good environment for this. The same issue applies to the SVAR if one feeds a big "alternative" shock into the model and extrapolates the linear impulse responses. Even if the linear model might be relatively robust to a modest policy intervention, it would not be a good tool for a regime change intervention.

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Appendix

A Illustration

Figure A-1: FOMC statement in November 2005

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Table 1: Alternative Language for the November FOMC Announcement

	September FOMC	Alternative A	Alternative B	Alternative C
Policy Decision	1. The Federal Open Market Committee decided today to raise its target for the federal funds rate by 25 basis points to 3¾ percent.	The Federal Open Market Committee decided today to leave its target for the federal funds rate unchanged.	The Federal Open Market Committee decided today to raise its target for the federal funds rate by 25 basis points to 4 percent.	The Federal Open Market Committee decided today to raise its target for the federal funds rate by 25 basis points to 4 percent.
Rationale	2. Output appeared poised to continue growing at a good pace before the tragic toll of Hurricane Katrina. The widespread devastation in the Gulf region, the associated dislocation of economic activity, and the boost to energy prices imply that spending, production, and employment will be set back in the near term. In addition to elevating premiums for some energy products, the disruption to the production and refining infrastructure may add to energy price volatility. While these unfortunate developments have increased uncertainty about near-term economic performance, it is the Committee's view that they do not pose a more persistent threat. Rather, monetary policy accommodation, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity.	Elevated energy prices and hurricane-related disruptions in economic activity seem to have slowed the growth of spending, set back employment, and weakened consumer and business confidence. The persistence of such effects is uncertain, but robust underlying growth of productivity and monetary policy accommodation are providing support to economic activity.	Elevated energy prices and hurricane-related disruptions in economic activity seem to have temporarily slowed the growth of spending and set back employment. However, monetary policy accommodation, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity. Spending will also be boosted by rebuilding efforts in hurricane-affected areas.	The disruptive effects of recent hurricanes seem likely to be temporary, especially in light of increased spending associated with rebuilding efforts. Economic growth continues to be supported by robust underlying growth in productivity.
	3. Higher energy and other costs have the potential to add to inflation pressures. However, core inflation has been relatively low in recent months, and longer-term inflation expectations remain contained.	High energy and other costs have added to inflation pressures. However, core inflation has been relatively low in recent months, and longer-term inflation expectations remain contained.	The cumulative rise in energy and other costs has added to inflation pressures. However, core inflation has been relatively low in recent months, and longer-term inflation expectations remain contained.	Core inflation and longer-term inflation expectations remain contained. However, high energy and other costs have boosted near-term inflation expectations and price pressures, likely making further policy firming necessary.
Assessment of Risk	4. The Committee perceives that, with appropriate monetary policy action, the upside and downside risks to the attainment of both sustainable growth and price stability should be kept roughly equal.	[no change]	[no change]	[none]
	5. With underlying inflation expected to be contained, the Committee believes that policy accommodation can be removed at a pace that is likely to be measured. Nonetheless, the Committee will respond to changes in economic prospects as needed to fulfill its obligation to maintain price stability.	With underlying inflation expected to be contained, the Committee believes that remaining policy accommodation can be removed at a pace that is likely to be measured. Nonetheless, the Committee will respond to changes in economic prospects as needed to fulfill its obligation to maintain price stability.	[no change]	[none]

Figure A-1 provides the official FOMC statement released in November 2005. The largest discrepancy between Alt A and Alt C under USE

$$sim(FOMC_t, FOMC_{A,t}) = 0.984, \quad sim(FOMC_t, FOMC_{C,t}) = 0.858. \tag{A-1}$$

Two key changes in Alt C: (i) drops the "measured pace" language for the first time; (ii) eliminates the balance of risk in the previous statement.

Figure A-2 provides the official FOMC statement released in September 2007. Alt C was supposed to be more hawkish than Alt B but the balance of risk statement overwhelmed a

Figure A-2: FOMC statement in September 2007

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Table 1: Alternative Language for the September 2007 FOMC Announcement

	Alternative A	Alternative B	Alternative C	Alternative D
Policy Decision	1. The Federal Open Market Committee decided today to lower its target for the federal funds rate 50 basis points to 4¾ percent.	The Federal Open Market Committee decided today to lower its target for the federal funds rate 50 basis points to 4¾ percent.	The Federal Open Market Committee decided today to lower its target for the federal funds rate 25 basis points to 5 percent.	The Federal Open Market Committee decided today to keep its target for the federal funds rate at 5¼ percent.
Rationale	2. Tighter credit conditions and the intensification of the housing correction appear likely to exert appreciable restraint on economic growth. Moreover, the potential for significant spillovers from credit market disruptions to business and household spending poses a risk to the outlook. Today's action is intended to help mitigate the adverse effects on the broader economy arising from the disruptions in financial markets and to promote moderate growth over time.	Economic growth was moderate during the first half of the year, but the tightening of credit conditions has the potential to intensify the housing correction and to restrain economic growth more generally. Today's action is intended to help forestall some of the adverse effects on the broader economy that might otherwise arise from the disruptions in financial markets and to promote moderate growth over time.	Economic growth was moderate during the first half of the year, but the tightening of credit conditions has the potential to intensify the housing correction and to restrain economic growth more generally. Today's action is intended to help forestall some of the adverse effects on the broader economy that might otherwise arise from the disruptions in financial markets and to promote moderate growth over time.	Economic growth was moderate during the first half of the year. Financial market conditions have deteriorated in recent weeks, leading to tighter credit and an intensification of the housing correction. These developments have the potential to restrain growth in economic activity. Nonetheless, the economy seems likely to continue to expand at a moderate pace over coming quarters, supported by solid growth outside the housing sector and a robust global economy.
	3. Readings on core inflation have improved modestly this year. However, the Committee judges that some inflation risks remain, and it will continue to monitor inflation developments carefully	Readings on core inflation have improved modestly this year. However, the Committee judges that some inflation risks remain, and it will continue to monitor inflation developments carefully.	Readings on core inflation have improved modestly this year. However, the Committee judges that some inflation risks remain, and it will continue to monitor inflation developments carefully.	Readings on core inflation have improved modestly this year. However, a sustained moderation in inflation pressures has yet to be convincingly demonstrated. Moreover, the high level of resource utilization has the potential to sustain those pressures.
Assessment of Risk	4. Even after today's action, the Committee judges that the downside risks to economic growth outweigh the upside risks to inflation. Future policy adjustments will depend on the outlook for both inflation and economic growth, as implied by incoming information.	The Committee will continue to closely follow timely indicators of economic prospects and will act as needed to foster price stability and sustainable economic growth.	Even after today's action, the Committee judges that the downside risks to economic growth outweigh the upside risks to inflation. Future policy adjustments will depend on the outlook for both inflation and economic growth, as implied by incoming information.	In the current circumstances, the Committee judges that the downside risks to economic growth are now roughly balanced by the upside risks to inflation. Future policy adjustments will depend on the outlook for both inflation and economic growth, as implied by incoming information.

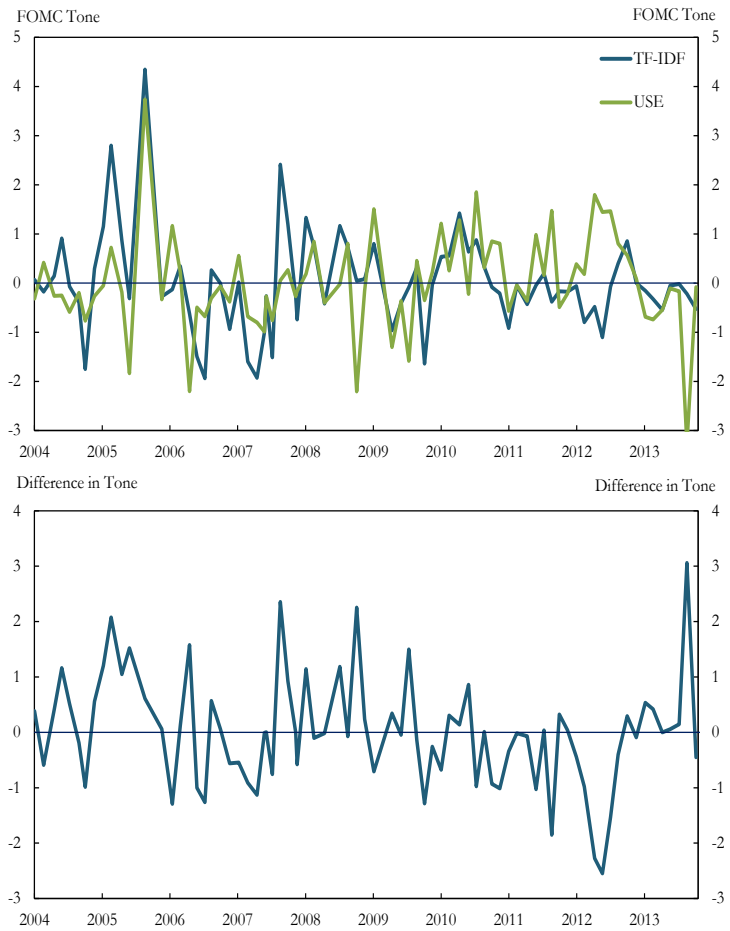
smaller rate cut. The released statement does not include a change in the risk assessment while the cutting the rate by 50 basis points as in Alt B.

$$\begin{aligned} sim(FOMC_{A,t}, FOMC_{C,t}) &= 0.99 > 0.968 = sim(FOMC_{A,t}, FOMC_t) \qquad \text{(A-2)} \\ sim(FOMC_{C,t}, FOMC_{D,t}) &= 0.897 < 0.968 = sim(FOMC_t, FOMC_{D,t}). \end{aligned}$$

The similarity calculation indicates that not just the size of the rate cut but also the statement of the balance of risk matters. Our measures suggest that the balance of risk statement could have provided more accommodation than a 25 bps rate cut.

Figure A-3 compares the approach of TF-IDF with USE. Note that TF-IDF finds a small

Figure A-3: FOMC tone identification: TF-IDF versus USE (normalized)



difference between Alt A and Alt C while USE detects a large difference.

$$\text{USE: } sim(FOMC_t, FOMC_{A,t}) = 0.895, \quad sim(FOMC_t, FOMC_{c,t}) = 0.99 \tag{A-3}$$

$$\text{TF-IDF: } sim(FOMC_t, FOMC_{A,t}) = 0.975, \quad sim(FOMC_t, FOMC_{c,t}) = 0.972 \tag{A-4}$$

A change in the description of the interpretation of the incoming data seems to play a bigger role in USE than TF-IDF. We can see that in Figure A-4 - Figure A-6.

Figure A-4: Alternative A FOMC statement in October 2013

FOMC STATEMENT—OCTOBER 2013 ALTERNATIVE A

1. **The effects of the temporary shutdown of the federal government [, including delays in releases of some key data,] have made the evolution of economic conditions during the intermeeting period somewhat more difficult to assess. However,** information received since the Federal Open Market Committee met in ~~July~~ **September generally** suggests that economic activity has been expanding at a ~~moderate~~ **modest** pace. ~~Some~~ Indicators of labor market conditions have shown **some** further improvement ~~in recent months~~, but the unemployment rate remains elevated. **Available data suggest that** household spending and business fixed investment advanced, ~~and~~ **but that the recovery in** the housing sector ~~has been strengthening, but mortgage rates have risen further~~ **has slowed in response to higher mortgage rates.** ~~and~~ Fiscal policy is restraining economic growth. Apart from fluctuations due to changes in energy prices, inflation has been running below the Committee's longer-run objective, ~~but~~ **even though** longer-term inflation expectations have remained stable.
2. Consistent with its statutory mandate, the Committee seeks to foster maximum employment and price stability. The Committee expects that, with appropriate policy accommodation, economic growth will pick up from its recent pace and the unemployment rate will gradually decline toward levels the Committee judges consistent with its dual mandate. The Committee sees the downside risks to the outlook for the economy and the labor market as having diminished, on net, since last fall, but the tightening of financial conditions observed ~~in recent months~~ **since the spring**, if sustained, could slow the pace of improvement in the economy and labor market. The Committee recognizes that inflation persistently below its 2 percent objective could pose risks to economic performance, but it anticipates that inflation will move back toward its objective over the medium term.
3. Taking into account the extent of federal fiscal retrenchment **over the past year**, the Committee sees the improvement in economic activity and labor market conditions since it began its asset purchase program ~~a year ago~~ as consistent with growing underlying strength in the broader economy. However, the Committee ~~decided to await more evidence that progress will be sustained before adjusting~~ **judges that progress toward its objectives for the labor market and inflation is not yet sufficient to warrant reducing** the pace of its purchases. Accordingly, the Committee decided to continue purchasing additional agency mortgage-backed securities at a pace of $40 billion per month and longer-term Treasury securities at a pace of $45 billion per month. The Committee is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities and of rolling over maturing Treasury securities at auction. Taken together, these actions should maintain downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative, which in turn should promote a stronger economic recovery and help to ensure that inflation, over time, is at the rate most consistent with the Committee's dual mandate.
4. The Committee will closely monitor incoming information on economic and financial developments in coming months and will continue its purchases of Treasury and

Figure A-5: Released FOMC statement in October 2013

Press Release

FEDERAL RESERVE press release

Release Date: October 30, 2013

For immediate release

Information received since the Federal Open Market Committee met in September generally suggests that economic activity has continued to expand at a moderate pace. Indicators of labor market conditions have shown some further improvement, but the unemployment rate remains elevated. Available data suggest that household spending and business fixed investment advanced, while the recovery in the housing sector slowed somewhat in recent months. Fiscal policy is restraining economic growth. Apart from fluctuations due to changes in energy prices, inflation has been running below the Committee's longer-run objective, but longer-term inflation expectations have remained stable.

Consistent with its statutory mandate, the Committee seeks to foster maximum employment and price stability. The Committee expects that, with appropriate policy accommodation, economic growth will pick up from its recent pace and the unemployment rate will gradually decline toward levels the Committee judges consistent with its dual mandate. The Committee sees the downside risks to the outlook for the economy and the labor market as having diminished, on net, since last fall. The Committee recognizes that inflation persistently below its 2 percent objective could pose risks to economic performance, but it anticipates that inflation will move back toward its objective over the medium term.

Taking into account the extent of federal fiscal retrenchment over the past year, the Committee sees the improvement in economic activity and labor market conditions since it began its asset purchase program as consistent with growing underlying strength in the broader economy. However, the Committee decided to await more evidence that progress will be sustained before adjusting the pace of its purchases. Accordingly, the Committee decided to continue purchasing additional agency mortgage-backed securities at a pace of $40 billion per month and longer-term Treasury securities at a pace of $45 billion per month. The Committee is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities and of rolling over maturing Treasury securities at auction. Taken together, these actions should maintain downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative, which in turn should promote a stronger economic recovery and help to ensure that inflation, over time, is at the rate most consistent with the Committee's dual mandate.

The Committee will closely monitor incoming information on economic and financial developments in coming months and will continue its purchases of Treasury and agency mortgage-backed securities, and employ its other policy tools as appropriate, until the outlook for the labor market has improved substantially in a context of price stability. In judging when to moderate the pace of asset purchases, the Committee will, at its coming meetings, assess whether incoming information continues to support the Committee's expectation of ongoing improvement in labor market conditions and inflation moving back toward its longer-run objective. Asset purchases are not on a preset course, and the Committee's decisions about their pace will remain contingent on the Committee's economic outlook as well as its assessment of the likely efficacy and costs of such

Figure A-6: Alternative C FOMC statement in October 2013

FOMC STATEMENT—OCTOBER 2013 ALTERNATIVE C

1. Information received since the Federal Open Market Committee met in ~~July~~ **September** suggests that economic activity ~~has been expanding~~ **continues to expand** at a moderate pace. ~~Some~~ Indicators of labor market conditions have shown **some** further improvement ~~in recent months~~**; in particular**, ~~but~~ the unemployment rate, ~~remains~~ **though still** elevated**, has continued to decline**. Household spending and business fixed investment advanced, and the housing sector has ~~been strengthening, but~~ **continued to strengthen, even though** mortgage rates have risen ~~further~~ **on balance in recent months** and fiscal policy is restraining economic growth. Apart from fluctuations due to changes in energy prices, inflation has been running **somewhat** below the Committee's longer-run objective, but longer-term inflation expectations have remained stable.

2. Consistent with its statutory mandate, the Committee seeks to foster maximum employment and price stability. The Committee expects that, with appropriate policy accommodation, economic growth will pick up from its recent pace and the unemployment rate will gradually decline toward levels the Committee judges consistent with its dual mandate. The Committee sees the downside risks to the outlook for the economy and the labor market as having diminished, on net, since last fall. ~~but the tightening of financial conditions observed in recent months, if sustained, could slow the pace of improvement in the economy and labor market. The Committee recognizes that inflation persistently below its 2 percent objective could pose risks to economic performance, but it anticipates~~ **The Committee has become more confident that labor market conditions will continue to improve and** that inflation will move back toward its **2 percent** objective over the medium term.

3. Taking into account the extent of federal fiscal retrenchment **over the past year**, the Committee sees the improvement in economic activity and labor market conditions since it began its asset purchase program ~~a year ago~~ as consistent with growing underlying strength in the broader economy. ~~However, the Committee decided to await more evidence that progress will be sustained before adjusting the pace of its purchases. Accordingly, the Committee decided to continue purchasing additional agency mortgage-backed securities at a pace of $40 billion per month and longer-term Treasury securities at a pace of $45 billion per month.~~ **In light of the cumulative progress toward maximum employment and the improvement in the outlook for labor market conditions, the Committee decided to make modest downward adjustments in the pace of its of asset purchases. Beginning in November, the Committee will add to its holdings of agency mortgage-backed securities at a pace of [$30] billion per month rather than $40 billion per month, and will add to its holdings of longer-term Treasury securities at a pace of [$35] billion per month rather than $45 billion per month.** The Committee is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities and of rolling over maturing Treasury securities at auction. ~~Taken together, these actions~~ **The Committee's sizable and still-increasing holdings of longer-term securities** should maintain downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative, which

Alternatives