

Evaluating Quantitative Easing: The Importance of Accounting for Forward Guidance

By Brent Bundick and A. Lee Smith

On March 15, 2020, the Federal Open Market Committee (FOMC) lowered the federal funds rate—its primary policy tool—to its effective lower bound in response to the pandemic-induced contraction in economic activity. At the same time, the FOMC began engaging in large-scale asset purchases (LSAPs) and provided forward guidance about the future path of the funds rate. Both LSAPs and forward guidance are less conventional tools that the FOMC also deployed to combat the Great Recession of 2007–09. Although the Great Recession and pandemic crisis were driven by very different factors, policymakers in both periods looked to LSAPs and forward guidance to help stabilize financial markets and promote maximum employment and price stability.

In theory, LSAPs support the economy by putting downward pressure on longer-term interest rates and improving the flow of credit to households and firms. However, policymakers and economists have yet to reach a consensus on how effective LSAPs are in providing accommodation and improving macroeconomic outcomes. One common approach to measuring the effectiveness of these tools is to study how financial markets respond to announced changes in LSAPs and forward guidance. But the market responses to these tools can be difficult to disentangle because announced changes in LSAPs often coincide with

Brent Bundick is a senior research and policy advisor and A. Lee Smith is a vice president and economist at the Federal Reserve Bank of Kansas City. Logan Hotz, a research associate at the bank, helped prepare the article. This article is on the bank's website at www.KansasCityFed.org

changes in forward guidance about the future path of interest rates. For example, at the conclusion of its December 2008 meeting, the FOMC announced that it would purchase large quantities of agency debt and mortgage-backed securities and evaluate the potential benefits of purchasing longer-term Treasury securities (Board of Governors 2008a). In the same announcement, however, the Committee also announced that the federal funds rate would remain exceptionally low “for some time.” When responding to the pandemic in 2020, the FOMC’s adoption of new forward guidance on the funds rate on March 15 occurred at the same time as the announcement of additional asset purchases, again making the policies’ outcomes difficult to disentangle.

In this article, we highlight our research in Bundick, Herriford, and Smith (2021) that attempts to measure the efficacy of the FOMC’s previous asset purchase programs during 2008–10 while explicitly accounting for changes in forward guidance. We find that controlling for concurrent changes in forward guidance implies a roughly 25 percent reduction in the accommodative effects of the FOMC’s first two asset purchase programs relative to estimates that do not disentangle the two tools.

Overall, we argue that forward guidance and asset purchases represent two distinct tools in a central bank’s toolkit. This interpretation contrasts with other recent research arguing for a signaling channel of asset purchases, in which changes in asset purchases themselves provide information about the future funds rate and hence directly play a role in communicating the central bank’s forward guidance. Our empirical analysis suggests little evidence for the signaling channel, supporting our interpretation of forward guidance and asset purchases as two distinct policy tools that can help stabilize the economy.

Section I reviews the announcements of the FOMC’s asset purchase programs in response to the Great Recession and the changes in forward guidance that often occurred at the same time. Section II documents that even prior to the federal funds rate hitting the effective lower bound and the adoption of LSAPs, changes in forward guidance alone affected longer-term interest rates by changing the perceived uncertainty surrounding future policy rates. Section III estimates the efficacy of asset purchase programs adopted during the 2008–10 period, explicitly accounting for concurrent changes in forward guidance.

I. The Federal Reserve's Asset Purchase Programs in Response to the Great Recession

As labor market conditions deteriorated near the end of 2008, the FOMC lowered the federal funds rate to near zero “to promote the resumption of sustainable economic growth and to preserve price stability” (Board of Governors 2008a). With its conventional policy tool exhausted, the Committee then turned to forward guidance and large-scale asset purchases, also known as quantitative easing (QE), to help stabilize the economy as the recession continued. Over the course of the recession and recovery, the FOMC engaged in three subsequent rounds of QE, known as QE1, QE2, and the maturity extension program (MEP).¹

QE1: Support to the housing sector and broader Treasury markets

In 2006, the housing sector began to contract, and the rapid rise in subprime mortgage delinquencies eventually led to a significant tightening in financing conditions for households and a broader decline in economic activity. To support the housing market and increase the availability of credit, the Federal Reserve announced on November 25, 2008, that it would purchase up to \$100 billion in government-sponsored enterprise (GSE) debt and \$500 billion in GSE mortgage-backed securities (Board of Governors 2008b). In subsequent communications, Chair Bernanke and the FOMC signaled they were also prepared to engage in purchases of Treasury securities if conditions continued to deteriorate. As the economy continued to lose hundreds of thousands of jobs in early 2009, the FOMC followed through on these intentions by announcing purchases of \$300 billion in Treasury securities and an additional \$750 billion in mortgage-backed securities over the next six months (Board of Governors 2009). Gagnon and others (2011) argue that these actions led to an economically meaningful reduction in longer-term interest rates, even for securities that were not directly purchased by the FOMC.

QE2: Maintaining and adding to the Fed's holdings of Treasury securities

Despite the policy actions taken by the FOMC to support the economy, the economic recovery slowed during the summer of 2010. As a result, the Committee announced at its August 2010 meeting that it would begin reinvesting principal payments from the maturing securities on its balance sheet into longer-term Treasury securities (Board of Governors 2010c). While the economy continued to shed jobs and bank lending contracted, the Committee stated at its September 2010 meeting that it was prepared to add accommodation if needed to support the economic recovery (Board of Governors 2010b). The pace of the recovery remained slow in the fall of 2010, and the FOMC announced in November 2010 that it would buy about \$75 billion of longer-term Treasury securities per month for the next eight months—a total program size of \$600 billion (Board of Governors 2010a). Krishnamurthy and Vissing-Jorgensen (2011) show longer-term Treasury yields declined significantly following the initial announcements in August and September 2010. By the time the second asset purchase program was announced in November, market participants largely anticipated the announcement, leading Treasury yields to actually rise slightly following the meeting.²

The MEP: Shifting composition to longer-term Treasury securities

In mid-2011, the economic recovery showed signs of stalling, with the unemployment rate stuck around 9 percent. To provide further monetary accommodation, the FOMC again decided to undertake a new asset purchase program, the MEP (Board of Governors 2011a). Unlike the previous two asset purchase programs, the MEP did not increase the size of the balance sheet but instead changed its composition, as the FOMC simultaneously sold short-term Treasury securities and used the proceeds to buy longer-term securities. In its September 2011 statement, the FOMC indicated that by the end of the following June, it would extend the average maturity of its holdings by purchasing \$400 billion of Treasury securities set to mature within six and 30 years while selling the same amount of securities set to mature within three years or less.³ Even though the program did not change the size

of the Fed's balance sheet, the announcement of a composition shift toward longer-maturity Treasury securities led to a significant decline in longer-term bond yields.

Contemporaneous changes in forward guidance about the federal funds rate

At first glance, the responses of bond yields to the announcement of these past programs suggest that asset purchases are a potent tool in the central bank's toolkit. However, this casual analysis fails to account for contemporaneous changes in forward guidance about the future path of the funds rate.

Table 1 shows that some of the key announcements regarding asset purchases in fact coincided with simultaneous changes in forward guidance. The announcement on December 16, 2008, coincided with guidance that the federal funds rate would remain exceptionally low "for some time." The announcement on March 18, 2009, coincided with guidance that the funds rate would likely remain low for an "extended period." Other announcements, such as the FOMC's intention to "provide additional accommodation if needed to support the recovery" during its September 2010 announcement of QE2, could apply to either asset purchases or a change in the path of the funds rate. While Krishnamurthy and Vissing-Jorgensen (2011) associate this language with increasing the likelihood of a new asset purchase program, this language may have also led to expectations of a lower future path for the federal funds rate.

The response of bond yields to the August 2011 FOMC meeting illustrates how forward guidance, even in the absence of a change in an asset purchase program, can affect longer-term bond yields. In its statement on August 9, 2011, the Committee specified that economic conditions "are likely to warrant exceptionally low levels for the federal funds rate at least through mid-2013" (Board of Governors 2011b). This statement marked the first use of forward guidance that referenced a specific date, and most market participants interpreted this guidance as an expectation that policy rates would remain near zero for the next several quarters.⁴ Even though the FOMC did not make changes to its asset purchase program at that meeting, the change in forward guidance led longer-term bond yields to fall significantly.

Table 1
**Announcements of Selected Asset Purchase Programs
 and Forward Guidance**

Announcement date	Purchase program	Asset purchases	Forward guidance
November 25, 2008	QE1	Announcement that Federal Reserve will purchase \$100 billion of GSE debt and \$500 billion GSE mortgage-backed securities.	None provided.
December 1, 2008	QE1	In a speech, Chair Bernanke suggests FOMC could purchase additional agency securities or Treasury securities.	No discussion of forward guidance.
December 16, 2008	QE1	Committee states it is “evaluating potential benefits of purchasing longer-term Treasury securities.”	New guidance that federal funds rate would remain exceptionally low “for some time.”
January 28, 2009	QE1	Announces intention to purchase longer-term Treasury securities if circumstances dictate they would be effective in supporting credit markets.	Maintains previous “some time” guidance.
March 18, 2009	QE1	Announces purchases up to \$300 billion of longer-term Treasury securities over next six months.	New guidance that funds rate is likely to remain low for an “extended period.”
August 10, 2010	QE2	Committee states it will begin reinvesting principal payments from maturing securities.	Maintains previous “extended period” guidance.
September 21, 2010	QE2	Committee states that it will continue reinvestment and provide additional accommodation as necessary.	Maintains previous “extended period” guidance, provide additional accommodation as necessary.
August 9, 2011	None	N/A	Conditions are “likely to warrant exceptionally low levels for the federal funds rate at least through mid-2013.”
September 21, 2011	MEP	Announces sale of short-term Treasury securities and reinvestment into longer-term securities.	No actual or expected change.

Sources: Krishnamurthy and Vissing-Jorgensen (2011) and Board of Governors of the Federal Reserve System.

II. How Forward Guidance Affects Longer-Term Interest Rates

Analyzing the effectiveness of any asset purchase program that coincides with forward guidance requires understanding the mechanism through which changes in the announced path of the federal funds rate could affect longer-term interest rates. Our research highlights that changes in forward guidance, by altering the perceived uncertainty around the future path of the funds rate, can significantly affect the compensation an investor requires to hold the longer-term bond (called the “term premium”).⁵ For example, statements policymakers issue to provide additional clarity about the future path of the federal funds rate often lead to a decline in the perceived uncertainty about the path of future short-term interest rates. This decline typically leads financial market participants to demand less compensation—that is, a lower term premium—for holding a longer-term bond, and thus Treasury bond yields fall. Conversely, more opaque statements that offer less clarity lead to higher perceived uncertainty, which can raise yields on longer-term bonds. Through this uncertainty channel of forward guidance, central bank communication can affect longer-term bond yields.

However, to evaluate the quantitative importance of this potential transmission mechanism, we first must measure the uncertainty about future short-term interest rates. One way to measure this uncertainty from financial markets is to examine prices from options on Eurodollar futures contracts. Eurodollar contracts are financial market instruments whose payoff depends on the London Interbank Offer Rate (LIBOR), a short-term borrowing rate for financial firms that closely tracks the federal funds rate. Options on these Eurodollar contracts are additional instruments that have a positive return only under specific outcomes for future interest rates.

The price of a Eurodollar option today reflects financial market participants’ beliefs about future short-term interest rates. For example, a given option may have a positive payoff only if the LIBOR rises above 3 percentage points at the end of the next year. A high price for this option suggests financial market participants believe that short-term interest rates are highly likely to be above the 3 percent threshold in a year. In contrast, a price near zero suggests financial market participants believe this event is quite unlikely.⁶

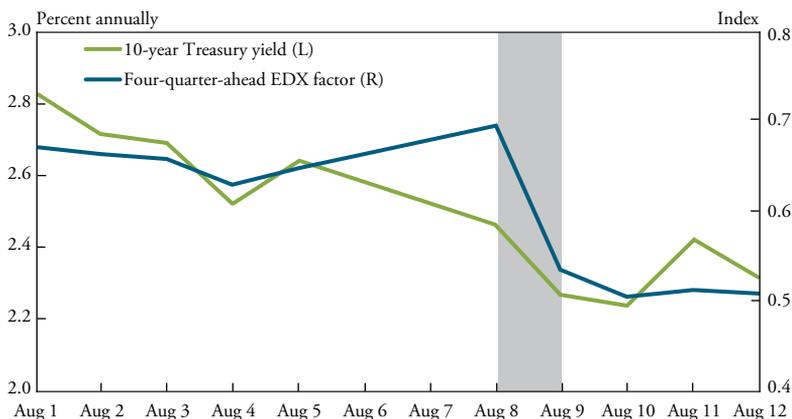
In Bundick, Herriford, and Smith (2021), we use a variety of different interest rate options to create a measure of uncertainty about future short-term interest rates, which we denote as the Eurodollar Volatility Index (EDX). We construct these measures across different time horizons, which provides measures of interest rate uncertainty over the next one to five quarters.⁷ With these measures of interest rate uncertainty, we can attempt to quantify how changes in central bank forward guidance might transmit to longer-term bond yields through interest rate uncertainty.

The adoption of the previously mentioned “at least through mid-2013” guidance at the FOMC’s meeting on August 9, 2011, highlights how forward guidance can affect longer-term bond yields by changing perceived uncertainty around the future policy path. Although this announcement lowered expectations for future policy rates, it also lowered the perceived amount of uncertainty around the path of policy in the coming quarters. Chart 1 plots the 10-year bond yield and our four-quarter-ahead EDX measure in the days before and after the August 2011 FOMC meeting. On the day of the announcement (highlighted in gray), Chart 1 shows a large reduction in our four-quarter-ahead EDX (blue line), which measures uncertainty about one-year-ahead short-term policy rates. This decline in uncertainty coincides with a significant decline in longer-term bond yields (green line), consistent with the idea that announcements that provide more clarity about the future path of rates lower both uncertainty about future policy rates as well as longer-term bond yields.

Beyond the single August 2011 announcement, our related research in Bundick, Herriford, and Smith (2021) highlights that this interest rate uncertainty channel of forward guidance is quantitatively important during the 1994–2008 period. During this time, the FOMC made many changes to its forward guidance but did not engage in any asset purchase programs. For example, at its June 2004 meeting, the FOMC stated that “policy accommodation can be removed at a pace that is likely to be measured,” which provided additional clarity about the path of the funds rate (Board of Governors 2004). We find evidence that during the 1994–2008 period, policy announcements that provided greater clarity reduced interest rate uncertainty and lowered the compensation investors required to hold longer-term Treasury bonds, on average.

Chart 1

Bond Yields and Interest Rate Uncertainty Fell after Announcement on August 9, 2011



Notes: The blue line is the EDX factor at the four-quarter horizon, and the green line is the nominal 10-year Treasury yield. The chart uses end-of-day data; the shaded area highlights the change in each measure on the day of the FOMC announcement, August 9, 2011.

Source: Authors' calculations.

III. Revisiting the Efficacy of Asset Purchases Accounting for Forward Guidance

Overall, our analysis of the FOMC's August 2011 announcement as well as the earlier 1994–2008 period highlights not only that forward guidance can affect longer-term bond yields but also that it can affect longer-term bond yields independently from changes to the central bank's balance sheet. Thus, any attempt to evaluate the efficacy of an asset purchase program must account for simultaneous changes in forward guidance.

We evaluate the effects of the FOMC's three asset purchase programs while accounting for coincident changes in forward guidance. To do so, we specify a simple statistical model that examines the daily change in 10-year Treasury yields following each announcement.

To provide a baseline for comparison, we first study the cumulative change in yields on the eight QE announcement dates relative to non-QE announcement dates. Specifically, we include a dummy variable in the model that takes a value of 1/8 for each of the eight QE announcement dates listed in Table 1. The coefficient on this variable gives an estimate of the cumulative change in yields resulting from the FOMC's

first three asset purchase programs, ignoring any contemporaneous change in forward guidance. The blue bar in Chart 2 illustrates the estimated results and shows that the announcements regarding the asset purchase programs reduced the 10-year Treasury yield by a total of 1.60 percent, a statistically significant and economically large effect. This approach, however, fails to account for any contemporaneous changes in forward guidance, which may overstate the estimated efficacy of the purchase programs.

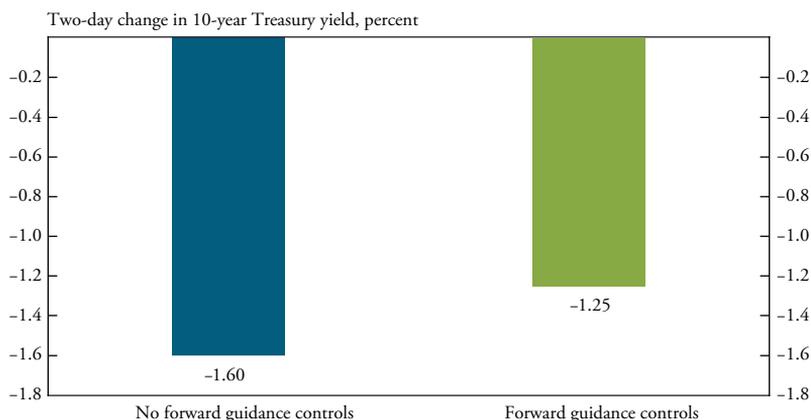
When we control for contemporaneous changes in forward guidance operating through interest rate uncertainty, we find a roughly 25 percent reduction in the cumulative effects of the asset purchase programs. The green bar in Chart 2 shows the results if we include our EDX measures of interest rate uncertainty in our statistical model.⁸ Specifically, we include two interest rate uncertainty factors that capture the daily changes in our one-to-five-quarter-ahead EDX measures around the policy announcements. Controlling for interest rate uncertainty shrinks the estimated decline in 10-year yields due to the asset purchase announcements by 35 basis points, from 1.60 percent to 1.25 percent. Thus, the statistical model suggests that part of the decline in longer-term rates is likely attributable to forward guidance, not just asset purchases.

In addition, a statistical test that examines the significance of our interest rate uncertainty measures illustrates that interest rate uncertainty plays an important role in explaining movements in the 10-year Treasury yields following these announcements. These results suggest that forward guidance and asset purchases can both effectively lower longer-term Treasury yields; however, policymakers must account for all their policy instruments in measuring the efficacy of a particular policy tool.

Using a slightly expanded specification allows us to examine the individual effects of the three asset purchase programs and evaluate whether failing to control for forward guidance biased the estimates of some programs more than others. We replace the single asset purchase program summary variable in our previous statistical model with a set of three dummy variables, one for each of the first three asset purchase programs.⁹ This expanded specification allows us to decompose the decline in yields into the effects from each program.

Chart 2

Effects of Large-Scale Asset Purchases with Forward Guidance Controls



Notes: Each bar reports the coefficient on the asset purchase dummy variable both with and without controls for interest rate uncertainty. The coefficients are statistically significant at the 1 percent level.

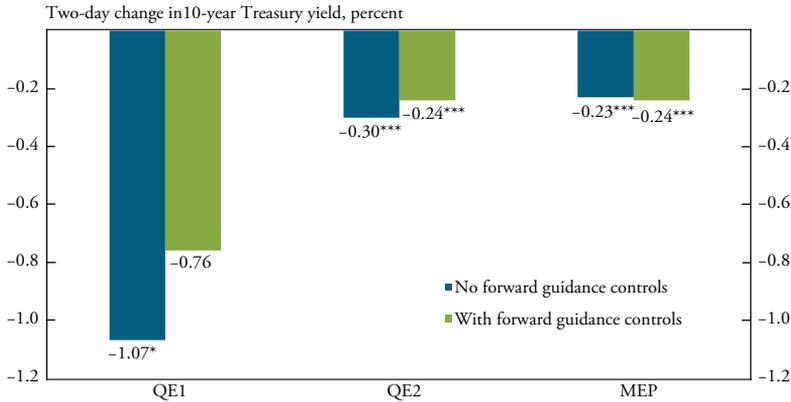
Source: Authors' calculations.

Chart 3 illustrates the proportion of the decline in yields attributable to each of the FOMC's first three purchase programs. The blue bars, which do not control for forward guidance, show that QE1 led to a 1.07 percent decline in the 10-year Treasury yield, while QE2 led to a 0.30 percent decline. However, when we account for forward-guidance-induced changes in interest rate uncertainty, the estimated efficacy falls. The green bars show that the estimated efficacy of QE1 falls to only 0.76 percent after controlling for forward guidance, and this estimated effect is no longer statistically different from zero. The estimated efficacy of QE2 drops from 0.30 percent to 0.24 percent while retaining its statistical significance. In contrast, the estimated efficacy of the MEP is unaffected when we include controls for FOMC-induced changes in interest rate uncertainty. These results suggest that failing to control for forward guidance may lead policymakers to overstate the estimated effects of QE1 in particular.

Our finding that contemporaneous changes in forward guidance differentially affected each asset purchase program is consistent with differences in the announcements in each period. For example, the QE1 announcement on December 16, 2008, clearly provided information about the future path of the funds rate ("for some time") and

Chart 3

Effects of Individual Asset Purchases with Forward Guidance Controls



* Significant at the 10 percent level

** Significant at the 5 percent level

*** Significant at the 1 percent level

Notes: Each bar reports the coefficient on a dummy variable for each of the asset purchase programs both with and without controls for interest rate uncertainty. See Bundick, Herriford, and Smith (2021) for more details.

Source: Authors' calculations.

contained information about the FOMC's intended balance sheet policies. Thus, we might expect the estimates of the efficacy of QE1 to be biased upward if we fail to account for this simultaneous change in guidance. However, the QE2 announcement in September 2010, in which the FOMC signaled its intent to "provide additional accommodation," is less clear about the Committee's likely actions for each policy tool; thus, we might expect the bias from not controlling for forward guidance to be smaller for this announcement. Finally, consistent with the fact that the announcement of the MEP was not accompanied by any actual or expected change in forward guidance, we see no effect of controlling for forward guidance with that announcement.

Exploring an alternative explanation: the signaling channel of asset purchases

In this article, we argue that changes in the FOMC's forward guidance that reduce uncertainty about the future funds rate lead to lower longer-term bond yields. If these changes occur at the same time as the announcement of a new asset purchase program, then the estimated

efficacy of the program could be overstated if researchers fail to account for the contemporaneous changes in guidance about the funds rate.

However, research by Woodford (2012), Bauer and Rudebusch (2013), and Bhattarai, Eggertsson, and Gafarov (2015) instead argues that changes in asset purchases themselves provide information about the future funds rate and hence directly play a role in communicating the central bank's forward guidance. These papers suggest that through this signaling channel, asset purchases communicate the Committee's intention to keep policy rates low for some time to help the central bank avoid large losses on its asset holdings. For example, suppose a central bank purchases a large quantity of longer-term sovereign bonds. If policymakers then subsequently raise short-term policy rates at a pace faster than what financial market participants anticipated when the central bank acquired the longer-term securities, the price of these securities will fall as longer-term yields adjust to the higher expected path of future policy rates. Therefore, the signaling channel of asset purchases suggests that asset purchases imply a commitment by policymakers to keep short-term rates low (a form of forward guidance) to avoid losses on the central bank's balance sheet.

Unfortunately, precisely identifying the signaling channel is difficult in general, and researchers have failed to reach a consensus on its importance. Gagnon and others (2011) find little support for the signaling channel of asset purchases in QE1. In examining the same program, Krishnamurthy and Vissing-Jorgensen (2011) instead argue that the signaling channel represents an important mechanism through which asset purchases transmit to the economy. A possible factor underpinning this disagreement on the signaling channel is that policymakers have often adjusted their forward guidance and asset purchases at the same time, making it difficult to cleanly separate the mechanisms and effects of their tools.

However, the announcement of the MEP, coupled with our measures of interest rate uncertainty, provides a straightforward opportunity to test for the presence of a signaling channel of asset purchases. The announcement of this program contained no actual or expected changes in the FOMC's forward guidance. If the signaling channel of asset purchases is important, the MEP should reduce uncertainty about future short-term rates through the central bank's implicit

commitment to keep future policy rates low and avoid losses on its balance sheet. Thus, we can look at the response of our interest rate uncertainty measures following the MEP announcement to test for the presence of the signaling channel. We find that our measures of interest rate uncertainty remain nearly unchanged following the MEP announcement, which provides evidence against a significant signaling channel in asset purchases (at least for this particular program).

Conclusion

When monetary policymakers cannot lower their short-term policy rate any further, they often turn to asset purchases and forward guidance to help stabilize the economy in the face of adverse shocks. In this article, we argue that the effects of a given asset purchase program—such as the LSAPs announced in response to the pandemic crisis in March 2020 or the Great Recession in 2008—could be overstated if researchers fail to account for the changes in interest rate uncertainty induced by forward guidance occurring at the same time. Although our empirical work attempts to capture the relevant channels of these policy tools, our analysis cannot control for all possible mechanisms through which asset purchases and forward guidance affect the macroeconomy. However, we aim simply to make researchers aware of the difficulty in assessing the efficacy of asset purchase programs when policymakers simultaneously use multiple policy tools, each capable of independently affecting longer-term rates.

Endnotes

¹We follow Krishnamurthy and Vissing-Jorgensen (2011) in dating and characterizing each program.

²See page 245 of Krishnamurthy and Vissing-Jorgensen (2011) for a discussion of the market expectations regarding the announcement on November 3, 2010.

³The September 21, 2011, statement also stated that the Committee will reinvest its maturing principal from maturing agency debt and mortgage-backed securities back into mortgage-backed securities.

⁴For example, after the release of the FOMC announcement on August 9, 2011, the two-year bond yield was trading less than 20 basis points.

⁵The yield on a longer-term Treasury bond can be broken down into two components. The first component reflects the expectations for the path of short-term interest rates (such as the federal funds rate) from today until the bond matures. The second component, the term premium, reflects the additional compensation an investor requires to hold the longer-term bond to maturity rather than alternatively investing in short-term securities over the same time horizon. In Bundick, Herriford, and Smith (2021), we show that the forward guidance-induced changes in interest rate uncertainty affect longer-term bond yields through the term premium component. In this article, we focus our discussion for simplicity on the effects of overall yields.

⁶See Bundick and Herriford (2017) for additional details on these instruments.

⁷See Bundick, Herriford, and Smith (2021) for more information on the construction of our EDX measures.

⁸Using a statistical technique known as principal component analysis, we can condense down the daily changes in our interest rate uncertainty measures over the next one to five quarters into two components. These two factors concisely summarize changes in the market-perceived uncertainty about future short-term interest rates that follow changes in FOMC forward guidance.

⁹This exercise closely follows the specification of Krishnamurthy and Vissing-Jorgensen (2011). Thus, our findings without including our EDX controls for this model exactly replicate a subset of the results in Tables 1 and 5 of their paper.

References

- Bauer, Michael D., and Glenn D. Rudebusch. 2013. "The Signaling Channel for Federal Reserve Bond Purchases." Federal Reserve Bank of San Francisco, working paper no. 2011-21, April. Available at <https://doi.org/10.24148/wp2011-21>
- Bhattarai, Saroj, Gauti B. Eggertsson, and Bulat Gafarov. 2015. "Time Consistency and the Duration of Government Debt: A Signalling Theory of Quantitative Easing." National Bureau of Economic Research, working paper no. 21336, July. Available at <https://doi.org/10.3386/w21336>
- Board of Governors of the Federal Reserve System. 2011a. "Federal Reserve Issues FOMC Statement." Press release, September 21.
- . 2011b. "FOMC Statement." Press release, August 9.
- . 2010a. "FOMC Statement." Press release, November 3.
- . 2010b. "FOMC Statement." Press release, September 21.
- . 2010c. "FOMC Statement." Press release, August 10.
- . 2009. "FOMC Statement." Press release, March 18.
- . 2008a. "FOMC Statement." Press release, December 16.
- . 2008b. "Federal Reserve Announces It Will Initiate a Program to Purchase the Direct Obligations of Housing-Related Government-Sponsored Enterprises and Mortgage-Backed Securities Backed by Fannie Mae, Freddie Mac, and Ginnie Mae." Press release, November 25.
- . 2004. "Federal Reserve Release." Press release, June 30.
- Bundick, Brent, and Trenton Herriford, 2017. "How Do FOMC Projections Affect Policy Uncertainty?" Federal Reserve Bank of Kansas City, *Economic Review*, vol. 102, no. 2, pp. 5–22. Available at <https://doi.org/10.18651/ER/2q17BundickHerriford>
- Bundick, Brent, Trenton Herriford, and A. Lee Smith. 2021. "Forward Guidance, Monetary Policy Uncertainty, and the Term Premium." Federal Reserve Bank of Kansas City, Research Working Paper no. 17-07, February. Available at <http://doi.org/10.18651/RWP2017-07>
- 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.
- 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*, vol. 2011, no. 2, pp. 215–287. Available at <https://doi.org/10.1353/eca.2011.0019>
- Woodford, Michael. 2012. "Methods of Policy Accommodation at the Interest-Rate Lower Bound." *The Changing Policy Landscape*. Proceedings of the Federal Reserve Bank of Kansas City Economic Policy Symposium, Jackson Hole, WY, August 30–September 1.