

Has Forward Guidance Been Effective?

By A. Lee Smith and Thealexa Becker

Since 2008, the Federal Reserve has relied on unconventional policy measures to fulfill its dual mandate. These unconventional tools became necessary when the effective lower bound on nominal rates prevented further cuts in the target federal funds rate. One such tool used in the aftermath of the Great Recession has been forward guidance, which is communication about the future path of policy rates. But has forward guidance, as recently practiced by the Federal Open Market Committee (FOMC), been effective?

Economists have yet to reach a consensus on whether forward guidance is an effective substitute for changes in the target federal funds rate. Forward guidance is similar to conventional policy in that it provides information about short-term interest rates which affect broader interest rates that influence spending by consumers and businesses. However, forward guidance differs from conventional policy in that it carries a greater risk of being misinterpreted (Woodford). Statements that extend the duration of exceptionally low rates may be perceived as a revised forecast of a bleaker economic outlook. Consequently, forward guidance may actually reduce economic sentiment and, in turn, lower aggregate demand.

This article shows that forward guidance, as practiced by the FOMC since 2008, has had similar effects on the economy as past changes in the target federal funds rate. Policy guidance signaling that

A. Lee Smith is an economist at the Federal Reserve Bank of Kansas City. Thealexa Becker is an assistant economist at the bank. This article is on the bank's website at www.KansasCityFed.org

the federal funds rate would remain lower in the future than previously expected has led to increases in employment and prices. Moreover, the peak effects on employment and prices following a typical forward guidance announcement are quantitatively similar to those that followed a typical change in the effective federal funds rate before the zero lower bound became a binding constraint on conventional policy.

One caveat to these conclusions is that our empirical analysis is unable to disentangle the relative contribution of quantitative easing (QE) from the estimated effects of forward guidance. Woodford, among others, suggests QE acts as a signal to the public affirming the FOMC's commitment to its interest rate guidance. Increases in QE may have therefore played an integral role in generating the estimated stimulatory effects of guidance about lower future rates. This is especially plausible since the FOMC statements and transcripts analyzed in this article illustrate that some members of the Committee were hesitant to make policy commitments that would constrain monetary policy in the future.

Section I reviews various channels through which forward guidance can influence economic activity and documents the FOMC's intent behind its recent forward guidance. Section II presents evidence that FOMC forward guidance about lower future rates increases employment and prices and compares these estimates with the effects of changes in the effective federal funds rate prior to the zero lower bound period. Section III concludes with a discussion of the limits of forward guidance as a tool to stimulate the economy when the federal funds rate is constrained by the zero lower bound.

I. How Can Forward Guidance Affect the Economy?

Conventional monetary policy primarily influences the economy through its effects on interest rates. A change in the target federal funds rate, which was the primary focus of policy deliberations prior to 2008, shifts the expectations of future monetary policy which, in turn, affect long-term interest rates. These long-term interest rates, such as those on auto loans and mortgages, are most relevant to households' spending decisions. Through this channel, then, a reduction in the target federal funds rate is able to promote spending in the economy and thus increase price pressures for firms as they begin to use resources more intensively

to meet the higher demand. When the federal funds rate is fixed at its effective lower bound, however, reductions in the target overnight interest rate can no longer be used to generate this economic stimulus.

Forward guidance is thought to operate through a similar interest rate channel but doesn't require a change in the current target federal funds rate. FOMC statements that policy rates will remain exceptionally low in the future can reduce both components of long-term rates—the term premium and the expected path of future interest rates. This type of policy guidance reduces the term premium by reducing the risk of future policy rates unexpectedly increasing. Consequently, investors buying a long-term bond will require a lower term premium, which is the additional compensation they require to bear the risk of future short-term rates differing from their expected path. A lower term premium can stimulate the economy by lowering the credit premium on private debt, which decreases borrowing costs for businesses and households.¹

Forward guidance can also lower long-term interest rates by lowering the expected path of short-term interest rates. Past policy actions suggest that when the economy slows, the Federal Reserve will lower future policy rates to stabilize the economy. When the policy rate is at its effective lower bound, however, future policy rates can't be lowered further. Instead, the FOMC can issue statements about how long the target federal funds rate will remain exceptionally low. If the announced duration of low interest rates is longer than the public expects, a fall in the future path of interest rates then causes an immediate decline in longer-term rates. But whether this change in policy stimulates the economy depends on how the public interprets the forward guidance.

Forward guidance in theory and in practice

In theory, forward guidance about a lower path of future policy rates can be classified as either a policy commitment or a forecast of future policy rates. For example, FOMC statements about low future policy rates could be a commitment to provide future accommodation when policy is otherwise constrained by the zero lower bound. Such promises of more accommodative monetary policy in the future can create a boom in economic activity. Businesses may seek to take advantage of a future boom by hiring more employees to prepare for higher future demand. In this sense, the boom can become self-fulfilling and

lead to a more robust economic recovery. These stimulatory effects can be achieved as long as the forward guidance is perceived as a credible commitment and the path of future interest rates is lower than expected prior to the announcement.

But policy guidance about low future policy rates might also simply reflect the Committee's forecast for the U.S. economy. FOMC forecasts of low future rates may have some stimulatory effect by making future monetary policy more transparent, but the full effects are less clear. To the extent private-sector forecasts align with those of the FOMC, policy guidance does not reveal new information about macroeconomic fundamentals. But if the public places a great deal of trust in the FOMC's macroeconomic forecast, a forecast of future policy rates that is lower than the public anticipated could inadvertently paint a pessimistic picture of the economic outlook. In this case, forecast-based forward guidance may be counterproductive by decreasing consumer sentiment and, in turn, discouraging consumers from making big-ticket purchases.

While classifying forward guidance as either a commitment or a forecast is useful in theory, forward guidance as practiced by the FOMC since 2008 may not fit neatly in either category. In the words of former Philadelphia Fed President Charles Plosser, "the FOMC has not been clear about the purpose of its forward guidance. Is it purely a transparency device, or is it a way to commit to a more accommodative future policy stance to add more accommodation today?"

Intent and perceptions of FOMC forward guidance

FOMC meeting transcripts may shed some light on the intent behind the Committee's recent use of forward guidance. Dialogue from the FOMC's December 2008 meeting suggests the Committee issued forward guidance statements that were intended to provide accommodation but not necessarily a commitment. Although FOMC members wanted to communicate their intention to keep rates low to support the economic recovery, they seemed hesitant to restrict their ability to react to future economic conditions. Former Kansas City Fed President Thomas Hoenig described the Committee's trade-off: "In general, I think that it is difficult to construct a very specific statement that is credible to markets and does not unduly tie the hands of this Committee"

(FOMC 2008, 56) For this reason, the FOMC sought to balance the economic benefits of committing to accommodation with the potential risks associated with constraining future monetary policy.

To allow the FOMC flexibility while still influencing expectations for the future path of interest rates, the Committee chose to issue “more-general rather than more-specific ... statements” (FOMC 2008, 56). Then-Chairman Bernanke described the resulting December 2008 forward guidance statement as “a forecast of policy rather than a commitment to policy, but [one that provides] some information about the Committee’s expectations and should affect market rates” (25). Evidently, the Committee understood that despite their reluctance to commit to future policy actions, effective forward guidance required altering the market’s expectations for the path of future rates.

The FOMC’s forward guidance appears to have been successful in this respect. Table 1 reviews how the price of interest rate futures contracts changed in reaction to major forward guidance announcements during the zero lower bound period. While the FOMC had used forward guidance to indicate future monetary policy actions before 2008, the zero lower bound period marks the first use of policy guidance when the federal funds rate could not be lowered further.² During this period, the communication challenges of implementing forward guidance were considerably more difficult. Despite not being able to use conventional policy measures in tandem with forward guidance, the FOMC was able to affect market interest rates in a manner largely consistent with their statement’s policy guidance.

The first two forward guidance statements from the FOMC during the zero lower bound period qualitatively described the length of time for which the target federal funds rate would remain exceptionally low. In the December 2008 statement, the Committee stated “that weak economic conditions are likely to warrant exceptionally low levels of the federal funds rate for some time.” Bernanke’s hypothesis that this statement would affect market rates was correct. Interest rate futures contracts imply investors lowered their expectations of future policy rates following this announcement (Table 1). The subsequent revision to this forward guidance in March 2009, in which the Committee replaced “some time” with “an extended period,” qualitatively extended the duration for which the Committee anticipated exceptionally

Table 1

Market Reactions to Major Changes in FOMC Forward Guidance

Date of statement	Forward guidance	Market expectations of future rates
December 16, 2008	"The Committee anticipates that weak economic conditions are likely to warrant exceptionally low levels of the federal funds rate for some time."	Decreased
March 18, 2009	"Economic conditions are likely to warrant exceptionally low levels of the federal funds rate for an extended period."	Decreased
August 9, 2011	"Economic conditions[...]are likely to warrant exceptionally low levels of the federal funds rate at least through mid-2013."	Decreased
January 25, 2012	"Economic conditions[...]are likely to warrant exceptionally low levels for the federal funds rate at least through late 2014."	Decreased
September 13, 2012	"Exceptionally low levels for the federal funds rate are likely to be warranted at least through mid-2015."	Decreased
December 12, 2012	"This exceptionally low range for the federal funds rate will be appropriate at least as long as the unemployment rate remains above 6-1/2 percent, inflation between one and two years ahead is projected to be no more than a half percentage point above the Committee's 2 percent longer-run goal, and longer-term inflation expectations continue to be well anchored." Policy is expected to remain "highly accommodative" for a "considerable time" after the end of the asset purchase program.	Mixed
October 29, 2014	QE III Asset Purchase Program ends. Even after employment and inflation are near target, "economic conditions may, for some time, warrant" lower than average levels of the federal funds rate.	Increased
December 17, 2014	Clock starts on "considerable time" from October meeting.	Increased

Notes: The table shows how the price of federal funds futures contracts, which settle four to 12 months ahead, and Eurodollar futures contracts, which settle 13-31 months ahead, changed from the day before various FOMC announcements to the day after.

Sources: Federal Open Market Committee press releases, Chicago Board of Trade, Thomson Reuters, and authors' calculations.

low interest rates. This extension triggered another downward revision in investors' expectations for the future path of policy rates.

Date-based forward guidance was the first notable change from qualitative descriptions of the duration of low rates. In the August 2011 FOMC statement, the Committee replaced "an extended period" with "mid-2013." In January 2012, the FOMC revised "mid-2013" to "late 2014." Eight months later, the FOMC further extended the duration to "mid-2015." Each of these announcements was evidently perceived as the FOMC's credible intention, if not commitment, since each statement lowered the market's expected path of the federal funds rate.

Guidance based on future economic conditions was the second notable change in the type of forward guidance the FOMC issued.³ In the December 2012 statement, the Committee replaced explicit

date-based guidance with new language specifying that monetary policy would remain “highly accommodative” even after the “economic recovery strengthens.” This change in policy came shortly after Woodford cautioned against using calendar-based guidance for its risk of being misinterpreted. To mitigate this risk, the Committee instead used an unemployment “threshold” for keeping rates exceptionally low as long as “the unemployment rate remains above 6-½ percent” and inflation expectations remain “well anchored.” Investors’ reaction to the threshold-based guidance was mixed, with near-term expected rates falling and longer-term expected rates rising, suggesting investors expected at least one of the threshold conditions to be met in about two years.

From December 2012 to March 2014, the unemployment rate declined faster than most analysts forecast.⁴ The rapidly decreasing unemployment rate meant that one of the Committee’s thresholds was likely to be surpassed before the FOMC felt there was broad-based improvement in the labor market, highlighting the risk of using numeric thresholds in forward guidance statements. Consequently, in March 2014, the Committee altered its forward guidance by turning away from quantitative thresholds and instead basing the duration of exceptionally low interest rates on a “wide range of information” regarding “labor market conditions.” The October and December 2014 statements both incorporated the same qualitative thresholds for maintaining exceptionally low rates but added a calendar-based clause suggesting rates would be below their longer-run level for “some time.”

The results in Table 1 suggest the Committee was able to change the expected path of the federal funds rate; however, they do not necessarily imply forward guidance had the Committee’s intended effect on the macroeconomy. When the FOMC signaled a “late 2014” end to exceptionally low rates in their January 2012 statement, *The New York Times* responded with the headline, “Fed Signals That a Full Recovery Is Years Away.” Although the FOMC intended to provide additional policy accommodation by communicating that rates would be held exceptionally low until “late 2014,” *The New York Times* headline instead implied lackluster economic growth would persist until late 2014. This latter interpretation was likely an unintended consequence of the forward guidance and calls into question the efficacy of such statements.

Evidence that perverse effects can arise from policy guidance extends beyond anecdotes from newspapers. Campbell and others show FOMC forward guidance that results in a lower market-expected

path of interest rates is associated with the private sector revising up their forecasts for unemployment and revising down their forecasts for inflation.⁵ The authors interpret these counterintuitive results as evidence that the public believes the FOMC has information about macroeconomic fundamentals the public does not. Admittedly, this interpretation contradicts prior research finding private sector and FOMC forecasts are similar (Gavin and Mandal; Gavin and Pande). But if the FOMC has no forecasting advantage over the public, then guidance indicating exceptionally low levels of the federal funds rate should, at worst, have no effect on the economy.

II. Evaluating the Effects of Forward Guidance

Since 2008, FOMC forward guidance that lowered the expected path of the federal funds rate resulted in increases in employment and inflation. The stimulatory effect on the economy suggests that any information about the economic outlook contained in such forward guidance is trumped by the promise of more accommodative future monetary policy. In other words, any advantage the FOMC may have in forecasting the macroeconomy is overshadowed by its ability to target the future path of the federal funds rate. Consumers and firms reacted to announced periods of exceptionally low future interest rates by increasing aggregate demand, leading to more hiring and increased inflationary pressure in the U.S. economy.

Furthermore, unexpected changes in forward guidance appear to have similar effects on employment and inflation as a change in the effective federal funds rate prior to the zero lower bound period. These different policy measures have quantitatively similar macroeconomic effects even though forward guidance changes shift the level of interest rates much less than conventional monetary policy changes. Three factors could explain forward guidance's estimated potency. First, unlike conventional monetary changes, forward guidance announcements have a larger effect on long-term expected rates than near-term expected rates. Second, forward guidance announcements alter expected interest rates at much longer horizons than conventional monetary policy changes. Third, concurrent changes in the FOMC's QE programs, which often accompanied forward guidance announcements, may have amplified the estimated effects of forward guidance.

A statistical model of forward guidance

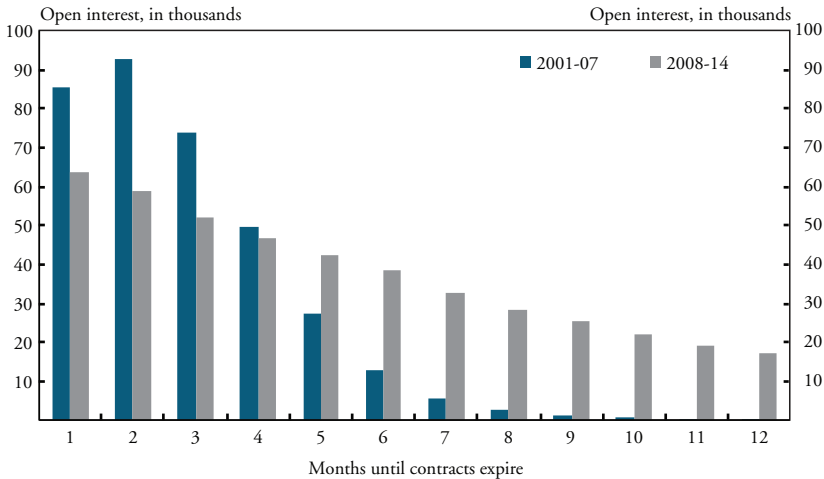
We use a vector autoregression (VAR) to evaluate how the economy responds to the FOMC's use of forward guidance. The sample starts in December 2008, when the target federal funds rate was set to its effective lower bound, and ends in December 2014. The VAR includes seven variables: employment growth, inflation, and the expected federal funds rate at five horizons in the future. We measure employment growth using the monthly change in nonfarm payrolls and the inflation rate using the percent change in the price index for personal consumption expenditures (PCE). These variables are closely related to the Federal Reserve's dual mandate to keep the economy operating near full employment with stable prices.

To measure how investors' views about the future path of the federal funds rate have evolved since late 2008, we examine changes in the prices of interest rate futures contracts. The Chicago Board of Trade's federal funds futures market allows investors to purchase a contract which pays them interest on their investment equal to the average federal funds rate during the settlement month. These futures contracts are written up to 36 months in advance, but until recently, only the near-term contracts (those written for the next two to three months) were heavily traded. Since the end of 2008, when the FOMC began to increasingly use forward guidance, longer-term contracts have become more widely traded. Chart 1 shows one measure of market participation, open interest, in contracts five to 12 months ahead has increased substantially since 2008. The increase in open interest indicates these contracts have become more liquid and, therefore, that their prices better reflect market-wide views of where the federal funds rate is headed as opposed to liquidity premiums.

The VAR includes a range of expected future interest rates, starting with the federal funds rate expected three FOMC meetings into the future to the federal funds rate expected seven meetings into the future.⁶ With eight (scheduled) FOMC meetings per year roughly six weeks apart, the response of the expected federal funds rate after the third future meeting to a forward guidance shock can be interpreted as the change in the expected federal funds rate four to five months from the announced forward guidance. Similarly, the response of the expected federal funds rate seven meetings into the future can be interpreted as

Chart 1

Market Participation in Federal Funds Futures Contracts before and after 2008



Note: The bars show the average monthly open interest in federal funds futures contracts.
Sources: Chicago Board of Trade and authors' calculations.

the change in the expected federal funds rate about one year from the announced guidance.⁷

We use changes in the closing price of federal funds contracts from the day before an FOMC statement to the day the statement is issued to measure the change in investors' expectations about the future path of policy rates. The methodology used to extract the change in investors' expectations follows from previous FOMC announcement event studies and is documented in the Appendix (Gürkaynak, Sack, and Swanson, 2005 and 2007; Doh and Connelly; Berge and Cao).⁸

Unlike previous studies that have used interest rate futures contracts to measure the effects of FOMC forward guidance, we include the extracted change in investors' expectations about future monetary policy as an endogenous variable in the VAR. Previous research suggests that changes in federal funds futures contracts are not purely exogenous (Piazzesi and Swanson). Table 2 presents the results of a test for predictability of the daily change in interest rate futures contracts around FOMC meetings over the December 2008 to December 2014 sample. Table 2 shows that one lag of PCE inflation or one lag of

Table 2

The Predictability of Changes in Forward Guidance around FOMC Meetings

Expected policy rate after...	One lag of macro variable		Six lags of macro variable	
	Employment growth	PCE inflation rate	Employment growth	PCE inflation rate
Current meeting	0.110	0.021**	0.002***	0.002***
First-future meeting	0.091*	0.012**	0.051*	0.300
Second-future meeting	0.143	0.032**	0.009***	0.087*
Third-future meeting	0.002***	0.041**	0.003***	0.538
Fourth-future meeting	0.010**	0.072*	0.134	0.016**
Fifth-future meeting	0.030**	0.013**	0.078*	0.001***
Sixth-future meeting	0.007***	0.674	0.166	0.251
Seventh-future meeting	0.028**	0.483	0.078*	0.002***

* Significant at the 90 percent confidence level.

** Significant at the 95 percent confidence level

*** Significant at the 99 percent confidence level.

Notes: For each line in the table, the p value for an F-test is reported for an ordinary least squares regression of the expected policy rate on a constant and one or six lags of either employment growth or the inflation rate according to the PCE price index. Newey-West standard errors computed with three lags are used to generate the test statistic. The regressions are estimated from December 2008 to December 2014.

Sources: Bureau of Labor Statistics, Bureau of Economic Analysis, Chicago Board of Trade, and authors' calculations.

employment growth is able to systematically predict a portion of the change in the implied federal funds futures rates around FOMC meetings.⁹ This predictability implies estimates of the effects of forward guidance which treat the extracted changes in interest rates futures as unforecastable will be biased. We therefore identify forward guidance shocks from the portion of the change in federal funds futures implied rates that cannot be explained by lagged macroeconomic variables.

We isolate a forward guidance shock from all other shocks hitting the U.S. economy in any given month as an exogenous change in the expected future path of interest rates that does not affect employment and inflation contemporaneously. This assumption follows from the notion that prices and employment are slow to adjust to changes in monetary policy (see, for example, Friedman). This assumption is also the standard identifying device used to elicit the effects of changes in the effective federal funds rate on employment and inflation when the target federal funds rate is not at its effective lower bound. Consequently, estimates of the effects of forward guidance and changes in conventional monetary policy are comparable along this important dimension.

The effects of FOMC forward guidance

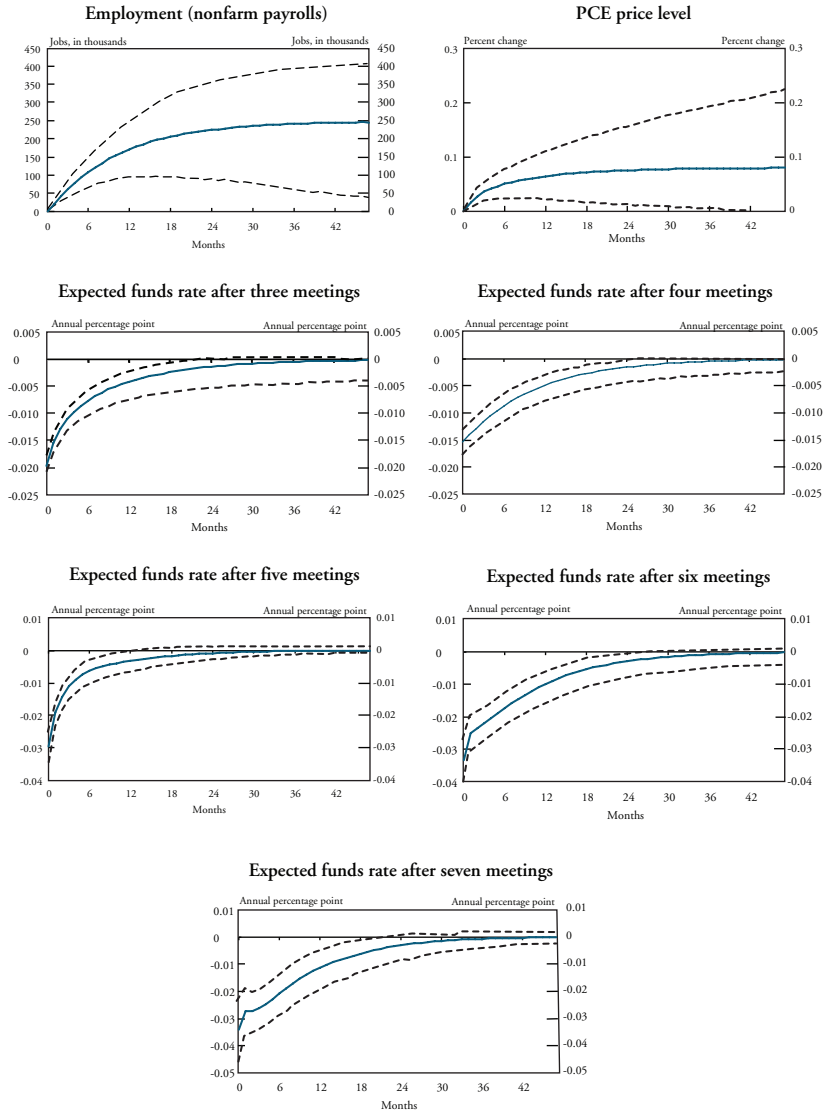
An unexpected change in the FOMC's forward guidance that lowered the expected path of future policy rates during the zero lower-bound period is estimated to have stimulated the U.S. economy. Chart 2 shows how nonfarm payrolls, the PCE price index (on a log scale), and the expected federal funds rate three to seven meetings into the future respond over time to a forward guidance shock that lowers expected future policy rates. Employment and the price level do not respond the month the guidance is issued, as restricted by the identifying assumptions. In subsequent months, employment begins to grow and peaks after almost four years. The cumulative growth in nonfarm payrolls totals nearly 250,000 jobs. Forward guidance implying more accommodative future policy also puts upward pressure on prices. Inflation gains accumulate to a 0.1 percent increase in the PCE price level two years after the guidance is issued. Together, these responses suggest the FOMC's use of forward guidance had an economically significant effect on employment and a smaller, yet still significant, effect on inflation. However, these macroeconomic effects are not fully felt until several years after the guidance is issued.

The responses of employment and inflation to a forward guidance shock imply forward guidance has qualitatively similar effects to unexpected changes in the federal funds rate. To more directly compare these policies, we estimate a conventional monetary policy VAR from August 1979 to October 2008. This time series spans the Volcker-Greenspan chairmanships as well as the portion of the Bernanke chairmanship that preceded the use of unconventional monetary policy. Consequently, we use the level of the effective federal funds rate over this sample to measure the stance of monetary policy following the standard approach used, for example, in Christiano, Eichenbaum, and Evans (1999, 2005). In addition to the effective federal funds rate, the conventional VAR includes the monthly change in nonfarm payrolls and the monthly inflation rate measured by the PCE price index. We make the same identifying assumption as in the previous model to distinguish conventional monetary policy shocks from all other shocks to the economy.

Although the macroeconomic effects of a conventional monetary policy shock on employment and prices are similar to those of a

Chart 2

Impulse Responses to a Forward Guidance Shock



Notes: The VAR model shows the impulse response to a forward guidance shock. The x-axis measures the months since the forward guidance shock. The solid line represents the median response, and the dashed lines are 68 percent confidence bands computed with a Bayesian Monte Carlo procedure. The VAR is estimated from December 2008 to December 2014 using one lag selected using the Akaike Information Criterion.

Sources: Chicago Board of Trade, Bureau of Labor Statistics, Bureau of Economic Analysis, and authors' calculations.

forward guidance shock, the sizes of these policy changes differ (Chart 3). The peak effect on payrolls and prices occurs 18-24 months after the expansionary monetary policy surprise and results in payroll gains totaling about 150,000 jobs and a total increase in the PCE price level of 0.15 percent. These estimates suggest the effects of a typical forward guidance shock on the economy are disproportionately outsized given the change in the expected future path of interest rates. Even though the typical size of a forward guidance shock is much smaller than the size of a federal funds rate shock (2.5 basis points compared with 50 basis points), both shocks result in similar changes in payrolls and prices.¹⁰

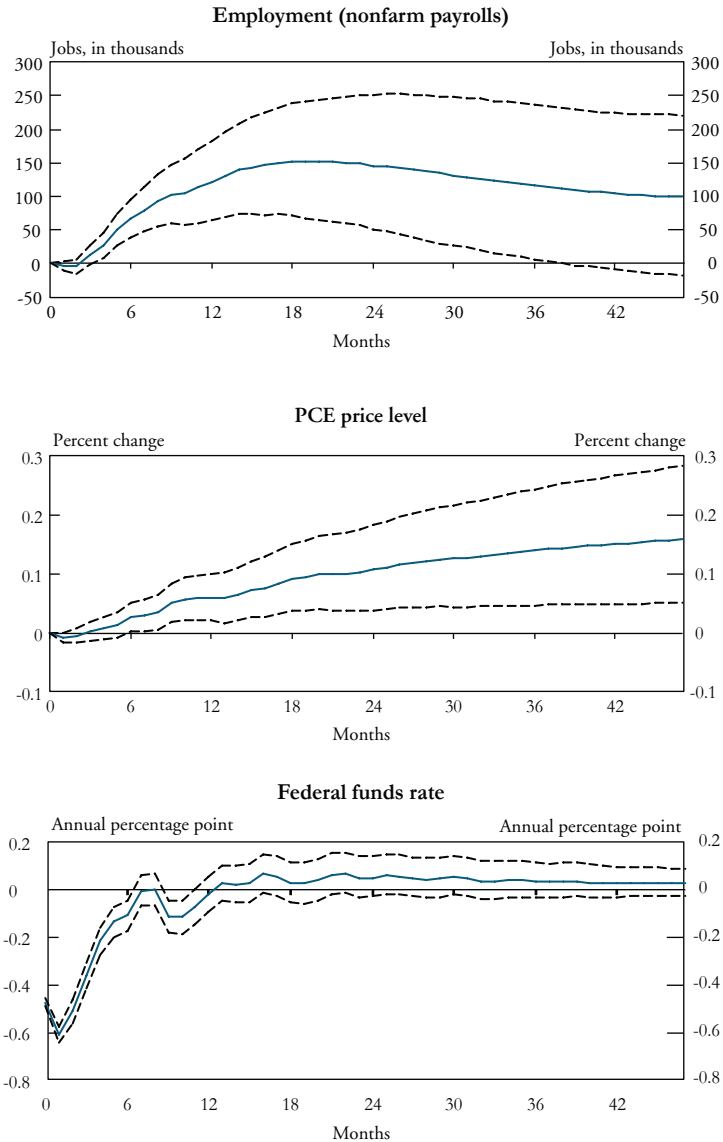
However, forward guidance shocks affect rates for a much longer time than do conventional monetary policy surprises. The effects of a forward guidance shock on the expected federal funds rate 12 months ahead (after seven FOMC meetings) are significant for the first 20 months after the guidance is issued. By this measure the expected federal funds rate falls a statistically significant amount 32 months after guidance is issued. Meanwhile, the effects of a conventional monetary policy shock on the effective federal funds rate dissipate after 12 months.

Furthermore, forward guidance shocks that imply a lower expected path of the federal funds rate decrease the slope of the expected funds rate curve—that is, expected rates one year out fall more than expected rates four to five months out. In contrast, conventional monetary policy shocks that decrease the federal funds rate are estimated to increase the slope of the expected funds rate—the policy rate falls more in the near term than the long term.

These differences in the behavior of expected future policy rates may explain why forward guidance shocks have similar effects as conventional monetary policy shocks despite their relatively small size. However, another possibility is that QE amplifies the effects of forward guidance. The so-called “signaling theory” of QE suggests that when the FOMC expands its balance sheet, it is signaling its commitment to maintain exceptionally low levels of the target federal funds rate in the future.¹¹ While we focus on forward guidance by studying the reaction of interest rate futures prices to FOMC statements, concurrent QE announcements could also influence expected future policy rates. However, to the extent QE is perceived as merely a commitment device for forward guidance—as hypothesized by the signaling theory—

Chart 3

Impulse Responses to a Monetary Policy Shock



Notes: The VAR model shows the impulse response to a monetary policy shock when the federal funds rate is above the zero lower bound. The x-axis measures the months since the monetary policy shock. The solid line represents the median response, and the dashed lines are 68 percent confidence bands computed with a Bayesian Monte Carlo procedure. The VAR is estimated from August 1979 to October 2008 using 11 lags selected using the Akaike Information Criterion.

Sources: Federal Reserve Bank of New York, Bureau of Labor Statistics, Bureau of Economic Analysis, and authors' calculations.

disentangling the effects of QE from forward guidance would not be necessary, were it possible. If QE also operates through a “portfolio-balance” channel, whereby investors replace bonds sold to the Federal Reserve during QE with more risky assets, then the empirical strategy we use may overstate the effects of forward guidance.

III. Conclusion and Caveats

Our results suggest forward guidance, as practiced by the FOMC, was a powerful policy tool when the federal funds rate was constrained by its effective lower bound. Changes in the FOMC’s forward guidance appear to have significant effects on two macroeconomic aggregates closely related to the Federal Reserve’s dual mandate. However, these results also raise the question of why the recovery from the Great Recession was sluggish if the FOMC had such a powerful tool.

Forward guidance has several limitations. The primary limitation of forward guidance is that future policy rates are also limited by the zero lower bound. For example, following the September 13, 2012 FOMC meeting, when the Committee announced that rates would likely be low through mid-2015, the expected federal funds rate three years ahead fell to 0.21 percent (see Table 1).¹² With expected future rates so low, forward guidance has little room to stimulate the economy without stretching the horizon of forward guidance four or five years ahead. However, the Committee may not view the benefits of such extreme forward guidance as worth the risks of constraining monetary policy far into the future. It may be impossible for a central bank to communicate a credible inflation target while simultaneously committing to easy future monetary policy that will generate a period of above-target inflation. Krugman has described this paradox by noting that implementing forward guidance requires the central bank to “credibly promise to be irresponsible.”

These concerns were clearly at play in past FOMC deliberations. Transcripts from the December 2008 FOMC meeting reveal that some members of the FOMC were hesitant to lean too heavily on future policy commitments to stimulate the economy. The Committee’s use of forward guidance since 2008 has consequently been a balancing act between communicating to the public that policy will remain accommodative and not unduly tying the FOMC’s hands. Despite the

FOMC's hesitancy to make explicit policy commitments, our estimates suggest that FOMC forward guidance that future policy rates would remain exceptionally low has, on average, been effective in increasing employment and prices.

Appendix

Technical Details on Identifying Monetary Policy Shocks

Recovering the change in the expected path of the federal funds rate using federal funds futures data follows a technique used by Gürkaynak, Sack, and Swanson (2005). This method uses the relationship between the federal funds futures rates and FOMC policy decisions at a daily frequency, assuming that high-frequency changes in the term premium are negligible.

The change in the expected federal funds rate after the current meeting comes from the equation

$$e_t^0 = (f_t^0 - f_{(t-1)}^0) \frac{m_0}{(m_0 - d_0)},$$

where $(f_t^0 - f_{(t-1)}^0)$ represents the change in the federal funds futures rate, m_0 is the number of days in the month, d_0 is the day of the FOMC meeting, and $\frac{m_0}{m_0 - d_0}$ is a scale factor that adjusts for the number of days left in the month after the FOMC meeting. This scale factor is needed to account for the monthly average structure of the federal funds futures contracts.

To determine the effects of changes in the expected path of the federal funds rate at longer horizons, a slightly different formulation is needed. The change on day t in the federal funds expected rate after n future meetings is represented by the equation

$$e_t^n = \left[(f_t^{i(n)} - f_{(t-1)}^{i(n)}) - \frac{d_n}{m_n} e_t^{n-1} \right] \frac{m_n}{m_n - d_n},$$

where e_t^n represents the change in the expected federal funds rate after n future meetings, $(f_t^{i(n)} - f_{(t-1)}^{i(n)})$ now represents the change in federal funds futures rates, and $i(n)$ is the number of months from t to the n th future meeting. The term $\frac{d_n}{m_n} e_t^{n-1}$ is an adjustment for the number of days in the $i(n)$ 'th month for which the expected change in the policy rate is determined by e_t^{n-1} . The term $\frac{m_n}{m_n - d_n}$ is again the scale factor that adjusts for the number of days left in the month after the n th future meeting.

These monetary policy shocks are constructed for the current meeting through the seventh-future meeting from November 2008 to December 2014. As there are only eight FOMC meetings every year, months with no FOMC meeting have a change in expected future policy rates equal to 0.

The statistical model for this analysis is a VAR using monthly data. The vector, X_t , includes the change in private non-farm employment, PCE inflation, and the cumulative sum of the expected change in the future federal funds rates as defined in the first part of the Appendix. The cumulative sum is used so that the expected interest rates that enter the VAR are in levels instead of first differences. The *structural* VAR is expressed as

$$BX_t = B_0 + B_1X_{t-1} + \dots + B_kX_{t-k} + \varepsilon_t, \varepsilon_t \sim (0, I),$$

where the matrix B captures the contemporaneous relationships between the variables. The VAR is estimated in *reduced form* using ordinary least squares (OLS) performed equation by equation:

$$X_t = A_0 + A_1X_{t-1} + \dots + A_kX_{t-k} + z_t, z_t \sim (0, \Omega).$$

The structural shocks, ε_t , can be recovered from the vector of reduced form residuals, z_t , by the relationship

$$B^{-1}B^{-1'} = \Omega.$$

This article assumes that the structural shocks are related to the reduced form residuals by the relationship, $\varepsilon_t = C^{-1}z_t$, where C is the unique lower triangular Cholesky decomposition of Ω . The forward guidance shock is identified as the orthogonalized shock to the expected federal funds rate after three future meetings. Given the lower-triangular form of the Cholesky decomposition C , the forward guidance shock is therefore identified as the only shock which can affect all of the expected future federal funds rates in the VAR model contemporaneously but has no contemporaneous effect on the change in employment or inflation. For the alternative VAR model, the same identifying assumption is used: a monetary policy shock is the only shock which can affect the federal funds rate contemporaneously and have no contemporaneous effect on the change in employment or inflation.

Endnotes

¹Recent research has highlighted the relationship between changes in the federal funds rate, term premiums on government debt, and other risk premiums on private sector debt. See, for example, Hanson and Stein (2014); Gertler and Karadi; and Gilchrist, López-Salido, and Zakrajšek.

²Rudebusch and Williams, Campbell and others, and Doh and Connelly provide overviews of the FOMC's use of forward guidance prior to the zero lower bound period.

³The December 2012 statement described the economic conditions that would need to be met before the Committee anticipated the need to increase the target federal funds rate (Table 1).

⁴In the December 2012 Blue Chip Consensus Forecasts, the unemployment rate was expected to average 7.6 percent in the fourth quarter of 2013. The actual average was 7 percent, with the December 2013 unemployment rate falling 0.3 percentage point to 6.7 percent.

⁵In most of Campbell and others' specifications, the macroeconomic effects of forward guidance are not statistically significant.

⁶The expected federal funds rate after the current, future, and second-future FOMC meetings are excluded, since these expected policy rates haven't varied much with changes in FOMC announcements following the forward guidance issued in December 2008. In other words, investors expected the FOMC would not increase the target federal funds rate in the near future after setting it to its current 0-0.25 percent range. Furthermore, a parsimonious model is desirable since the sample is short relative to the number of parameters estimated.

⁷We also estimate a VAR using Eurodollar futures contracts with longer settlement dates (up to 31 months into the future) and find similar effects on employment and inflation.

⁸Other recent studies which use interest rate futures contracts to measure the effects of FOMC forward guidance include Nakamura and Steinsson, and Gertler and Karadi.

⁹Using six lags of these macroeconomic aggregates yields similar results.

¹⁰Del Negro, Giannoni, and Patterson find that standard theoretical macroeconomic models have a similar phenomenon in that they predict forward guidance is extremely powerful. They dub this the "Forward Guidance Puzzle."

¹¹Bauer and Rudebusch, Krisnamurthy and Vissing-Jorgensen, and Woodford present evidence in favor of the signaling theory interpretation of QE.

¹²The three-year OIS contract closed at 0.21 percent on September 13, 2012, according to data from Bloomberg.

References

- Appelbaum, Binyamin. 2012. "Fed Signals That a Full Recovery Is Years Away," *The New York Times*, January 25.
- Berge, Travis J., and Guangye Cao. 2014. "Global Effects of U.S. Monetary Policy: Is Unconventional Policy Different?" Federal Reserve Bank of Kansas City, *Economic Review*, vol. 99, no. 1, pp. 65-91.
- Bauer, Michael D., and Glenn D. Rudebusch. 2014. "The Signaling Channel for Federal Reserve Bond Purchases," *International Journal of Central Banking*, vol. 10, no. 3, pp. 233-289.
- Campbell, Jeffrey R., Charles L. Evans, Jonas D. M. Fisher, and Alejandro Justiniano. 2012. "Macroeconomic Effects of Federal Reserve Forward Guidance," *Brookings Papers on Economic Activity*, pp. 1-80, Spring.
- Christiano, Lawrence J., Martin Eichenbaum, and Charles L. Evans. 2005. "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy," *Journal of Political Economy*, vol. 113, no. 1, pp. 1-45.
- _____. 1999. "Monetary Policy Shocks: What Have We Learned and to What End?" in John B. Taylor and Michael Woodford, eds., *Handbook of Macroeconomics*, vol. 1, pt. A, pp. 65-148. Amsterdam: Elsevier.
- Coibion, Olivier. 2012. "Are the Effects of Monetary Policy Shocks Big or Small?" *American Economic Journal: Macroeconomics*, vol. 4, no. 2, pp. 1-32.
- Del Negro, Marco, Marc P. Giannoni, and Christina Patterson. 2012. "The Forward Guidance Puzzle," Federal Reserve Bank of New York Staff Report 574.
- Doh, Taeyoung, and Michael Connolly. 2013. "Has the Effect of Monetary Policy Announcements on Asset Prices Changed?" Federal Reserve Bank of Kansas City, *Economic Review*, vol. 98, no. 3, pp. 31-65.
- Faust, Jon, Eric T. Swanson, and Jonathan H. Wright. 2004. "Do Federal Reserve Policy Surprises Reveal Superior Information About the Economy?" *Contributions in Macroeconomics*, vol. 4, no. 1, pp. 1534-6005.
- Federal Open Market Committee (FOMC). 2014. "Meeting of the Federal Open Market Committee on December 16-17, 2014," transcript, December. Available at <http://www.federalreserve.gov/monetarypolicy/files/FOMC-20141217meeting.pdf>.
- _____. 2014. Press release, "Policy Statement," October 29.
- _____. 2014. Press release, "Policy Statement," March 19.
- _____. 2012. Press release, "Policy Statement," December 12.
- _____. 2012. Press release, "Policy Statement," September 13.
- _____. 2012. Press release, "Policy Statement," January 25.
- _____. 2011. Press release, "Policy Statement," August 9.
- _____. 2009. Press release, "Policy Statement," March 18.
- _____. 2008. Press release, "Policy Statement," December 16.
- Friedman, Milton. 1961. "The Lag in Effect of Monetary Policy," *The Journal of Political Economy*, vol. 69, no. 5, pp. 447-466.
- Gagnon, Joseph, Matthew Raskin, Julie Remache, and Brian Sack. 2011. "The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases," *International Journal of Central Banking* vol. 7, no. 1, pp. 3-43.

- Gavin, William T., and Geetanjali Pande. 2008. "FOMC Consensus Forecasts," Federal Reserve Bank of St. Louis, *Review*, vol. 90, no. 3, pp. 149-164.
- _____, and Rachel J. Mandal. 2001. "Forecasting Inflation and Growth: Do Private Forecasts Match Those of Policymakers?" *Business Economics*, vol. 36, no. 1, pp. 13-20.
- Gertler, Mark, and Peter Karadi. 2014. "Monetary Policy Surprises, Credit Costs and Economic Activity," *National Bureau of Economic Research Working Paper* no. 20224, June.
- Gilchrist, Simon, David López-Salido, and Egon Zakrajšek. 2014. "Monetary Policy and Real Borrowing Costs at the Zero Lower Bound," *National Bureau of Economic Research Working Paper* no. 20094, May.
- Gürkaynak, Refet S., Brian P. Sack, and Eric T. Swanson. 2007. "Market-Based Measures of Monetary Policy Expectations," *Journal of Business & Economic Statistics*, vol. 25, no. 2, pp. 201-212.
- _____, _____, and _____. 2005. "The Sensitivity of Long-Term Interest Rates to Economic News: Evidence and Implications for Macroeconomic Models," *American Economic Review*, vol. 95, no. 1, pp. 425-436.
- Hanson, Samuel G., and Jeremy C. Stein. 2014. "Monetary Policy and Long-Term Real Rates," *Journal of Financial Economics*, vol. 115, no. 3, pp. 429-448.
- Krishnamurthy, Arvind, and Annette Vissing-Jorgensen. 2011. "The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy," *Brookings Papers on Economic Activity*, pp. 215-287, Fall.
- Krugman, Paul R., Kathryn M. Dominguez, and Kenneth Rogoff. 1998. "It's Baaack: Japan's Slump and the Return of the Liquidity Trap," *Brookings Papers on Economic Activity* 2, pp. 137-205, Fall.
- Nakamura, Emi, and Jón Steinsson. 2013. "High Frequency Identification of Monetary Non-Neutrality," *NBER Working Paper* no. 19260, July.
- Piazzesi, Monika, and Eric T. Swanson. 2008. "Futures Prices as Risk-Adjusted Forecasts of Monetary Policy," *Journal of Monetary Economics* vol. 55, no. 4, pp. 677-691.
- Plosser, Charles I. 2014. "Communication Challenges," Address to the 2014 U.S. Monetary Policy Forum Initiative on Global Markets, University of Chicago Booth School of Business, New York, February 28.
- Rudebusch, Glenn D., and John C. Williams. 2008. "Revealing the secrets of the temple: The value of publishing central bank interest rate projections." *Asset Prices and Monetary Policy*, pp. 247-289. University of Chicago Press.
- Woodford, Michael. 2012. "Methods of Policy Accommodation at the Interest-Rate Lower Bound," Federal Reserve Bank of Kansas City, *The Changing Policy Landscape: 2012 Jackson Hole Symposium*.